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REVIEW PAPER

A Systematic Review of Applied Behavior Analytic Interventions for Children with Autism in Mainland China

Yini Liao[1] · Karola Dillenburger[2] · Wei He[1] · Ying Xu[1] · Hongwei Cai[1]

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Abstract

Applied behavior analysis (ABA)-based intervention is typically utilized to support children with autism spectrum disorders (ASD), which has been widely used across the world. However, little is known about the current extent of the utilization of applied behavior analysis for children with autism in China. This paper provides a systematic review on the ABA-based intervention studies conducted in Mainland China. Studies published in Chinese and English journals were included, and 35 empirical studies qualified for the selection criteria were analyzed. The results suggest that the Chinese ABA-based programs are generally effective. Among the overall publications on the ABA-based intervention, there is a limited number of empirical studies, but this type of studies increases in recent years. In addition, one characteristic of the Chinese programs is that parental involvement is emphasized. The review also reveals the wide use of non-behavioral eclectic methods and the limit in the experimental design in some Chinese studies. The implications of these findings for research and practice are discussed.

Keywords Review · Behavioral intervention · Autism spectrum disorder · Developmental disorder · China

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that is diagnosed when individuals display difficulties in social communication and/or restricted, ritualized behaviors over a prolonged period (American Psychiatric Association, APA 2013). Various treatment approaches have been developed to help children with autism and their families. A great number of evidence-based interventions (Eikeseth et al. 2009; Howard et al. 2014; Smith et al., 2019) are based on the application of the scientific discipline of behavior analysis (Baer 1962; Baer et al. 1968, 1987; Skinner 1988). ABA-based interventions for children with autism were originally developed in the USA (Lovaas 1987; Smith 2001; United States Surgeon General 1999) and are now used across the world (Eikeseth, Klintwall, Jahr, and Karlsson 2012; Liao et al. 2018; Love et al. 2009; Peters-Scheffer et al. 2010). In applied behavior analysis (ABA), data collection and analysis are key elements (Cooper et al. 2007) and theses are typically demonstrated through intra-subject comparisons using single-system designs (Hitchcock et al. 2015; Institute of Education Sciences, IES 2017; Kratochwill et al. 2013). By visually analyzing the graphed data in different phases of the intervention, researchers and clinicians assess the effects of the intervention and, if necessary, adjust interventions in a timely and individually tailored manner.

Early intensive behavioral intervention (EIBI) is a part of the comprehensive ABA-based treatment package for young children with autism that includes procedures and strategies, such as discrete trial teaching (DTT) and natural environment training (NET) (Lovaas 1987; Orinstein et al. 2014; Smith et al. 2000). EIBI has been used to increase many socially significant behaviors, including language and communication skills, life skills, cognitive, and functional behaviors (Fein et al. 2013; Lovaas 1987; Reichow et al. 2012; Reichow and Wolery 2009; Wong et al. 2015).

ABA-based interventions have been used in developed and developing countries. In China, autism was recognized for the first time in 1982 (Tao 1987), much later than that in the USA

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✉ Yini Liao
liaoyn3@mail.sysu.edu.cn

[1] Department of Psychology, Sun Yat-sen University, 132 Waihuan Dong Road, Higher Education Mega Center, Guangzhou 510006, China

[2] Center for Behavior Analysis, School of Social Sciences, Education, and Social Work, Queen's University Belfast, Belfast, UK

where early cases were reported by Leo Kanner in 1938 (Kanner 1943) and that in Austria where first cases were reported by Hans Asperger in 1944 (Translated by Frith 1991). It was not until 1995 that autism was included in the second edition of the Chinese Category of Mental Disorders (Psychosis Branch of Chinese Medical Association and Brain Hospital of Nanjing Medical University 1995).

Partly due to the relatively late identification of autism as a stand-alone diagnostic category, studies of prevalence rates are still being accumulated. Also, the existing data of prevalence rate from different studies are not consistent. For example, Jin et al. (2018) conducted a cross-sectional study among 74,252 children aged between 3 and 12 years old in Shanghai and found that 8.3 in every 10,000 children were diagnosed with autism according to DSM-5. Yang et al. (2015) surveyed 15,200 preschool children in a city in South China and reported 260 per 10,000 of the children had a high risk of autism and 400 per 10,000 were suspected to have autism. Guo (2004) reported only 5 children with autism and co-occurring intellectual disability among 3,606 children (2–6 year olds) in a city in North China. Other studies reported that the pooled prevalence of autism in Mainland China is estimated 39.23 per 10,000 children aged between 1.6 and 8 years old (Wang et al. 2018) and 70 per 10,000 children aged between 6 and 12 years old (Zhou et al. 2018b).

Although autism prevalence rates vary across Chinese studies, they are generally lower than that of Western countries. For example, in the USA, 241 in 10,000 children were diagnosed with autism (Xu et al. 2018a) and in the UK, 350 in 10,000 children were reported to have autism in a sample of over 15,000 families (Dillenburger et al. 2015). The reasons for the relatively low prevalence of autism reported in China are unclear, but this may be related to the relatively late recognition of autism as a stand-alone diagnostic category. If this was the case, future surveys may report the higher prevalence rate, and it may be more aligned with the data of the Western countries.

Given the huge population of China, there are a great number of Chinese children with this neurodevelopmental disorder (Sun et al. 2013), even if the estimate is made based on the existing relatively low rate. Not surprisingly, many organizations aimed to support these children have been established since 1990s (McCabe and Tian 2001). There are approximately 1000 autism training centers in Mainland China, and they use various intervention approaches (Zhou et al. 2014). The first training organization, *Beijing Stars and Rain*, was established in 1993, and it was also the first one introducing ABA-based interventions into their program (Guo 2006; McCabe and Tian 2001; Wen 2014; Zhou et al. 2014). Subsequently, therapists, researchers, and government policy makers together promoted ABA-based approaches and make them publically available (Zheng et al. 2016).

However, little has been known about the current extent of the use of ABA-based interventions in Mainland China. For example, there is little research about the amount of published ABA-based intervention studies . Similarly, it is also unclear how ABA-based interventions are used by Chinese professionals and researchers and the effectiveness of these interventions. In particular, whether and how targeted behaviors have been changed after interventions; how family members are involved in the interventions; and whether the interventions result in psychological changes in family members. Answers to these questions will depict the current status of the ABA-based interventions in Mainland China.

This line of research will also help deepen the understanding of how the ABA-based interventions, which originate from the West, develop in diverse cultural contexts. This can clarify the optimal settings in which ABA-based interventions can be applied, and facilitate the dissemination of the science of behavior analysis internationally. All of these help shape how ABA-based interventions develop in the future. For example, eye contact is considered a pivotal and important behavior in training for children with autism to attend socially (Foxx 1977; Helgeson et al. 1989). However, the interpretation of eye contact differs across cultures. In Eastern cultures, it is perceived very differently from Western norms (Akechi et al. 2013). Specifically, in East Asian cultures, prolonged eye gazing at another person would be considered aggressive and/or disrespectful towards others (Uono and Hietanen 2015). Therefore, while intensive and long-term behavior analytic intervention programs (e.g., Perry et al. 2019) including strategies such as a progressive model of teaching (e.g., Cook et al. 2017; Rapp et al. 2018) and differential reinforcement (e.g., Hall et al. 2009; Jeffries et al. 2016) have been found to lead to optimal outcomes for children in the West, these conclusions cannot be transferred across cultures without further analysis (Lovaas 1987; Remington et al. 2007).

Chang and Zaroff (2018) have reviewed local service programs, supporting policies, and the use of ABA-based interventions in Mainland China and Hong Kong. However, their review was limited to studies written in English and did not include relevant findings published in Chinese. Given that many Chinese researchers publish their work in Chinese journals, it is possible that Chang and Zaroff's review may miss some important work. To overcome this limitation, the present review aims to comprehensively reveal the use of ABA-based interventions in Mainland China and includes literature published in both English and Chinese. The review reported here focused on two main research questions:

1. What is the current status of ABA-based interventions for autism in Mainland China?

2. What empirical methods have been used in ABA-based interventions in Mainland China?

Methods

To review empirical studies regarding ABA-based intervention in Mainland China, systematic search, for Chinese and English publications, respectively, were conducted using the methodology of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) (Moher et al. 2009, 2015).

Search Strategy

The search covered databases of journals in English or Chinese. In the English language databases, the key words used were "Autism Spectrum Disorder," "Applied Behavior Analysis," and "Mainland China," and the variants of these terms (e.g., "ABA," "intensive behavior intervention," "early intensive behavior intervention") according to the thesaurus based on the Pearl Harvesting method (Sandieson 2006; 2019). Boolean operators such as AND and OR were used in combination in the command line, the truncation operator "*" was used to capture all variations of similar terms, e.g., autism and autistic become autis*, and restriction of exact words was ensured by using double quotation marks around a term. For example, "applied behavior analysis" would return only those papers that refer to the exact US spelling of *behavior*. However, the UK spelling "behaviour" and the US spelling "behavior" were searched by using "behavi*".

In the Chinese language databases, the following key words were used: autism ("自闭症" or "孤独症") and Applied Behavior Analysis ("应用行为分析"). The search strategy was the same as that in the English language review. The exact combinations of search terms used for the English and Chinese databases can be found in Appendix.

Selection Criteria

To be included in analyses, all studies need to meet the following selection criteria:

1) They included children with autism; they could also include parents (mothers, fathers), other caregivers (e.g., grandparents) of these children, or professionals who worked with these children (e.g., therapists);
2) They focused on applied behavior analytic interventions or interventions based on or referred to Baer et al. 1968; 1987);
3) They were conducted in Mainland China with a local population;
4) They were published in peer-reviewed journals;
5) They reported empirical studies that were either experimental, such as single-system design studies (SSDs) or non-experimental studies, such as quantitative surveys, qualitative interviews, census data, or descriptive data.

English Language Databases

Five English databases and sixteen additional English journals were searched. English databases included ERIC (Educational Resources Information Center – ProQuest), Web of Science, ProQuest Social Science, SCOPUS, and PubMed. The initial search took place between 10 and 25 January 2017 and the search was updated between 10 and 13 January 2018. Sixteen journals were manually searched, including *Journal of Applied Behavior Analysis*, *Journal of Early and Intensive Behavior Intervention*, *Analysis of Verbal Behavior*, *Journal of the Experimental Analysis of Behavior*, *Behavior Analysis in Practice*, *European Journal of Behavior Analysis*, *Behavior Analyst*, *Behavioral Interventions*, *Behavior Analyst Today*, *Journal of Positive Behavior Interventions*, and *Behavior and Philosophy*, *Behavior Modification*, *Research in Autism Spectrum Disorder*, *Research in Developmental Disabilities*, *Research and Practice for Persons with Severe Disabilities*, and *Journal of Autism and Developmental Disorder*.

PRISMA Chart of English Language Databases

Figure 1 presents the PRISMA chart that shows the results of the English language search. The search across databases, additional backwards search, and manual-search of journals produced 273 articles. These articles reduced to 251 articles after removing the duplicates. An additional search was conducted through a backward literature search, i.e., searching the bibliography of the final included articles, which produced additional 8 papers. The 259 papers were reduced to 27, after 232 articles were removed, because of the irrelevances in titles and/or abstracts, according to the criteia above. The full texts of these 27 articles were read for eligibility inclusion and 7 of them were selected for the final analyses. Figure 1 outlines the review process.

Chinese Language Databases

A separate systematic review was conducted using three Chinese language databases, including China National Knowledge Infrastructure (CNKI), WeiPu (VIP), and Wanfang, which are considered the most frequently used Chinese academic databases (e.g., Sun et al. 2013). Articles from CNKI were searched on 26–28 January 2017 and articles from VIP were search on 4–5 February 2017. An updated

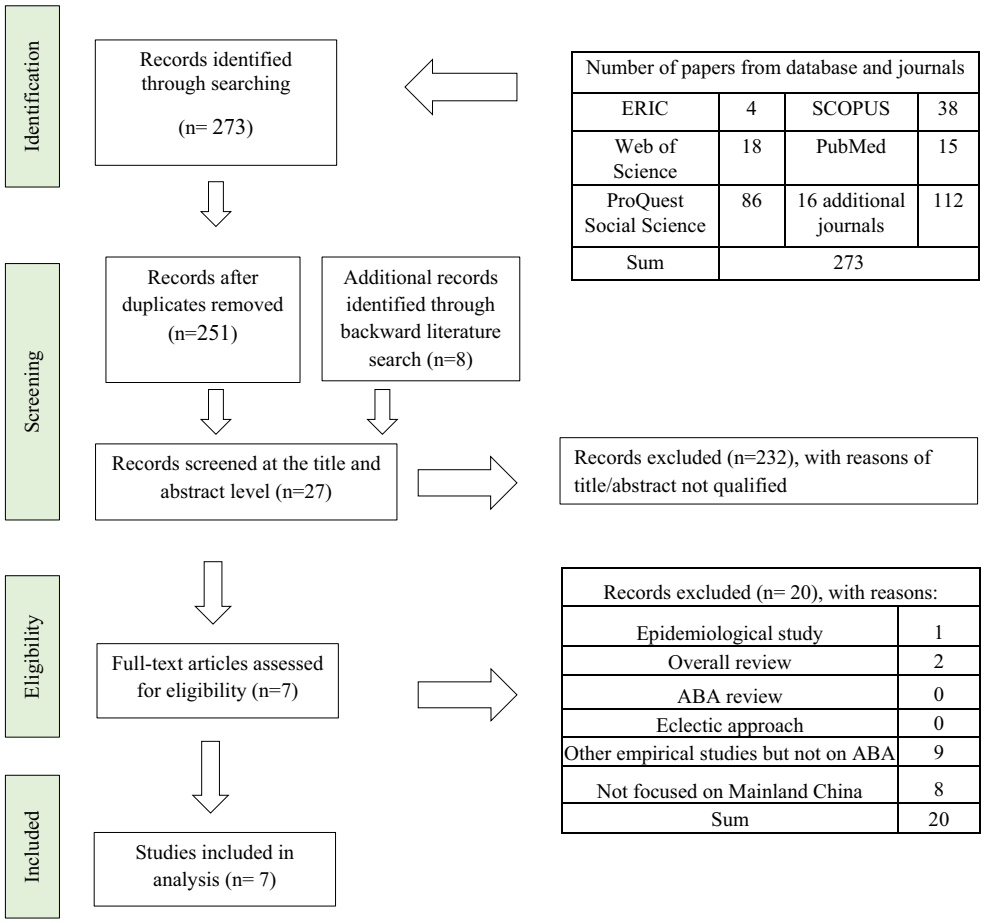

Fig. 1 PRISMA chart for English articles

search including all three databases was conducted again between 11 and 15 January, 2018. Since Chinese journals were released in open access through databases (Huang 2004; Wang and Yao 2005), no additional journals were searched.

PRISMA Chart of Chinese Language Databases

Figure 2 is the PRISMA chart showing the procedure of the search and review for articles in Chinese. The search produced 889 records, which were filtered down to 749 articles after duplicates were removed. An additional search was conducted through a backward literature search and produced 2 additional records. The 751 articles were reduced to 173 after screening for titles and/or abstracts. The resulted 173 records were further filtered down to 28 records, for the final analyses, after reading the full texts. Figure 2 presents the review process for the Chinese publications.

Articles Excluded after Full-text Reading

As shown in Table 1, 165 articles, 20 English articles and 145 Chinese articles, passed the duplication and the title/abstract screening, but were excluded through the full-text screening procedure. The majority of these English articles were excluded because they were not focused on the ABA-based interventions or the populations were not in Mainland China (e.g., they focused on the populations in Hong Kong; e.g., Leung and Wu 1997; Ling and Mak 2012). For the 145 Chinese articles , the majority of them were excluded because they were non-empirical reviews on the theories and practices of ABA-based interventions conducted in the West, i.e.,72 of them were general reviews on autism or treatment approaches (e.g., You and Yang 2006) and 20 of them were ABA review such as outlining what ABA-based interventions are and how they can be implemented (e.g., Liu and Li 2007), offering an overview of pivotal response training (PRT), a specific ABA-based intervention (e.g., Huang et al. 2010), and the usage of EIBI in the West (e.g., Wang and Kang 2011). In addition, 48 of the excluded Chinese articles were not solely about ABA but about eclectic methods, where researchers regarded ABA as a type of interventions and used with other approaches (e.g., Peng and Yu 2014).

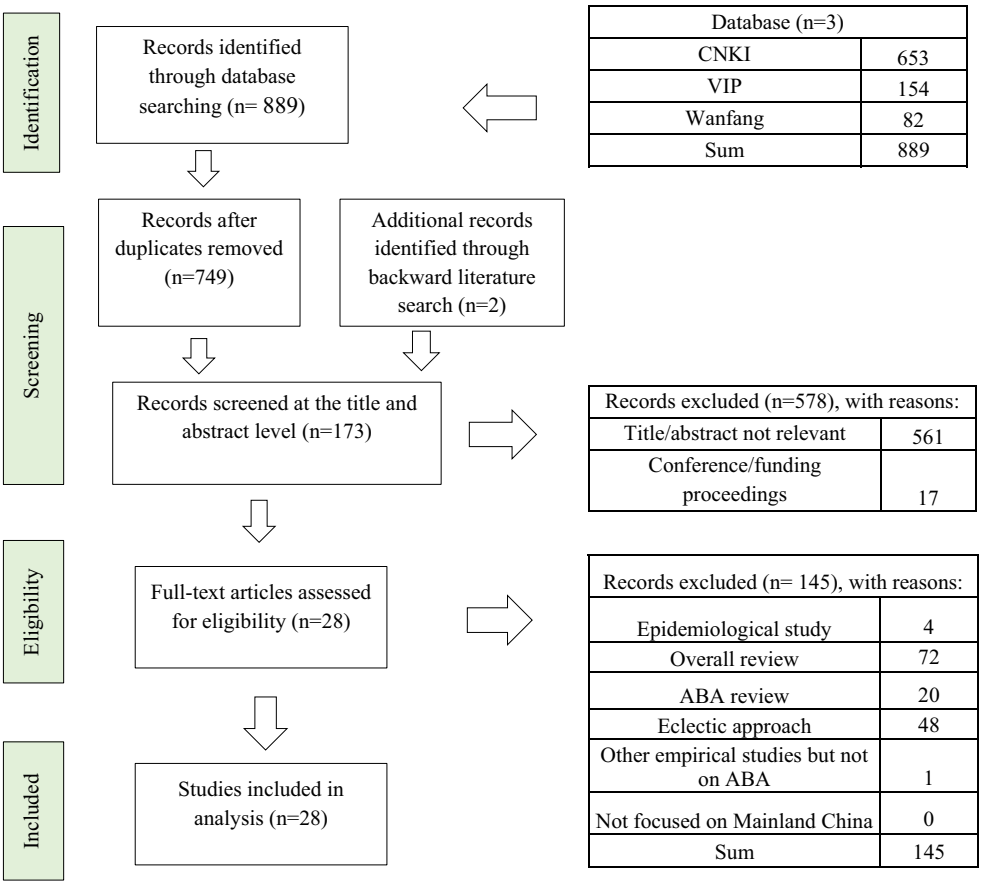

Fig. 2 PRISMA chart for Chinese articles

Interobserver Agreement

The first author YL undertook the majority of the search of both the English and the Chinese literature. In order to assess the internal validity of these reviews, a second reviewer independently searched and read the above databases and journal papers. Two authors discussed reasons for exclusion, such as "epidemiological study," "eclectic approach," "not focused on Mainland China," and "other empirical study but not focused on ABA-based interventions" (see Table 1 for reasons of exclusion).

YL and the third author (WH) reached 100% of agreement in the English database and journal paper search. YL and the fourth author (YX) reached 99.47% of agreement in Chinese database search. Four disputed articles were discussed by YL, KD, and YX to a reached consensus and further clarifications were sought

Table 1 Breakdown of excluded and included articles at the full-text screening level

	Chinese articles	English articles			Total
		Databases search	Additional backward search	Journal search	
Excluded articles					
Epidemiological study	4	1	-	-	
Overall review	72	2	-	-	
ABA review	20	0	-	-	
Eclectic approach	48	0	-	-	
Other empirical study but not on ABA	1	5	4	-	
Not focused on Mainland China	0	8	-	-	
Total	145	16	4	-	165
Included articles	28	2	4	1	35
Sum	173	18	8	1	200

from the relevant authors before making the decisions to include or exclude from the review. In the end, all the four papers were clarified as not focused on ABA-based interventions.

Quality Assessment of the Single-Case Design

Single-case research design (SCD) is commonly used in developing and evaluating behavior analytical interventions, including those in the field of special educational needs (Kratochwill et al. 2013), and interventions to support individuals with intellectual disabilities and/or autism (Matson et al. 2012). The methodological rigor of single-case design was assessed by What Works Clearinghouse (WWC) standards (Institute of Education Sciences 2017). The WWC reviewers categorized studies into three types, i.e., meeting evidence standards, meeting evidence standards with reservations, and not meeting evidence standards. In order to meet evidence standards, (a) the independent variable (i.e., the intervention) must be systematically manipulated and the study must identify when and how the independent variable conditions changed; (b) an inter-assessor agreement (IOA) must be collected by more than one assessor in each phase and at least 20% of the data points in each condition (e.g., baseline, intervention); and (c) the study must have the minimum number of phases and data points per phase to demonstrate the intervention effects. The quality of group design and non-experimental design articles were not assessed, because single-system designs (Hitchcock et al. 2015; Institute of Education Sciences 2017; Kratochwill et al. 2013) are the main research designs in the clinical and research area of behavior analysis. In addition, the limited number of randomized controlled trials (RCTs) made the quality of assessment not significant. The first author (YL) and the fifth author (HC) reached 100% agreement on the quality assessment of the single-case design studies.

Results

The systematic review generated 35 relevant articles, including both English and Chinese articles. Among these articles, there were 24 studies with the experimental research designs and 11 non-experimental ones, such as qualitative and quantitative research design articles. The details of these articles can be found in Table 2.

Research Trend Related to ABA and Autism

A total of 200 articles were extracted for analyzes at the full-text eligibility level (Table 1), i.e., 173 Chinese articles (145 excluded articles and 28 included articles) and 27 English articles (20 excluded articles and 7 included articles). In order to understand the research trend on children with autism and, especially, the use of the ABA-based interventions in Mainland China, a particular analysis was carried out on 103 articles, which included 35 final articles and excluded 68 articles with the reasons of "ABA review" (20; Table 1, second row, third column) and "eclectic approach" (48; Table 1, second row, fourth column). The results are presented in Figure 3.

In the figure, the horizontal line represents an equal number of 3-year interval. As the search ended on January 2018, the year of 2018 was grouped into the "2015–2018" category. The vertical line represents number of articles published in peer-reviewed journals. As indicated in Figure 3, articles coded as "ABA review," "eclectic approach," and "ABA empirical studies" increased yearly. Empirical research increased after 2005. Before that, most of the literature focused merely on introducing and reviewing ABA-related research from the West. However, in the short time span since 2005, there has been a relatively broad coverage of behavior analytic topics (see "ABA-based Interventions" of the Results section for more details). In addition, eclectic approach articles increased from 2009 onwards and empirical studies about ABA increased largely from 2015 onwards.

Empirical Methods

Among the 35 empirical studies, 14 articles used experimental study of single-/multiple-case design, 10 articles used experimental study of group design, and 11 articles were non-experimental empirical studies such as qualitative interviews (see Table 2 for details).

Of the 14 single-case design studies, 5 of them used the A-B-A design (Huo et al. 2016; Qian 2016; Wang 2016b; Xiao and Yu 2015; Zheng and Li 2017). Three studies used the A-B-A-B reversal design (Shen 2017; Yang et al. 2012; Hu et al. 2016a), and one used the A-B research design (Sun and Wei 2011). Of the remaining 5 single-case studies, Xu et al. (2017a) used the changing criterion design and 4 studies used the multiple-baseline design, with Hu and Fan (2014) using an A-B multiple-baseline design across settings and behaviors; Hu et al. (2015) using an A-B-A multiple-baseline design across subjects; Hu et al. (2016b) using multiple-baseline design across subjects. Lee et al. (2017) used multiple-baseline design across behaviors.

Of the 10 articles that used group research design, five used a within-group design, i.e., making measurement before and after intervention for the same group of participants (Duan and Niu 2013; Liu and Chen 2012; Ma et al. 2016; Shi et al. 2007; Xiong et al. 2010). Five studies used a within-group design and between-group research design, i.e., comparing the experimental group and the control group, plus pre- and post-test on each group (Ding et al. 2015; Wang 2008;Xu et al. 2017b; Xu et al. 2017b; 2018b; Zou et al. 2008). Three of these 5 studies used randomized control trials (RCT) related to ABA-based interventions on the Chinese population (Wang 2008; Xu et al. 2017b; 2018b).

Table 2 Articles included in systematic reviews

Article	Location	Measurement	Participant (year age)	Outcome	Research method	Diagnosis	Length of program
Xu et al. (2018b)	South east China (city NR)	PEP-3; CARS	*N* = 36; Expt.: 16 boys (3.96 years); Con.: 18 boys and 2 girls (3.58 years)	Symptoms decreased and severity categorization improved	Within- and between- group design	CARS and DSM-5	8 weeks (1 h per day and 5 h per week)
Liao et al. (2018)	Northern Ireland (city NR); Northern China (Beijing) & Southern China (city NR)	Self-administered interviews	*N* = 15; 10 professionals and 5 parents (age unknown)	Application of behavior analysis services vary across cultures	Semi-structured interview	N/A	N/A
Xu et al. (2017b)	Eastern China (Hangzhou & Xiamen)	CARS	*N* = 36; Expt.: 15 boys and 1 girl (3.96 years); Con.: 19 boys and 1 girl (3.58 years)	Social interaction, communication and emotional expression improved	Within- and between-group design	CARS and DSM-5	8 weeks (80 sessions)
Lee et al. (2019)	Central China (city NR)	Child: behavioral observation**	*N* = 5; 4boys and a girl (3–6 years)	Object-substitution symbolic play skills improved	Multiple probe design	ADOS-2 (Lord et al. 2012) and DSM-5; ADOS-2 and DSM-IV (APA, 1994)	1 h per day, 4 days per week. Duration not reported
Xu et al. (2017a)	Western China (city NR)	Child: behavioral observation**	1 boy (9 years)	Increased academic engagement	Changing criterion design	CARS and WISC-IV (Wechsler 2003)	29 15-min sessions
Ma* (2017)	Northern China (Inner Mongolia)	Child: behavioral observation**	1 boy (3.83 years)	Reduced inappropriate behavior	Single-case study with baseline data while intervention data not shown	Diagnosis confirmed by a hospital	14 days
He (2017)	Southern China (Nanchang)	Child: behavioral observation**	5 children (Other information unknown)	Emotional behavior improved and autism symptoms decreased	Case study without quantitative data	NR	3–12 months
Zheng and Li (2017)	NR	Child: behavioral observation**	1 boy (10 years)	Maladaptive behavior reduced and requesting behavior increased	Single-case design (A-B-A design)	Diagnosis confirmed by a hospital	10 days (twice per day, 30 min per session)
Shen (2017)	Southern China (Guangxi)	Child: behavior observation**	1 boy (7 years)	Inappropriate behavior reduced	Single-case reversal design (A-B-A-B design)	NR	13 weeks
Hu et al. 2016a)	Northern China (Beijing)	Child: behavioral observation**	1 boy (4 years)	Joint attention enhanced	Single-case design (A-B-A-B design)	Diagnosis confirmed by a hospital	21 days
Hu et al. (2016b)	Northern China (Beijing)	Child: behavioral observation**	1 boy (6 years) and 2 girls (5.5 years)	Communication skill improved	Multiple-baseline design	Diagnosis confirmed by a hospital & WPPSI-R	30 trials on average (around 30 min per trial per day)
Wang* (2016a)	North-central China (city NR)	Child: CARS; ATEC (Lu et al. 2004); Autism	3 children (1–6 years)	Pivotal response training is effective	Multiple-baseline design while	Chinese Classification	1.5 months

Table 2 (continued)

Article	Location	Measurement	Participant (year age)	Outcome	Research method	Diagnosis	Length of program
		Child Development Assessment Form (China Disabled Persons' Federation 2009)		for children with autism	quantitative data not shown	of Mental Diseases, 3rd (CCMD-3, Chen 2002)	
Zhong (2016)	North-eastern China (Yichun city)	Child: behavioral observation**	1 boy (11 years)	Aggressive behavior reduced	Case study without quantitative data	NR	3 months
Wang (2016b)	Southern China (Guangzhou)	Child: behavior observation**	1 boy (12 years)	Disruptive behavior reduced	Single-case study (A-B-A design)	Diagnosis confirmed by a hospital	20 days
Han* (2016)	South-western China (Chongqing)	Child: behavioral observation**	1 boy (10 years)	Disruptive behavior at classroom reduced	Case studies without quantitative data	NR	NR
Huo et al. (2016)	Northern China (Beijing)	Child: behavioral observation**	3 boys (7.33 years)	Facial expression recognition improved	Single-case study (A-B-A design)	NR	Over 51 classes across months (length not reported)
Ma et al.* (2016)	North-central China (Ningxia)	Child: CARS	$N = 90$; 68 boys and 22 girls (2.3 years)	Language, independent living skill, social communication, physical activity, and cognitive ability improved	Within-group design	DSM-IV	NR
Qian* (2016)	Eastern China (Shanghai)	Child: behavioral observation**	1 boy (8 years)	Language expressions improved	Single-case study (A-B-A design)	Diagnosis confirmedby a hospital	20 sessions (35 min per session, 3 times per week)
Hu et al. (2015)	South-eastern China (Chongqing)	Child: IQ and self-administered Curriculum Assessment Tool	3 boys (6.9 years)	Theory of mind ability improved	Multiple-baseline design (A-B-A design)	Diagnosis confirmedby a hospital	Two cases undertook 11 weeks and the other case undertook 9 weeks
Ding et al. (2015)	Southern China (City NR)	Parents: The Pediatric Quality of Life Inventory Measurement Models (Lu et al. 2008)	$N = 132$; Expt.: 58 boys and 8 girls (2.9 years); Con.: 58 boys and 8 girls (3.1 years)	Children's quality of life improved	Within- and between-group design	DSM-IV	3 months
Xiao and Yu (2015)	Southern China (Guangzhou)	Child: behavior observation**	1 boy (11 years)	Self-injurious behavior reduced	Single-case design (A-B-A design)	Diagnosis confirmed by a hospital	12 weeks
Zhou et al. (2014)	Northern China (Beijing)	NR	$N = 2{,}222$; (≤ 6 years); 100-member centers of Heart Alliance Autism Network	Number of hospitals diagnosing ASD and service centers increased, but limited in underdeveloped regions; age of the first diagnosis decreased	Students' registration archived data and survey	ADI-R/DSM-IV-TR	NR
Hu and Fan (2014)	Northern China (Beijing)	Child: behavior observation**; WPPSI--R; PEP-3	1 boy (4.25 years)	Child's mand behavior improved and aggressive behavior decreased	Multiple-baseline design (A-B design)	NR	3 months
Shao et al. (2014)			1 boy (2.5 years)			NR	

Table 2 (continued)

Article	Location	Measurement	Participant (year age)	Outcome	Research method	Diagnosis	Length of program
	West-southern China (Chongqing)	Child: behavioral observation**		Communication skills improved	Case study without quantitative data		1 year, 1 h per week, 4 times per week
Duan and Niu* (2013)	Northern China (city unspecified)	Child: autism behavior checklist (ABC)	*N* = 48; 26 boys and 22 girls (5.9 years)	Sensory issues, social communication, physical activity, language, and self-independent skills improved	Within-group design	NR	6 months
Zhu* (2013)	Eastern China (Hangzhou)	Child: behavioral observation**	1 boy (age unkown)	Food selective behavior improved	Case study without quantitative data	NR	NR
Liu and Chen (2012)	South-eastern China (Quanzhou)	No validated measurement	*N* = 41; 36 boys and 5 girls (2.5–5 years)	Language improved	Within-group design	Chinese Classification of Mental Diseases, 3rd (Chen 2002)	1 year
Yang et al. (2012)	NR	Child: behavior observation**	1 boy (5 years)	Seat-leaving behavior reduced	Single-case design (A-B-A-B design)	NR	7 weeks
Sun and Wei (2011)	Northern China (Beijing)	Child: behavior observation**	1 boy (11 years) and 1 boy (12 years)	Self-injury behavior reduced	single-case design (A-B design)	Diagnosis confirmed by a hospital	22 and 14 days, respectively
Xiong et al. (2010)	Northern China (Beijing)	Parents: Hospital Anxiety and Depression Scale (Barczak, Kane, Andrews, Congdon, Clay, & Betts, 1988); Child: ABC Scale	*N* = 76 mothers; age unknown	Sense, social, movement, speech, and self-care ability improved; mothers' anxiety and depression not improved	Within-group design	NR	10 weeks
Wang (2008)	North-eastern China (Shenyang)	Child: PEP–R (Schopler et al. 1990), CARS	*N* = 27; Expt.: 15 families (father = 34.53 years; mother = 33.4 years); Con.:12 families (father = 34.92 years; mother = 33.5 years); Expt.: 15 children (5.08 years); Con.: 12 children (5.78 years)	More appropriated responses to children; more acceptable of and engaging play with children	Within- and between-group design	NR	20 h in 4 weeks (16 h group training and 4 h individual home visits)
Zou et al. (2008)	Eastern China (Nanjing)	Child: CARS; Portage Early Education Behavior Checklist (Bluma 2001)	*N* = 135; parental trained group: 44 boys and 7 girls (4.33 years); professional-trained group: 68 boys and 11 girls (4.5 years); 5 missing	Socialization, self-help, language, cognitive, and motor behavior improved in both groups	Within- and between-group design	DSM-IV & CARS	3 months
Shi et al. (2007)					Within-group design	DSM-IV	3–12 months

Table 2 (continued)

Article	Location	Measurement	Participant (year age)	Outcome	Research method	Diagnosis	Length of program
	Northern China (Tianjin)	Child: Gesell Development Assessment (Gesell 1925), CARS	$N = 85$; 75 boys and 10 girls (3.67 years)	Children's skill improved and symptoms decreased			
Guo (2006)	Northern China (Beijing)	NR	$N = 129$; parents (sex and age unknown)	Early intervention results in better outcome	Empirical study without quantitative data	N/A	3 months
Guo et al. *(2006)	North-eastern China (Shenyang)	Children's exam grades reported by parents	$N = 64$; 51 boys and 13 girls (10.6 years)	Language, social communication, and recognition skill improved	Qualitative interview	Chinese Classification of Mental Diseases, 3rd (Chen 2002)	NR

Note: Expt. = Experimental group; Con. = Control group; the articles do not have an English title

**Behavior observations are typically using single-system designs (Hitchcock et al. 2015). Direct observation of ABC data (antecedent, A; behavior, B; and consequence, C) and Functional Behavior Assessment (FBA) were common types of behavior observations as of reported in this table

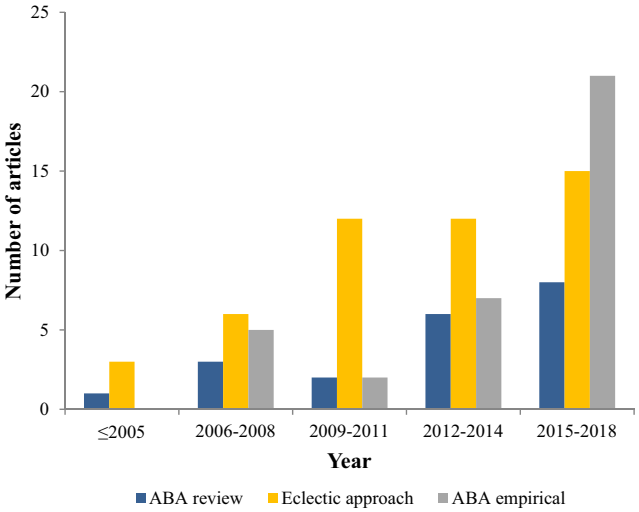

Fig. 3 Research trend related to ABA and autism in mainland China

Of the 11 non-experiment empirical studies, 7 studies were empirical case studies without quantitative data (Han 2016; He 2017; Ma 2017; Shao et al. 2014; Wang 2016a; Zhong 2016; Zhu 2013). These studies used descriptive words to indicate the child's behavior changes after ABA-based intervention. For example, Han (2016) reported the implementation of functional behavior analysis reduced a boy's disruptive behavior in the classroom. Four of these studies lacked quantitative data (Han 2016; He 2017; Shao et al. 2014; Wang 2016a); one article lacked intervention and maintenance stage data (Ma 2017), and 2 case study articles were reported as empirical studies by authors but lacked a clear research design (Zhong 2016; Zhu 2013). Two of the non-experiment studies were qualitative interviews. Specifically, Guo (2006) used telephone interviews with 64 parents to assess the type of school their children were enrolled in and their academic record at school; Liao et al. (2018) interviewed parents and professionals in England and China to explore cultural factors influencing ABA service delivery. The remaining 2 non-experiment studies collected children's past documentary data (i.e., archived data, Nichols 2001) and parents' training data for research purpose. Specifically, Zhou et al. (2014) analyzed the registration data between 1993 and 2012 at "Stars and Rain," one of the earliest autism NGO founded by a Chinese mother and surveyed 100 members of centers of Heart Alliance Autism Network, the organization started by Stars and Rain in 2005 to promote quality services and sharing resources (Zhou et al. 2014). Guo et al. (2006) analyzed parents' training data to describe the characteristics of parental training and challenges faced by Chinese parents.

The Quality of the Single-Case Design Studies

All of the 14 single-case design studies focused on improving children's behavior using ABA-based interventions. The methodological rigor of the 14 studies was assessed using

What Works Clearinghouse (WWC) standards (Institute of Education Sciences 2017). Results showed that all 14 articles met the first level of quality, and 8 of the articles met the criterion on inter-assessor agreement (IOA). For articles in which IOA process was not reported at all or was not detailed enough, emails were sent to corresponding authors for clarifications. If no responses were received after 3 weeks, the papers were excluded and deemed as not having met IOA level. Four articles had the required number of phases and data points per phase without reservation, and 2 articles met WWC pilot single-case design standards with reservations (Table 3).

Measurement Tools

Of the 24 experimental studies, 4 used Childhood Autism Rating Scale (CARS) (Schopler et al. 1986) (Wang 2008; Xu et al. 2017a; 2017b; 2018b; Zou et al. 2008). Seven articles indicated the diagnoses of participants were confirmed by authoritative hospitals (Hu et al. 2016a; 2016b; Qian 2016; Sun and Wei 2011; Zheng and Li 2017; Wang 2016a; Xiao and Yu 2015); ADOS-2 was used by one paper (Lee et al. 2017); Autism Behavior Checklist (ABC) (Krug et al. 1980) was used by one paper (Xiong et al. 2010); Two papers were based on DSM-IV, respectively (Ding et al. 2015; Ma et al. 2016) and one paper was based on CCMD-3rd (Zhu 2013); Eight articles did not mention diagnostic criteria (Duan and Niu 2013; Hu et al. 2015; Hu and Fan 2014; Huo et al. 2016; Shen 2017; Wang 2016a; Xiong et al. 2010; Yang et al. 2012).

In addition, functional developmental tools, such as the Chinese version Psychoeducational Profile-Third Edition (PEP-3) (Heep Hong Society 2009; Schopler et al. 2005), were used in 3 studies (Hu and Fan 2014; Ma 2017; Wang 2008; Xu et al. 2018b). The Gesell Developmental Scale (Gesell 1925) was used by Shi et al. (2007). The Wechsler Primary and Preschool Scale of Intelligence-Revised (WPPSI-R) (Wechsler 1989) was used by Hu and Fan (2014), Hu et al. (2016b), and Qian (2016). All of the 14 single-case design studies used direct behavior observations to collect data at baselines and/or different phases of the intervention (Hitchcock et al. 2015).

Target Behaviors

The behaviors targeted with ABA-based interventions in Mainland China were varied. The majority of the papers focused on the overall performance improvements (Ding et al. 2015; Zou et al. 2008), while some emphasized social communication (Hu and Fan 2014; Qian 2016; Shao et al. 2014; Zheng and Li 2017; Hu et al. 2016b; Hu et al. 2016a), language (Ma et al. 2016), aggressive behavior (Hu and Fan 2014; Zhong 2016), theory of mind (Hu et al. 2015), interference behavior (Wang 2016b), self-injurious behavior (Xiao and Yu 2015), seat-leaving behavior (Yang et al. 2012), and food-selecting behavior (Zhu 2013), respectively.

Table 3 The Quality of research of single-case system design studies

Year	Authors	Study design	(a)	(b)	(c)	Study rating determinants for single-case designs
2017	Lee et al.	Multiple probe design	✓	✓	✓	Meets WWC pilot single-case design standards without reservations
2017	Xu et al.	Changing criterion design	✓	✓	✗	Does not meet WWC pilot single-case design standards
2017	Zheng and Li	A-B-A design	✓	✗	✗	Does not meet WWC pilot single-case design standards
2017	Shen	A-B-A-B design	✓	✗	✓	Meets WWC pilot single-case design standards without reservations
2016a	Hu et al.	A-B-A-B design	✓	✓	With reservation	Meets WWC pilot single-case design standards with reservations
2016b	Hu et al.	Multiple-baseline design	✓	✓	✓	Meets WWC pilot single-case design standards without reservations
2016	Wang	A-B-A design	✓	✗	✗	Does not meet WWC pilot single-case design standards
2016	Huo et al.	A-B-A design	✓	✓	✗	Does not meet WWC pilot single-case design standards
2016	Qian	A-B-A design	✓	✗	✗	Does not meet WWC pilot single-case design standards
2015	Hu et al.	A-B-A design	✓	✗	✗	Does not meet WWC pilot single-case design standards
2015	Xiao and Yu	A-B-A design	✓	✓	✗	Does not meet WWC pilot single-case design standards
2014	Hu and Fan	Multiple-baseline design	✓	✓	✓	Meets WWC pilot single-case design standards without reservations
2012	Yang et al.	A-B-A-B design	✓	✓	With reservation	Meets WWC pilot single-case design standards with reservations
2011	Sun and Wei	A-B design	✓	✗	✗	Does not meet WWC pilot single-case design standards

ABA-Based Interventions

A variety of ABA-based interventions were used in China, including Picture Exchange Communication System (PECS; Hu and Fan 2014; Qian 2016; Shao et al. 2014; Zheng and Li 2017), speech-generating devices (Hu et al. 2016b); structured social play (Hu et al. 2016a); discrete trial teaching (DTT; Zheng and Li 2017; Zou et al. 2008), pivotal response training (PRT; Wang 2016a), and functional assessment (Wang 2016b; Xiao and Yu 2015; Yang et al. 2012). In addition, Zhou et al. (2014) reported that of the 100 autism non-governmental organizations (NGOs) of the *Heart Alliance*, 99 organizations provided ABA-based interventions, 73 provided sensory integrations intervention, and 36 provided Treatment and Education of Autistic and related Communication Handicapped Children (TEACCH). A total of 87 organizations provided more than two approaches (Zhou et al. 2014).

The duration of program reported in these articles was short in general, e.g., around 3 months (Ding et al. 2015; Guo 2006; Xiong et al. 2010). Most autism organizations served for young children, and only 18 out of 100 centers provided services for adults, aged 18 years or older. The number of professionals working at each organization ranged widely from 3 to 75, with a median staff-to-child ratio of 1:2.77 (Zhou et al. 2014).

Some researchers explored cultural differences that affected the service delivery of ABA-based interventions across countries (Liao et al. 2018) and culturally adapted services in China (Xu et al. 2018b).

Parental Involvements and Mental Health

Parents took an active role in ABA-based intervention programs in Mainland China (Guo 2006; Wang 2008; Xiong et al. 2010; Zhou et al. 2014). Results showed 4 out of the 10 group design articles studied parental involvements in children's ABA-based intervention programs, such as the exploration of low intensity of behavior analytic training when parents were involved in children's ABA-based intervention programs (e.g., Xu et al. 2017b; 2018b), and child's behavior change after parents recieved ABA training (e.g., Wang 2008; Zhou et al. 2018a, b). Many parents, who traveled from home to the major cities to access quality parent training, chose to leave their job (Liao et al. 2018). Of 100 autism NGOs included in Zhou et al. (2014), 73 organizations provided both children and parent training, 24 organizations solely provided children intervention, and 3 organizations solely provided parent training. The effectiveness of parent training was demonstrated also by Wang (2008), who reported improvements in interaction between the parent and the child with autism after parent-focused training. Parents were more accepting of their children, clearer about their children's interests, more able to deal appropriately with the children's challenging behavior, and able to better interact and communicate with children.

With regard to parental mental health, the Chinese model of including parent training provided parents a forum to share their feelings, to support each other, and to some extent, to relieve psychological pressure. Xiong et al. (2010) conducted a study comprised 76 mothers and children with autism. In their 70 Days' Project, mothers were trained to support their children under the supervision of ABA professionals. The study revealed that mothers' depression and anxiety level did not change; however, they suggested that further strengthening of training for parents could help relieve of mothers' mental health issues.

Child Outcomes

With regard to child outcomes, the majority of the Chinese researchers reported optimal outcomes in favor of ABA-based interventions. Zhou et al. (2014) reported that over a 20-year period (1993 to 2012), ABA-based interventions were highly effective for students at *Heart Alliance* and *Stars and Rains*. Wang (2008) conducted an assessment of 76 mothers after 3-month intervention of a parent-focused ABA training program, where interventions were based on the parent-child dyad under a teacher's supervision. Results showed improvement in the children's abilities with regard to sensory regulation, social skills, physical motor skills, verbal behavior and speech, and self-care skills. Interestingly, girls showed the greater improvement than boys in terms of social abilities and independent skills; older children had better outcomes than younger ones in terms of self-care competence.

A number of researchers reported specifically positive effects of ABA-based interventions on language and communication skills and challenging behaviors. For example, Liu and Chen (2012) conducted ABA communication training with 41 children with autism aged 2½–5 years old and found that the children's pronunciation, single-word sentences, and expression significantly improved after training. Hu and Fan (2014) reported children's ability with regard to "theory of mind" improved significantly, and Zhong (2016) revealed that after 3 months of ABA-based training, the participant's aggressive behavior reduced significantly.

Ding et al. (2015) assessed the physical ability, emotional ability, social ability, and school behavior of 66 significantly challenged children with autism after they had received 3-month training in ABA program using the Pediatric Quality of Life Inventory Measurement Models (PedsQLTM, Lu et al. 2008). While results showed improved quality of life (physical functioning), less improvement was achieved in emotional and social communication, possibly due to some program inflexibility. Xiong et al. (2010) trained 76 mothers and children with autism and found that children's social skills, language, motor ability, and self-care ability increased significantly.

Financing of Services

Funding for autism in China is limited to services within each local province (Liao et al. 2018). Consequently, most of the parents who wanted to avail of ABA-based services had to finance the interventions themselves. These families carried a larger financial burden (¥19,582.4 per year = $2846.94, currency on 20 August 2018) than families of children with physical disability (¥16,410.1 per year = $2385.74) or intellectual disability (¥6391.0 per year = $929.13) (Xiong et al. 2010). This additional cost was incurred in the context of low wages, i.e., according to the recent report by National Bureau of Statistics (2018). In non-rural regions, the average annual disposable income was ¥36, 396 per annum (= $5291.27), and in rural regions, the average annual disposable income was ¥ 13,432 per annum (= $1952.75).

Discussions

A systematic review was conducted regarding ABA-based interventions in Mainland China by searching for studies published in English and Chinese journals . The current review identified 35 empirical studies, out of the overall 1,171 records (1,162 records by databases and journals and 10 by manual beackward search), specifically focusing on ABA-based interventions for children with autism in Mainland China. However, this relatively low number of published studies does not mean that ABA-based interventions have not been used widely in Mainland China. In fact, ABA-based interventions were originally introduced by autism NGOs since 2000s (Zhou et al. 2014), and most Chinese indigenous research was driven by the needs of families rather than professionals and researchers. In addition, a local autism NGO, Shenzhen Autism Society (SAS 2013) reported that 88.89% of 56 autism organizations across the nation used ABA-based interventions in 2012.

One possible reason for the limited number of published empirical research in Mainland China is that the ABA-based interventions have been used mainly by therapists and parents at autism organizations rather than researchers at professional institutions. The former typically applied interventions at clinic settings focused on customers' needs rather than on publishing their work in peer-reviewed journals. The present review identified that some studies intergrated the ABA-based interventions with other approaches, such as sensory integration, music therapy, and language therapy. However, even when these studies were included the number of empirical studies was still less than 100 articles. This may be due to that most therapists have few opportunities to receive good-quality research training in ABA and this constraints their research abilities in the field.

Another reason may be that there are few qualified ABA professionals in Mainland China, which may result in the limited quantity of published research articles. Behavior Analyst Certification Board (BACB) provides professional credentialing in the field of behavior analysis. Board Certified Behavior Analysts (BCBAs) and Board Certified Behavior Analysts-Doctoral Level (BCBA-Ds) are graduate-level certificates that have demonstrated competency not only in directing and conducting applied behavior analytic interventions but also in designing and implementing behavior analytic research (Shook and Neisworth 2005). However, there are only 22 Board Certified Behavior Analysts (BCBAs), 2 Board Certified Behavior Analysts-Doctoral Level (BCBA-Ds), and 85 Board Certified assistant Behavior Analysts (BCaBAs) in Mainland China (BACB 2019), whereas there are 32,008 BCBAs and 3,437 BCaBAs around the world (BACB, 2019). The first Behavior Analyst Certification Board (BACB, 2019) verified course sequence was established at a Chinese university in 2017.

Results reported here show that the majority of the Chinese researchers concluded that children's ability improved with ABA-based interventions. Yet, few researchers reported to what extent ABA-based interventions worked and how external and environmental variables influenced their effectiveness. This raises concerns about the validity and reliability of research outcomes. In addition, the utilization of most commonly used instruments by Western researchers (e.g., Eikeseth et al. 2007; Peters-Scheffer et al. 2010), such as the Vineland Adaptive Behavior Scale (Sparrow et al. 2016) and the Wechsler Intelligence Scale for Children (Wechsler 1991) to assess effectiveness of the interventions was rather limited in the Chinese papers reviewed here.

These results indicate that ABA-based interventions in Mainland China are more about the practical application rather than theoretical exploration and research outputs. In addition, this review reflected a relatively short time of indigenous research on ABA-based interventions in Mainland China. Very few studies have explored cultural adapted service delivery (e.g., Xu et al. 2018b; Zhou et al. 2018a), the efficiency of skill acquisition (e.g., Cariveau et al. 2019), and treating problematic behaviors based on experimental verification of different functions of behavior (e.g., Gover et al. 2019).

Interestingly, one of the main features that became apparent in this review was the parental involvement. Findings reported here are consistent with the Shenzhen Autism Society (SAS 2013) who reported that over half (56%) the founders of organizations that deliver autism interventions were parents of children diagnosed with autism, who wanted to help their own children and others. The reason for this focus on family lies in the Chinese culture and the policy system. Children's educational development is regarded as one of the core characteristics of a successful family in Chinese culture (Huang and Gove 2012). The parents of children with disability, including

children with autism, spent more time and energy on parenting and education than the parents of other children (Liao et al. 2018). In addition, the lack of financial support from the government and social services and the lack of availability of quality professionals make the situation more difficult for these families (Wang et al. 2013). Parents, especially those who come from rural areas, either have to take an active role to work as a therapist or move out-of-place of residence to access quality services. Finally, parental training provided participants a platform to share their feelings and improve mental health (Liao et al. 2018; McCabe 2003; 2013). However, the possible problem of parental involvement is that parents, especially mothers, have to give up jobs to help their children avail of qualified treatment services. Parents' quality of life might be impacted (Liao 2017) and there is a potential for emotional conflict between being a mother and a professional, especially in dealing with problematic behaviors (McCabe 2007).

Importantly, the lack of systematic understanding of ABA was reflected in many of the studies in this review. For instance, some papers mixed ABA up with other intervention approaches or attributed the effectiveness of ABA-based approaches to something else (Wang et al. 2011). Some authors misread the origins of ABA. For example, some researchers stated that it was Lovaas who developed ABA as an intervention for children with autism in the 1970–1980s (e.g., Xiong et al. 2010, p. 971). This is a widely held misunderstanding of the history of ABA and autism, even in the West. In fact, ABA is not a "therapy for autism" (Dillenburger and Keenan 2009) and earlier than Lovaas (1987), Ferster and colleagues (Ferster and Demyer 1961) and Oppenheim (1974) explored ABA-based interventions to support children with autism. In addition, single-case system experimental design studies dominate the field but some of the Chinese research still lacked the expected rigor with regard to experimental control, generalization, or maintenance data (Johnston and Pennypacker 2010).

Finally, of the most papers included in this review, the term "ABA" was used rather loosely. For example, specific ABA-based interventions (mainly discrete trial teaching, DTT) were used along with other behavioral (e.g., Treatment and Education of Autistic and related Communication handicapped Children; TEACCH) or non-behavioral approaches, such as sensory integration, auditory integration (e.g., Wang et al. 2011), music therapy (e.g., Zhang 2005), and pharmacological treatments. However, usually, researchers did not differentiate to which intervention approach the effectiveness of the overall intervention was attributable (McCabe 2013), and there was little information on how control groups were managed (Clark and Zhou 2005). This indicates that some of the Chinese researchers or parents regarded ABA as one type of intervention method rather than a science that encompasses a large range of strategies, disciplines, and techniques (Cooper et al. 2007). It is doubtful that most of the "ABA" interventions used in Mainland China are truly behavior analytic in nature (Baer et al. 1968), because for the most part, "ABA" was used synonymously with DTT (Liao 2017).

Strengths, Limitations, and Recommendations

To our best knowledge, this is the first systematic literature review that included both English and Chinese papers. The present systematic review reflects the status of ABA-based interventions in Mainland China and thus provides practitioners, researchers, and policy makers with a landscape of behavior analytic interventions on children with autism in China.

On the other hand, the review has a number of limitations. While the search focused on published articles regarding autism and ABA in Mainland China, some unpublished studies such as doctoral or masters level were not included. In addition, the search was conducted before January 2018. It is possible that some peer-reviewed articles have been published since then. The authors may miss some articles published online before this time but printed thereafter. Future research is needed to replicate and extend this review periodically.

This paper sheds lights on the pressing needs of empirical research and systematic training on behavior analytic interventions in Mainland China. These can be achieved in three ways: First, it is recommended that more Chinese universities open behavior analytic intervention courses, such as the verified course sequence by Association for Behavior Analysis International (ABAI) , and provide training to students at undergraduate and postgraduate levels. Second, since culturally adapted research lacks in many areas of science, it is important to explore and compare the application of ABA-based interventions in different cultural contexts. For example, special education professionals are encouraged to receive systematic research training and to publish data-driven articles of their clinical practice. This may lead not only to a better understanding of behavior change procedures that support clients with autism, but also contribute to the exploration intervention strategies across cultures. Third, more books and research instruments on autism and behavioral intervention approaches need to be introduced to Chinese researches and therapists, and these interventions need to be integrated with Chinese indigenous cultures. It is also suggested to develop more Chinese assessment tools in research and clinical services. There are few trainers on Mainland China for the Autism Diagnostic Observation Schedule (ADOS), one of the mostly commonly used diagnostic tool in Western hospitals. Therefore, service providers should consider the distance training courses or workshops and invite experts from abroad when there are no local trainers . Last but not the least, parents working as therapists can relieve the shortage of special needs professionals. The awareness of parent training is increasing

in Mainland China and, given the large geographical area of Mainland China, it could be beneficial if tele-health practices are used to facilitate parents' hands-on experience (e.g., Dai et al. 2018).

Conclusions

The present study shows the currect status of the use of the science of behavior analysis for autism in Mainland China. A limited number of empirical studies on autism and ABA have been done in the past decade, and the theoretical and practical quality of some studies needs to be improved. It is suggested to conduct and publish experimental and non-experimental research in a more rigorous and well-designed manner (Pang et al. 2018). In particular, studies on the status of ABA-based interventions and service delivery are encouraged to adopt evidence-based methods, and these studies need to be known to the local Chinese policy-makers. As these studies become more widespread, they should include evidence for treatment fidelity and social validity, which would help dispel misunderstanding or misuse of the ABA-based intervention approaches and guide policy development. Chinese researchers are encouraged not only to replicate the Western model but also to develop indigenous models adapted to the local culture, educational system and society, based on the science of behavior analysis.

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Compliance with Ethical Standards

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

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