Received: 6 April 2020 | Revised: 9 June 2020 | Accepted: 11 June 2020

DOI: 10.1002/bin.1727

LITERATURE REVIEW

WILEY

A review of the literature on staff training strategies that minimize trainer involvement

Kathleen E. Marano[1] | Jason C. Vladescu[1] | Kenneth F. Reeve[1] | Tina M. Sidener[1] | David J. Cox[2]

[1]Department of Applied Behavior Analysis, Caldwell University, Caldwell, New Jersey

[2]The Johns Hopkins University School of Medicine, Baltimore, Maryland

Correspondence
Kathleen E. Marano and Jason C. Vladescu, Department of Applied Behavior Analysis, Caldwell University, 120 Bloomfield Avenue, Caldwell, NJ 07006.
Email: kmarano@caldwell.edu (K. E. M.) and jvladescu@caldwell.edu (J. C. V)

Abstract

Asynchronous training procedures, which do not require the simultaneous presence of a trainer and trainee, may offer benefits over synchronous training because they may be more efficient, cost-effective, and easier to disseminate. Additionally, asynchronous training may address low trainer to staff ratios. The purpose of this literature review was to identify studies that used asynchronous training procedures to teach any skill related to job performance. A total of 54 articles (containing 58 experiments) were identified for inclusion. The asynchronous staff training techniques identified included video models, computer-based instruction, non-computer based self-instruction, and self-instructional packages. The articles were coded according to participant characteristics, settings, training methodology, and outcomes. Results demonstrated that asynchronous training techniques resulted in mastery-level performance for a variety of skills, although non-computer-based self-instruction had the least consistent outcomes. Future researchers should directly compare asynchronous training strategies, evaluate individual training components, and assess asynchronous training techniques with a wider range of skills.

KEYWORDS

asynchronous, computer-based instruction, self-instruction, staff training, video model

A variety of staff training methods are available to train individuals to perform behavioral technologies that they may be required to perform as part of their jobs. Identifying the most effective and efficient training techniques that result in optimal performance outcomes is important to ensure that staff implement behavioral technologies with high procedural integrity. Procedural integrity refers to an intervention being implemented as it is designed (McIntyre, Gresham, DiGennaro, & Reed, 2007). Research on the impact of poor procedural integrity indicates that procedural integrity errors can negatively affect the learning of individuals receiving services by delaying or even preventing skill acquisition and resulting in decreased consumer compliance (Fryling, Wallace, & Yassine, 2012; McIntyre et al., 2007). Therefore, skills must be trained effectively to ensure trainees can accurately perform them following training, and researchers must identify effective staff training techniques.

One evidence-based staff training technique is behavioral skills training (BST), which involves instructions, modeling, rehearsal, and feedback (DiGennaro Reed, Blackman, Erath, Brand, & Novak, 2018). Although BST is considered to be one of the most effective techniques for training staff (DiGennaro Reed et al., 2018), it also may pose some limitations. BST is often resource-intensive because it typically requires the presence of a designated staff trainer (i.e., an individual with prior experience with the target skill who is responsible for teaching another individual to perform the skill themselves). Because it is often necessary for a trainer and trainee to be present concurrently for training to be delivered, in-vivo forms of BST may be considered synchronous training. Additionally, requiring trainees to meet a predetermined mastery criterion may increase the total training time, increasing the time commitment of both the trainer and trainee (Gerencser, Akers, Becerra, Higbee, & Sellers, 2019).

There is a relative deficit of staff trainers relative to the number of staff who require training within the field of applied behavior analysis (Graff & Karsten, 2012), which may make it difficult for trainers to provide individualized training to all trainees. In fact, for individuals in rural areas or in areas outside of the United States where there are fewer qualified staff trainers, it may be especially challenging for a staff trainer to provide in vivo training, thus limiting the utility of in vivo training in many rural and international cases (Gerencser et al., 2019). Researchers have attempted to make BST more accessible by evaluating modifications to in vivo BST, including telehealth technologies (e.g., Higgins, Luczynski, Carroll, Fisher, & Mudford, 2017; Knowles, Massar, Raulston, & Machalicek, 2017) or pyramidal training (Pence, St. Peter, & Tetreault, 2012).

A viable alternative to synchronous training procedures are asynchronous training procedures in which the trainer and trainee do not need to be present at the same time for training to take place. Asynchronous training procedures typically require a relatively higher up-front cost and time investment relative to synchronous training procedures while the training materials are created (Geiger, LeBlanc, Hubik, Jenkins, & Carr, 2018; e.g., purchasing required software, creating videos). However, a comparison of asynchronous and synchronous training procedures suggested that asynchronous training procedures are more cost-effective when an organization is responsible for training a relatively large number of staff (Geiger et al., 2018). Asynchronous procedures may also be easier to disseminate and reduce barriers to effective staff training in rural areas because trainees can often complete training from their own homes.

Several common asynchronous approaches include video modeling, computer-based instruction (CBI), self-instruction, and self-instructional packages. Video models require trainees to watch a video of another person implementing the skill correctly before they implement the skill themselves. Video models are often supplemented with on-screen text or voiceover instruction to ensure viewers attend to the relevant components of the video. For example, Lipshultz, Vladescu, Reeve, Reeve, and Dipsey (2015) required participants to view a video depicting correct implementation of various stimulus preference assessments (SPAs) while a narrator described how to perform each step. CBI requires trainees to complete interactive training on a computer, and typically involves a combination of text, graphics, and videos. In one study, Pollard, Higbee, Akers, and Brodhead (2014) used CBI, consisting of interactive modules including text, video clips, and quizzes, to teach participants to implement discrete trial instruction (DTI). Self-instruction involves presenting trainees with materials to review, often in the form of manualized or text-based instructions. For example, Gutierrez, Reeve, Vladescu, DeBar, and Giannakakos (2019) provided participants with a manual containing text that described how to implement token economies and then evaluated participant implementation of a token economy with confederates. Self-instructional packages often provide enhanced versions of the materials used for self-instruction by incorporating pictures, diagrams, or video supplements. For example, Graff and Karsten (2012) taught participants to implement SPAs by providing them with self-instructional packets containing text-based instructions supplemented with pictures and diagrams.

Due to the various asynchronous training strategies available to trainers, it is important to analyze the available literature to identify the efficacy of various training procedures for training different populations and target skills. Therefore, Gerencser et al. (2019) conducted a literature review of asynchronous staff training procedures for training human service staff to implement behavioral technologies with individuals with developmental disabilities. The literature review identified 22 studies that focused on teaching a variety of skills using self-instructional manuals, self-instruction manual packages, video modeling, video modeling with voiceover instructions, and CBI. However, the scope of the review was limited to only target skills that were performed directly with consumers (e.g., conducting DTI or SPAs), which excluded skills behavior analytic service providers perform as part of their job duties that do not take place with consumers (e.g., graphing or analyzing data). In addition, although the purpose of the literature review by Gerencser et al. was to identify staff training studies relevant for human service staff, it is also important to identify *all* research that used asynchronous staff training methods. Failing to look more broadly at the literature may limit the scope of the review and lead to incorrect assumptions about the usefulness of certain approaches. In addition, restricting the scope of the review to only research relevant to human service staff does not allow for an evaluation of the generality of asynchronous training approaches. For example, a more comprehensive review should include research focusing on training staff who work in other fields, rather than just behavior analytic service providers, and should include all job-related dependent variables. Therefore, it is necessary to conduct a more comprehensive review of the literature to provide a complete analysis of the effectiveness of asynchronous staff training techniques.

To address these needs, the present literature review was conducted with four primary purposes: providing staff training recommendations for practitioners, summarizing the findings of the review and describing how these findings may inform future research, describing how these findings extend the literature on asynchronous staff training, and providing recommendations for reviewers of the staff training literature. The literature review expands on the work of Gerencser et al. (2019) by including all experiments that used asynchronous training procedures to train staff in any setting. Additionally, because Gerencser et al. (2019) only included experiments that taught the implementation of behavioral technologies directly with a consumer, this literature review includes experiments that used asynchronous staff training procedures to teach any skill related to completing job duties.

1 | METHOD

1.1 | Search procedure

The search procedure identified relevant articles through a systematic search of the *PsychINFO*, *ERIC*, and *PsycARTICLES* databases. The term *training* was combined with the words *staff*, *parent*, *teacher*, and *paraprofessional*. For example, the first author searched using the term “staff training” and reviewed the results based on the inclusionary criteria. Then, “parent training” was searched and the results were reviewed. Additionally, two-keyword searches were performed by searching the term *applied behavior* analysis* with *video model**, *computer-based**, and *self-instruction**. Results were filtered to include only articles that were peer-reviewed, published in English, and were research-based (i.e., discussion articles and literature reviews were excluded). The search did not include any parameters for publication date. Next, the first author performed backward searches of the reference sections of the obtained articles and forward searches using Google Scholar to identify any additional articles that were not captured in the database search. The first author looked for keywords in the titles and reviewed the abstracts of all articles to assess whether they met the inclusionary criteria.

Articles were included in this review if they met the following criteria: (a) published in English in a peer-reviewed journal, (b) included an outcome measure of performance of a behavioral technology that is relevant for performance in a work setting (i.e., performance of any skill that may be required as part of an individual's work duties), (c) the primary independent variable did not initially require the simultaneous presence of a staff trainer and staff member (i.e., the participants received training initially via a modality other than a trainer or experimenter), and (d) specific training strategies were reported (e.g., video model, computer-based instruction). If an experiment included multiple training strategies, only information about asynchronous training strategies was included. Articles that did not meet any of the above criteria were excluded. Experiments that evaluated package interventions consisting of both asynchronous and synchronous training components were excluded because the purpose of this review was to evaluate training approaches that did not require in-vivo training (e.g., studies that evaluated video modeling plus feedback for all participants were excluded). However, similar to Gerencser et al. (2019), this review includes experiments that required procedural modifications following asynchronous training for only the participants who did not initially meet the mastery criterion (i.e., synchronous training was not planned as part of the initial training procedure). In such cases, unplanned additions to the initial training, such as performance feedback, are often used to achieve mastery level responding for the participants who did not meet the mastery criterion (e.g., DiGennaro Reed, Codding, Catania, & Maguire, 2010). Excluding such experiments because participants required synchronous training to achieve mastery potentially biases the results of the literature review to include only experiments with positive results. Therefore, it was important to include experiments that also included additional procedural modifications following training to ensure all participants met the mastery criterion and to provide a more complete evaluation of whether an initial training procedure resulted in participants meeting the performance criterion.

The database search resulted in a total of 6,608 articles. Eighty articles were retained following a review of the titles and abstracts of those articles, with 63 articles remaining after duplicates were removed. Conducting forward and backward citation searches of the retained articles resulted in seven additional articles after duplicates were eliminated. The inclusionary and exclusionary criteria were applied to a total of 70 articles. This resulted in the elimination of 16 articles. Fifty-four articles (containing 58 experiments) met the inclusionary criteria and were included in this review.

A second independent rater reviewed each of the articles obtained through the search process to determine whether the articles met the inclusionary criteria. Interrater agreement was calculated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100. Agreements were defined as both raters identifying an article as meeting the inclusionary or exclusionary criteria. Disagreements were defined as only one rater identifying an article as meeting the inclusionary or exclusionary criteria. The raters reviewed the initial 6,614 articles identified by the database and forward/backward searches and agreed that 54 articles (containing 58 experiments) met the inclusionary criteria (i.e., 100% agreement).

1.2 | Coding procedure

Each article included in this review was evaluated across several dimensions. If an article included two or more experiments, each experiment was evaluated separately.

1.2.1 | Participant and settings

Data were collected on (a) the position held by participants (i.e., parents, teachers, behavior analytic service providers, paraprofessionals, students, other-specified), (b) highest educational attainment (i.e., high school graduate, some college, associate's degree, bachelor's degree, master's degree, doctoral degree), (c) educational background (i.e., specific field of study), (d) prior experience with the target skill (i.e., amount of time participants worked in or were exposed to a setting that provided exposure to the target skill), (e) number of participants, and (f) the training setting (i.e., analogue or natural). We coded "analogue setting" when the skill was trained in an environment different from where the skill would be expected to be performed (e.g., working with a confederate consumer), whereas the setting was coded as "natural" if training was provided in the environment where the behavior was expected to occur.

1.2.2 | Experimental design and dependent/independent variables

Data were collected on the dependent variables in each experiment (i.e., the specific skill being trained), the experimental design used (i.e., the arrangement of conditions to allow comparisons of the effects of the presence and absence of the independent variable; AB replication series, within-subject AB design with replication, multiple baseline design, reversal design, between-subjects, delayed pre- and post-intervention probe, within-subjects pre/post-test, randomized two-group repeated measures design, multiple probe, between-groups), and the various components of the training procedures (i.e., independent variables).

The independent variables were coded based on the specific training strategy used (i.e., video model, CBI, non-computer based self-instruction, self-instructional package). If an experiment included more than one training strategy, it was coded as both strategies. Video models involved audio-visual demonstration of a response that viewers should complete, sometimes supplemented with on-screen text (video modeling with on-screen text) or a narrator's voice describing the steps (video modeling with voiceover instruction). CBI refers to training that is provided via a computer-based delivery system (e.g., modules that participants must complete). Self-instruction involves text-based materials that are provided to participants, which they typically complete at their own pace without trainer involvement (e.g., manuals or task analyses that describe the steps that must be completed). Although CBI procedures often involve self-instruction, the self-instruction category in this literature review refers to non-computer based self-instruction, and will hereafter be referred to as *non-computer based self instruction*. Self-instructional packages involve the same components as traditional non-computer based self-instruction, but also include enhancements (e.g., diagrams, videos).

The components of training were also coded based on the following characteristics: (a) whether training was self-paced (i.e., if participants could progress through the training at their own speed; Experiments with experimenter defined time limits were coded as not self-paced), (b) an experimenter was present during training (i.e., yes if the experimenter was present, no if the experimenter was not present, or not reported if no information about experimenter presence was provided), (c) whether participants practiced the skill during training (e.g., practiced presenting items while watching a video of SPA implementation), (d) whether the training involved interactive questions or activities (i.e., if participants were required to actively respond during training), (e) whether repetition of training was required (e.g., viewing video models more than once or repeating modules during CBI), (f) use of confederates and number of scripts (i.e., whether an individual played the role of a consumer and responded according to a pre-determined sequence of responses), (g) the number of examples and non-examples provided during training (i.e., how many examples of correct or incorrect performance were included in the training materials), (h) performance criterion required (i.e., mastery criterion required to complete the training procedures), (i) duration of training (i.e., amount of time required to complete the training procedure), (j) number of sessions required (i.e., number of sessions required to complete the training procedure), (k) mastery criterion (i.e., the percentage of correct responding required to implement the target skill at an acceptable level following training), and (l) whether additional training was required and what it involved (i.e., any modifications made to the initial training procedure). Additionally, the first author coded whether each experiment included measures of generalization (i.e., assessment of the target skill in an untrained context), maintenance (i.e., if maintenance was assessed and when), interobserver agreement (i.e., whether interobserver agreement was calculated), procedural integrity (i.e., measurement of the experimenter's behavior), and social validity (i.e., an evaluation of the goals, procedures, or outcomes of the experiment).

1.2.3 | Outcomes

Outcomes of each experiment were coded in terms of participant results. Outcomes were coded as positive (i.e., all participants demonstrated responding at the mastery criterion), negative (i.e., no participants demonstrated responding at the mastery criterion), or mixed (i.e., some participants achieved responding at the mastery criterion). For example, an experiment was coded as mixed if three out of four participants achieved mastery, which is likely a conservative measurement that may underestimate the overall efficacy of training. Therefore, we also coded the ratio of participants who achieved mastery and summarized data as the overall percentage of participants who achieved mastery following training. If experiments did not include a mastery criterion, participant performance was coded based on the lowest mastery criterion of all studies that taught the same skill. These coding procedures allowed for an analysis of participant responding both within and across experiments. Data were also collected on participant outcomes for the measures of generalization, maintenance, and social validity.

1.3 | Interobserver agreement

An independent rater reviewed 51.8% (range, 42–60% per training strategy) of the experiments that met the inclusionary criteria. The authors first provided the independent rater with written descriptions of each dimension by which experiments were coded. Then, the authors reviewed these descriptions with the independent rater and practiced reviewing two articles with the independent rater. Then, the independent rater practiced coding three articles independently. The authors considered training to be complete when 100% agreement was obtained between the authors and the independent rater on three consecutive experiments. Item-by-item agreement was assessed by comparing all dimensions in each data table. An agreement was defined as both raters coding a dimension with identical information. For example, an agreement was scored if both raters indicated that 22 participants received training. A disagreement was defined as each rater coding a dimension with different information. For example, a disagreement would be scored if one rater indicated that results were positive, while the other rater indicated that results were mixed. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. IOA was 100% across experiments.

2 | RESULTS

2.1 | General results

An overall summary of the independent variables, participant characteristics, and experimental designs is provided in Table 1. A summary of the outcomes, as well as information regarding generalization, maintenance, social validity, interobserver agreement, and procedural integrity, is provided in Table 2.

2.1.1 | Independent variables

The 58 experiments assessed four primary staff training techniques: video modeling, CBI, non-computer based self-instruction, and self-instructional packages. The most frequently used asynchronous staff training techniques were CBI (28.5%) and video modeling (28.5%). Non-computer based self-instruction (22.2%) and self-instructional packages (20.6%) were used in a similar number of experiments.

TABLE 1 Summary of participants, settings, and experimental designs

Study	Training strategy	Dependent variable	Participant position	Educational attainment	Educational background	Prior experience	Number of participants	Training setting	Experimental design
Al-Nasser et al. (2019)	Self-instruction, self-instructional package	DTI, SPA (PS, MSWO)	Students	Some college	Psychology, neuroscience, english literature, nursing, biochemistry	None	14	Analogue	AB replication series
Arnal et al. (2007)	Exp. 1: Self-instruction Exp. 2: Self-instructional package	Exp. 1: DTI Exp. 2: DTI	Exp. 1: Students Exp. 2: Students	Exp. 1: Some college Exp. 2: Some college	Exp. 1: Psychology Exp. 2: Psychology	Exp. 1: NR Exp. 2: NR	Exp. 1:4 Exp. 2:3	Exp. 1: Analogue Exp. 2: Analogue	Exp. 1: Within-subject AB design with replication Exp. 2: MBDxP
Berkman et al. (2019)	Self-instructional package, video model	Creating graphs in GraphPad prism	Teachers	Bachelor's, Master's	Applied behavior analysis or related field	0–7 years	11	Natural	Task 1: MBDxP and MBDxS with embedded multielement Task 2: Reversal (ABCACC)
Blackman et al. (2019)	CBI	Parent–child interactions	Parents	High school graduate – Advanced degree (not specified)	NR	None	6	Natural	Between-subjects
Catania et al. (2009)	Video model	DTI	Behavior analytic service providers	Bachelor's	NR	0–2 years	3	Analogue	MBDxP
Collins et al. (2009)	Video model	Problem-solving intervention	Behavior analytic service providers	High school graduates	NR	5–63 months	6	Analogue	MBDxP
Deliperi et al. (2015)	Video model	SPA (PS)	Students	Some college	NR	8–84 months	3	Analogue	MBDxP

(Continues)

TABLE 1 (Continued)

Study	Training strategy	Dependent variable	Participant position	Educational attainment	Educational background	Prior experience	Number of participants	Training setting	Experimental design
Delli Bovi et al. (2017)	Video model	SPA (MSWO)	Paraprofessional; other-vice principal	NR	NR	None	2	Analogue	MBDxP
DiGennaro Reed et al. (2010)	Video model	Individual behavioral interventions	Teachers	Bachelor's, Master's	Applied behavior analysis, education	None– 4 years	3	Natural	MBDxP
Dixon et al. (2009)	Self-instruction	Creating graphs in excel	Students	Bachelor's	Applied behavior analysis	NR	22	Natural	Between-subjects
Du et al. (2016)	Self-instruction, self-instructional package	Mirror protocol	Students	Bachelor's	Applied behavior analysis	None	16	Natural	Delayed pre and post intervention probe design
Eldevik et al. (2013)	CBI	DTI	Behavior analytic service providers	High school graduate, Bachelor's, Master's	Psychology	None	12	Analogue	Within-subjects pre-/post-test
Fazzio et al. (2009)	Self-instruction	DTI	Students	Some college	Psychology	NR	5	Analogue	Modified MBDxP
Geiger et al. (2018)	CBI	DTI	Students	Some college	NR	None	25	Analogue	Randomized two-group repeated measures design
Gerencser et al. (2017)	CBI	Implementation of photographic activity schedules	Parents	Some college	NR	None	3	Analogue	MBDxP
Gerencser et al. (2018)	CBI	DTI	Paraprofessionals	High school graduate, Bachelor's	NR	7–20 years	6	Natural	MBDxClassrooms (two participant student dyads per classroom)

TABLE 1 (Continued)

Study	Training strategy	Dependent variable	Participant position	Educational attainment	Educational background	Prior experience	Number of participants	Training setting	Experimental design
Graff and Karsten (2012)	Self-instructional package	SPAs (PS, MSWO)	Teachers	Bachelor's, Master's	NR	None	11	Analogue	MBDxS
Gutierrez et al. (2019)	Self-instruction	Token economy implementation	Students	Some college	Psychology, English	None	3	Analogue	MBDxP
Hansard and Kazemi (2018)	Self-instructional package	SPA (PS)	Students	Some college	Psychology	None	4	Analogue	MBDxP
Higbee et al. (2016)	Exp. 1: CBI Exp. 2: CBI	Exp. 1: DTI Exp. 2: DTI	Exp. 1: Students Exp. 2: Teachers	Exp. 1: Some college Exp. 2: College	Exp. 1: NR Exp. 2: Special education	Exp. 1: None Exp. 2: NR	Exp. 1:4 Exp. 2:4	Exp. 1: Analogue Exp. 2: Natural	Exp. 1: MBDxP Exp. 2: MBDxP
Howard and DiGennaro Reed (2014)	Video model	Discrete trial obedience with dogs	Students	Some college	Applied behavior analysis	None	3	Natural	MBDxP
Ingvarsson and Hanley (2006)	CBI	Interactions with Consumer's parents	Teachers, students	Some college	Education	NR	4	Natural	MBDxP
Lipshultz et al. (2015)	Video model	SPA (SS, PS, MSWO)	Behavior analytic service providers	NR	NR	3–60 months	4	Analogue	MBDxP
Luna et al. (2019)	Self-instructional package	Reinforcement procedures	Paraprofessionals, teacher	Associate's, Bachelor's, Master's	NR	Less than 1 year–10 years	6	Analogue	Noncurrent multiple probexP
Marano et al. (2020)	CBI	SPA (PS)	Other: Adults	Bachelor's	NR	None	3	Analogue	MBDxP
Martocchio and Rosales (2017)	Video model	Implementation of the picture exchange communication system	Students	Some college	NR	None	3	Analogue	Multiple ProbexP

(Continues)

TABLE 1 (Continued)

Study	Training strategy	Dependent variable	Participant position	Educational attainment	Educational background	Prior experience	Number of participants	Training setting	Experimental design
McCulloch and Noonan (2013)	Video model	Mand training procedures	Paraprofessionals	High school graduate, Bachelor's	Business	None	3	Natural	MBDxP
Miltenberger and Fuqua (1985)	Self-instruction	Behavioral assessment interview skills	Students	Some college, Bachelor's	Psychology	None	4	Analogue	MBDxP
Mitteer et al. (2018)	Video model	Creating graphs in GraphPad prism	Behavior analytic service providers	Bachelor's	NR	None	4	Natural	MBDxP
Moore and Fisher (2007)	Video model	Functional analyses	Behavior analytic service providers	Bachelor's	Psychology	None	3	Analogue	MBDxP with multielement
Nosik et al. (2013)	CBI	DTI	Behavior analytic service providers	High school graduates	NR	None	3	Analogue	MBDxP
Nosik and Williams (2011)	CBI	DTI, backward chaining	Students	Some college	Psychology	None	4	Analogue	MBDxdyads sequential analysis
O'Grady et al. (2018)	CBI	Visual analysis of graphs	Other: Adults	Bachelor's, Master's	Accounting, criminal justice, music education, business administration	None	4	Natural	MBDxS
Pollard et al. (2014)	CBI	DTI	Students	Some college	Communication disorders, English, education	None	4	Analogue	MBDxP
Ramon et al. (2015)	Self-instruction	SPA (MSWO)	Students	Some college	Psychology	None	8	Analogue	MBDxP

TABLE 1 (Continued)

Study	Training strategy	Dependent variable	Participant position	Educational attainment	Educational background	Prior experience	Number of participants	Training setting	Experimental design
Rosales et al. (2015)	Video model	SPA (PS, MSWO, FO)	Teachers	Bachelors, Master's	Speech and language pathology, NR	None	3	Analogue	MBDxP
Salem et al. (2009)	Self-instructional package	DTI	Students	Some college	NR	None	4	Analogue	Modified MBDxP
Schnell et al. (2018)	CBI	Analyzing functional analysis graphs	Students	Bachelor's	Applied behavior analysis	13/20 had prior exposure to FAs	20	Natural	Pretest/post-test within a MBD
Scott et al. (2018)	Exp. 1: CBI Exp. 2: CBI	Exp. 1: Detecting antecedents and consequences of problem behavior Exp. 2: Detecting antecedents and consequences of problem behavior	Exp. 1: Teachers, para-professionals Exp. 2: Teachers, para-professionals	Exp. 1: NR Exp. 2: NR	Exp. 1: NR Exp. 2: NR	Overall: 17/39 none, 22 had prior exposure *not reported per experiment	Exp. 1:19 Exp. 2:20	Exp. 1: Analogue Exp. 2: Analogue	Exp. 1: MBDxP Exp. 2: MBDxP
Severtson and Carr (2012)	Self-instruction	DTI	Behavior analytic service providers	High school graduates, some college	NR	None–Minimal training	6	Analogue	MBDxP
Shapiro et al. (2016)	Self-instruction	SPA (PS)	Students, behavior analytic service providers	Some college, Bachelor's, Master's	Psychology, social work, marriage and family therapy	None	13	Analogue	MBDxP
Shuler and Carroll (2019)	Video model	Providing performance feedback	Behavior analytic service providers	Bachelor's	Special education	2 years	4	Analogue	MBDxP

(Continues)

TABLE 1 (Continued)

Study	Training strategy	Dependent variable	Participant position	Educational attainment	Educational background	Prior experience	Number of participants	Training setting	Experimental design
Spiegel et al. (2016)	Video model	Guided compliance	Parents	Master's	Business, education	None	3	Analogue	MBDxP
Summers and Hall (2008)	Self-instruction	Individualized teaching procedures	Parents	NR	NR	None	4	Natural	Pre-post design
Thiessen et al. (2009)	Self-instruction	DTI	Students	Some college	Psychology	None	4	Analogue	MBDxP
Thomson et al. (2012)	Self-instructional package	DTI	Behavior analytic service providers	Some college	NR	None	8	Analogue	Modified MBDxPairs
Tyner and Fienup (2015)	Self-instruction, video model	Creating graphs in excel	Students	Some college	Psychology	NR	Self-instruction: 22 Video model: 22	Natural	Between-groups
Tyner and Fienup (2016)	Self-instruction, self-instructional package	Creating graphs in GraphPad prism	Students	Some college	Psychology	NR	Self-instruction: 8 Self-instructional package: 8	Natural	Between-groups
Vladescu et al. (2012)	Video model	DTI	Behavior analytic service providers	NR	NR	None	3	Analogue	MBDxP
Wainer and Ingersoll (2013)	CBI	Implementing imitation interventions	Students	Some college, Bachelor's, Master's	NR	None	9	Natural	MBDxP
Weldy et al. (2014)	Video model	SPA (MSWO, FO)	Behavior analytic service providers	Bachelor's; 2 NR	NR	None	9	Natural	Multiple probe design

TABLE 1 (Continued)

Study	Training strategy	Dependent variable	Participant position	Educational attainment	Educational background	Prior experience	Number of participants	Training setting	Experimental design
Wightman et al. (2012)	Self-instructional package	DTI	Behavior analytic service providers	High school graduates, some college	NR	1 participant with prior experience	12	Analogue	Modified MBDxP
Wolfe and Slocum (2015)	CBI	Visual analysis of AB graphs	Students	Some college	Education	None	123 total (divided into 3 groups)–Specifics NR	Analogue	Pre/post test with random assignment
Young et al. (2012)	Self-instructional package	DTI	Parents	High school graduates, Bachelor's	NR	None	5	Analogue	MBDxP

Abbreviations: DTI, discrete trial instruction; Exp, experimenter; MBDxP, multiple baseline design across participants; MBDxS, multiple baseline design across skill types; MSWO, multiple stimulus without replacement; NR, not reported; PS, paired stimulus; SPA, stimulus preference assessment; SS, single stimulus.

TABLE 2 Summary of outcomes

Study	Training strategy	Participant results	Generalization assessed and outcome	Maintenance assessed, when, and outcome	Social validity assessed and outcome	IOA assessed	Procedural integrity assessed
Al-Nasser, Williams, and Feeney (2019)	Self-instruction, self-instructional package	Mixed (0/8 with traditional; 7/8 improved with package) *no mastery criteria reported	No	No	Yes, positive	Yes	Yes
Arnal et al. (2007)	Exp. 1: Self-instruction Exp. 2: Self-instructional package	Exp. 1: Mixed (1/4) Exp. 2: Mixed (2/3)	Exp. 1: No Exp. 2: No	Exp. 1: No Exp. 2: No	Exp. 1: Yes, positive Exp. 2: Yes, positive	Exp. 1: Yes Exp. 1: Yes	Exp. 1: Yes Exp. 2: Yes
Berkman, Roscoe, and Bourret (2019)	Self-instructional package and video model	Positive (11/11) * no mastery criteria reported	No	No	Yes, positive	Yes	No
Blackman, Jimenez-Gomez, and Shvarts (2019)	CBI	Positive (6/6) *no mastery criteria reported	No	No	Yes, positive	Yes	No
Catania, Almeida, Liu-Constant, and DiGennaro Reed (2009)	Video model	Positive (3/3)	Yes, positive (no baseline data)	Yes, 1 week, positive	No	Yes	No
Collins, Higbee, and Salzberg (2009)	Video model	Positive (6/6)	Yes, positive	Yes, 2–4 weeks, positive	No	Yes	No
Deliperi, Vladescu, Reeve, Reeve, and DeBar (2015)	Video model	Positive (3/3)	Yes, mixed	Yes, 1 week – Months, positive	Yes, positive	Yes	Yes
Delli Bovi, Vladescu, DeBar, Carroll, and Sarokoff (2017)	Video model	Positive (2/2)	Yes, positive	Yes, 4–8 weeks, positive	Yes, positive	Yes	Yes

TABLE 2 (Continued)

Study	Training strategy	Participant results	Generalization assessed and outcome	Maintenance assessed, when, and outcome	Social validity assessed and outcome	IOA assessed	Procedural integrity assessed
DiGennaro Reed et al. (2010)	Video model	Mixed (1/3)	No	Yes, 1 week, positive	Yes, positive	Yes	Yes
Dixon et al. (2009)	Self-instruction	Positive *no individual data reported	No	No	No	Yes	No
Du, Nuzzolo, and Alonso-Alvarez (2016)	Self-instructional package	Mixed (15/16)	No	No	No	Yes	No
Eldevik et al. (2013)	CBI	Positive *no individual data or mastery criterion reported	Yes, positive	No	No	Yes	No
Fazzio, Martin, Arnal, and Yu (2009)	Self-instruction	Negative (0/5)	Yes, mixed	No	Yes, positive	Yes	Yes
Geiger et al. (2018)	CBI	Mixed (16/25)	Yes, positive	No	Yes, positive	Yes	Yes
Gerencser, Higbee, Akers, and Contreras (2017)	CBI	Positive (3/3)	Yes, positive	Yes, 2 weeks, positive	Yes, positive	Yes	Yes
Gerencser, Higbee, Contreras, Pellegrino, and Gunn (2018)	CBI	Mixed (1/6)	Yes, mixed	Yes, 2 weeks, mixed	Yes, positive	Yes	Yes
Graff and Karsten (2012)	Self-instructional package	Positive (11/11)	Yes, positive	Yes, 1 week–1 month, positive	Yes, positive	Yes	Yes
Gutierrez et al. (2019)	Self-instruction	Positive (3/3)	Yes, positive	Yes, 1 month, positive	Yes, positive	Yes	Yes
Hansard and Kazemi (2018)	Self-instructional package	Positive (4/4)	No	No	No	Yes	Yes

(Continues)

TABLE 2 (Continued)

Study	Training strategy	Participant results	Generalization assessed and outcome	Maintenance assessed, when, and outcome	Social validity assessed and outcome	IOA assessed	Procedural integrity assessed
Higbee et al. (2016)	CBI	Exp. 1: Negative (0/4) Exp. 2: Mixed (3/4)	Exp. 1: Yes, positive Exp. 2: Yes, mixed	Exp. 1: No Exp. 2: Yes, 1 month, mixed	Exp. 1: No Exp. 2: No	Exp. 1: Yes Exp. 2: Yes	Exp. 1: Yes Exp. 2: Yes
Howard and DiGennaro Reed (2014)	Video model	Negative (0/3)	Yes, negative	No	Yes, positive	Yes	No
Ingvarsson and Hanley (2006)	CBI	Mixed (2/4) *no mastery criteria reported	No	No	No	Yes	No
Lipshultz et al. (2015)	Video model	Mixed (3/4)	Yes, positive	Yes, 1 week, positive	Yes, positive	Yes	Yes
Luna, Nuhu, Palmier, Brestan-Knight, and Rapp (2019)	Self-instructional package	Mixed (2/6)	Yes, mixed	No	No	Yes	No
Marano, Vladescu, Reeve, and DiGennaro Reed (2020)	CBI	Positive (3/3)	Yes, positive	Yes, 1–2 weeks, positive	Yes, positive	Yes	Yes
Martocchio and Rosales (2017)	Video model	Mixed (2/3)	No	Yes, 2–3 weeks, mixed	No	Yes	Yes
McCulloch and Noonan (2013)	Video model	Mixed (1/3) *no mastery criteria reported	No	Yes, 5– Weeks, mixed	No	Yes	No
Miltenberger and Fuqua (1985)	Self-instruction	Positive (4/4)	No	No	Yes, positive	Yes	No
Mitteer, Greer, Fisher, and Cohrs (2018)	Video model	Positive (4/4)	No	Yes, 1 month, positive	Yes, positive	Yes	No

TABLE 2 (Continued)

Study	Training strategy	Participant results	Generalization assessed and outcome	Maintenance assessed, when, and outcome	Social validity assessed and outcome	IOA assessed	Procedural integrity assessed
Moore and Fisher (2007)	Video model	Mixed (2/3)	Yes, positive	No	No	Yes	No
Nosik, Williams, Garrido, and Lee (2013)	CBI	Mixed (4/6) *no mastery criteria reported	Yes, mixed	Yes, 6 weeks, mixed	Yes, mixed	Yes	No
Nosik and Williams (2011)	CBI	Negative (0/4) Positive after additional training CBI training (4/4)	Yes, positive	Yes, 6 weeks, positive	No	Yes	No
O'Grady, Reeve, Reeve, Vladescu, and Lake (2018)	CBI	Positive (4/4)	Yes, mixed	Yes, 1 day–1 month, mixed	Yes, positive	Yes	Yes
Pollard et al. (2014)	CBI	Positive (4/4/)	Yes, mixed	No	Yes, positive	Yes	Yes
Ramon, Yu, Martin, and Martin (2015)	Self-instruction	Mixed (7/8)	Yes, mixed	Yes, 1 week, mixed	Yes, positive	Yes	Yes
Rosales, Gongola, and Homlitas (2015)	Video model	Mixed (2/3)	Yes, mixed	Yes, 2 weeks–1 month, positive	No	Yes	No
Salem et al. (2009)	Self-instructional package	Mixed (2/4)	Yes, positive	No	Yes, positive	Yes	Yes
Schnell, Sidener, DeBar, Vladescu, and Kahng (2018)	CBI	Mixed (19/20)	Yes, mixed	Yes, 2 weeks, mixed	Yes, positive	Yes	Yes
Scott, Lerman, and Luck (2018)	CBI	Exp. 1: Mixed (17/19) Exp. 2: Positive (20/20)	Exp. 1: No Exp. 2: No	Exp. 1: No Exp. 2: No	Exp. 1: No Exp. 2: No	Exp. 1: Yes Exp. 2: Yes	Exp. 1: No Exp. 2: No

(Continues)

TABLE 2 (Continued)

Study	Training strategy	Participant results	Generalization assessed and outcome	Maintenance assessed, when, and outcome	Social validity assessed and outcome	IOA assessed	Procedural integrity assessed
Severtson and Carr (2012)	Self-instruction	Mixed (3/6)	Yes, mixed	Yes, 3–5 days, mixed	No	Yes	Yes
Shapiro, Kazemi, Pogosjana, Rios, and Mendoza (2016)	Self-instruction	Mixed (9/13)	Yes, mixed	No	No	Yes	Yes
Shuler and Carroll (2019)	Video model	Mixed (3/4)	Yes, mixed	Yes, 1 month, mixed	Yes, positive	Yes	Yes
Spiegel, Kisamore, Vladescu, and Karsten (2016)	Video model	Positive (3/3)	Yes, positive	Yes, 1 & 2 months, positive	Yes, positive	Yes	Yes
Summers and Hall (2008)	Self-instruction	Mixed (2/4) *no mastery criteria reported	No	No	No	Yes	No
Thiessen et al. (2009)	Self-instruction	Positive (4/4)	Yes, mixed	No	Yes, positive	Yes	Yes
Thomson et al. (2012)	Self-instructional package	Positive (8/8)	No	No	Yes, positive	Yes	Yes
Tyner and Fienup (2015)	Self-instruction, video model	Self-instruction: Mixed (8/22) Video model: Mixed (12/22) *no mastery criteria reported	No	No	Yes, positive	Yes	Yes

TABLE 2 (Continued)

Study	Training strategy	Participant results	Generalization assessed and outcome	Maintenance assessed, when, and outcome	Social validity assessed and outcome	IOA assessed	Procedural integrity assessed
Tyner and Fienup (2016)	Self-instruction, self-instructional package	Self-instruction: Negative (0/8) Self-instructional package: Mixed (6/8) *no baseline data or mastery criteria reported	No	No	No	Yes	No
Vladescu, Carroll, Paden, and Kodak (2012)	Video model	Positive (3/3)	Yes, positive	No	No	Yes	No
Wainer and Ingersoll (2013)	CBI	Mixed (6/9)	No	No	Yes, positive	Yes	No
Weldy, Rapp, and Capocasa (2014)	Video model	Mixed (7/9)	No	No	No	Yes	No
Wightman et al. (2012)	Self-instructional package	Mixed (9/13)	Yes, positive	No	Yes, positive	Yes	Yes
Wolfe and Slocum (2015)	CBI	Mixed *no individual data or mastery criteria reported	No	No	Yes, mixed	Yes	Yes
Young, Boris, Thomson, Martin, and Yu (2012)	Self-instructional package	Mixed (1/5)	Yes, positive	Yes, 1 month, positive	Yes, positive	Yes	Yes

2.1.2 | Dependent variables

Nearly all experiments (98.3%) included dependent variables relevant for human-service staff working with individuals with autism spectrum disorder or other developmental disabilities. Only one experiment (1.7%) taught a skill that was not relevant for human-service staff. Howard and DiGennaro Reed (2014) taught volunteer staff in an animal shelter to implement obedience procedures with dogs. The most commonly taught skill was DTI (33.9%). SPAs were the next most commonly taught skill (18.6%). More specifically, experiments included the paired-stimulus (8 experiments), multiple-stimulus without replacement (7 experiments), free operant (2 experiments), and single stimulus (1 experiment) assessments. The next most frequently taught skill was graph creation (8.4%), while visual analysis of graphs was taught less frequently (5.1%). Individualized behavior interventions and the identification of antecedents and consequences of problem behavior were taught relatively infrequently (5.1 and 3.4%, respectively). The following remaining dependent variables were each assessed in only one experiment (1.7%): implementing reinforcement procedures, implementing photographic activity schedules, implementing chaining procedures, conducting interviews as part of behavioral assessments, learning to greet consumers' parents by name, implementing the Picture Exchange Communication System, implementing functional analysis procedures, implementing guided compliance procedures, implementing the mirror protocol, appropriate parent–child interactions, implementing mand training procedures, implementing problem-solving interventions, implementing token economies, and delivering feedback.

2.1.3 | Participant and setting characteristics

Students participated in experiments most frequently (41.9%), followed by behavior analytic service providers (22.6%), teachers (14.2%), paraprofessionals (9.5%), and parents (8%). Adults of unspecified occupations and a vice principal were included as participants the least frequently (3.2 and 1.5%, respectively). The majority of participants experienced some level of higher education (79.8%), with most of those participants having some college education (35%), some obtaining Bachelor's degrees (29.7%), and fewer participants obtaining Master's degrees (14.8%); a smaller number of participants' highest degree was a high school diploma (12.1%) and some experiments did not report the educational levels of participants (8.1%). A large number of experiments did not report the field of study of the participants (43.5%). Of the experiments that did report the field of study, psychology was represented most frequently (24.1%), followed by education (14.5%), and then applied behavior analysis (6.4%). Participants studied unrelated fields in a relatively small number of experiments (11.2%). Most participants did not have any prior experience with the target skill (63%), while only some had prior experience with the target skill (21%) and fewer experiments did not report the participants' prior experience (15.7%). The majority of experiments trained skills in an analogue setting (86.4%), while fewer experiments trained skills in the natural setting (13.6%). The majority of experiments included in this review were conducted in the United States (81%). Of the small percentage of studies conducted outside of the United States, the majority were conducted in Canada (81.8%; Arnal et al., 2007; Fazzio et al., 2009; Ramon et al., 2015; Salem et al., 2009; Summers & Hall, 2008; Thiessen et al., 2009; Thomson et al., 2012; Wightman et al., 2012; Young et al., 2012), with one study conducted in the United Kingdom (9%; Eldevik et al., 2013) and one conducted in Brazil (9%; Higbee et al., 2016).

2.1.4 | Experimental design

Most experiments used single-subject experimental designs (86%), while fewer experiments used group designs (14%). The single-subject designs used included AB replication series (4%), multiple-baseline across participants (60%), modified multiple baseline across participants (8%), multiple-baseline across participants with multielement (4%), multiple-baseline across settings (8%), reversal design (4%), multiple probe design (6%), and a pre and post intervention design (6%). The group designs used included between-subjects (37%), within-subjects pre/post-test (25%), randomized two-group repeated measures design (13%), and between-groups design (25%). Additionally, most experiments evaluated only one independent variable (91.2%), whereas only a few experiments evaluated more than one independent variable (8.8%).

2.1.5 | Training characteristics

Most experiments allowed participants to complete the training at their own pace (56.8%). The experimenter was present during training for approximately one-third of experiments (34.4%) and was not present during training in a small percentage of experiments (20.6%). Most experiments did not report whether the experimenter was present during training (41.3%). Approximately half of the experiments required participants to practice the target skill during training (46.5%) and required participants to repeat the training procedure multiple times (51.7%). Most experiments involved the use of confederate consumers during training (62%). The majority of experiments in this review required participants to actively respond during training (58.6%; e.g., answering questions while completing a module). Additionally, only a small percentage of experiments incorporated both examples and non-examples of correct responding during training (17.2%). Less than half of experiments required participants to meet a mastery criterion during training before implementing the target skill (43.1%). Following training, the majority of experiments required participants to meet a mastery criterion for implementation of the target skill (75.8%). Less than half of the experiments required additional modifications following training to ensure participants met the mastery criterion (41.3%), including feedback and modeling (either in-vivo or a video model).

2.1.6 | Outcomes

In general, the experiments included in this literature review indicated mixed results for the efficacy of asynchronous training procedures. Of the 58 experiments included in this review, approximately half of them indicated that initial asynchronous training resulted in mastery level responding for some, but not all participants (51.7%). Positive results were obtained for all participants less frequently (41.3%), whereas negative results were found for all participants least often (6.9%). An analysis of the overall results for all participants across experiments showed that the majority of participants mastered the target skill following initial asynchronous training (68.9%).

The number of participants who achieved a pre-determined mastery criterion after experiencing each training strategy varied across dependent variables. Video modeling resulted in mastery-level performance for training the creation of graphs (Berkman et al., 2019; Mitteer et al., 2018; Tyner & Fienup, 2015); teaching staff to carry out DTI (Catania et al., 2009; Vladescu et al., 2012; Young et al., 2012); SPAs (Deliperi et al., 2015; Delli Bovi et al., 2017; Lipshultz et al., 2015); guided compliance procedures (Spiegel et al., 2016); and problem solving interventions for all participants (Collins et al., 2009). Results were mixed for training functional analysis procedures (Moore & Fisher, 2007); SPAs (Rosales et al., 2015); individual behavioral interventions (DiGennaro Reed et al., 2010); implementation of the Picture Exchange Communication System (Martocchio & Rosales, 2017); mand training procedures (McCulloch & Noonan, 2013); and providing performance feedback (Shuler & Carroll, 2019). Video modeling did not result in shelter volunteer staff reaching a pre-determined mastery criterion for implementing discrete trial obedience with dogs (Howard & DiGennaro Reed, 2014).

CBI resulted in mastery-level responding for most participants for training parent–child interactions (Blackman et al., 2019); graph creation (Berkman et al., 2019); DTI (Eldevik et al., 2013; Geiger et al., 2018; Gerencser et al., 2018; Higbee et al., 2016; Nosik et al., 2013; Nosik & Williams, 2011; Pollard et al., 2014); photographic activity schedules (Gerencser et al., 2017); interactions with consumers' parents (Ingvarsson & Hanley, 2006); SPAs (Marano et al., 2020); visual analysis of graphs (O'Grady et al., 2018; Schnell et al., 2018; Wolfe & Slocum, 2015);

detecting antecedents and consequences of problem behavior (Scott et al., 2018); and imitation interventions (Wainer & Ingersoll, 2013).

Non-computer based self-instruction resulted in participants meeting a pre-determined mastery criterion for implementing token economies (Gutierrez et al., 2019) and conducting behavioral assessment interviews (Miltenberger & Fuqua, 1985). Non-computer-based self-instruction had mixed results for training participants to conduct SPAs (Al-Nasser et al., 2019; Ramon et al., 2015; Shapiro et al., 2016); create graphs (Dixon et al., 2009; Tyner & Fienup, 2015; Tyner & Fienup, 2016); and individualized behavioral interventions (Summers & Hall, 2008). It did not result in mastery level-responding for training most participants to implement DTI (Al-Nasser et al., 2019; Arnal et al., 2007; Fazzio et al., 2009; Severtson & Carr, 2012), with only one experiment (Thiessen et al., 2009) finding positive outcomes for all participants.

Self-instructional packages resulted in participants meeting a pre-determined mastery criterion for training most participants to conduct SPAs (Al-Nasser et al., 2019; Graff & Karsten, 2012; Hansard & Kazemi, 2018); DTI (Al-Nasser et al., 2019; Arnal et al., 2007; Salem et al., 2009; Thomson et al., 2012; Wightman et al., 2012; Young et al., 2012); graph creation (Berkman et al., 2019; Tyner & Fienup, 2016); a mirror protocol (Du et al., 2016); and reinforcement procedures (Luna et al., 2019).

Five experiments directly compared multiple staff-training strategies. Three experiments compared non-computer based self-instruction and a self-instructional package (Al-Nasser et al., 2019; Du et al., 2016; Tyner & Fienup, 2016). All three experiments found that a self-instructional package had better performance outcomes than text-based self-instruction alone for training staff to implement DTI and SPAs (Al-Nasser et al., 2019), training participants to implement the mirror protocol (Du et al., 2016), and creating graphs (Tyner & Fienup, 2016). One experiment compared video modeling with voiceover instruction to con-computer based self-instruction and found that video modeling with voiceover instruction had better results for training participants to create graphs (Tyner & Fienup, 2015). One experiment compared video modeling with voiceover instruction and a self-instructional package and found that both strategies successfully trained participants to create graphs at mastery levels (Berkman et al., 2019).

2.1.7 | Generalization

Slightly more than half of the experiments assessed generalization (58.6%). Of the experiments that assessed generalization, half demonstrated positive outcomes for all participants (52.9%), less than half demonstrated mixed outcomes (44.9%), and only one experiment demonstrated negative outcomes (2.9%). Across all experiments, generalization of the target skills was demonstrated for the majority of participants (83.3%).

2.1.8 | Maintenance

Less than half of the experiments assessed maintenance of the target skill over time (43.1%). Of the experiments that assessed maintenance after training was complete, the majority found positive outcomes for all participants (60%), less than half of the experiments found mixed outcomes (40%), and no experiments demonstrated negative results for maintenance. The majority of participants who completed maintenance probes demonstrated maintenance of the target skills (85.9%). Maintenance probes ranged from several days after training was completed to 8 weeks following training.

2.1.9 | Social validity

Most of the experiments included in this review assessed social validity (60.3%). The majority of experiments demonstrated positive results (94.3%), a small percentage indicated mixed social validity results (5.7%), and 0% demonstrated negative results for social validity.

TABLE 3 Summary of study characteristics for video models

Study	Components	Self-paced	Exp. present	Practice during training	Interactive questions/ activities	Examples (#)/non-examples (#)	Repetition of training required	Confederate/ Number of scripts	Performance criterion required (for training)	Mastery criterion	Additional training required
Berkman et al. (2019)	Voiceover instruction	No	Yes	Yes	Yes	Ex. (1)	Yes	N/A	No	NR	No
Catania et al. (2009)	Voiceover instruction	No	NR	No	No	Ex. (NR)	Yes	Yes, NR	No	Stable responding	Yes, feedback
Collins et al. (2009)	Video only	No	NR	No	No	Ex. (NR)	Yes	Yes, NR	No	Yes, 90%	No
Deliperi et al. (2015)	Voiceover instruction	No	NR	No	No	Ex. (1 per step, then full SPA)	Yes	Yes, 6	No	Yes, 90%	No
Delli Bovi et al. (2017)	Voiceover instruction	No	NR	No	No	Ex. (1 per step, then full SPA)	Yes	Yes, NR	No	Yes, 90%	No
DiGennaro Reed et al. (2010)	On-screen text, voiceover instruction	No	NR	No	No	Ex. (1)	Yes	No	No	Yes, 100%	Yes, video model plus feedback
Howard and DiGennaro Reed (2014)	On-screen text	No	Yes	No	No	Ex. (NR)/non-ex. (NR)	No	No	No	Yes, 90%	Yes, feedback and modeling
Lipshultz et al. (2015)	On-screen text, voiceover instruction	No	No	No	No	Ex. (NR)	Yes	Yes, 12	No	Yes, 90%	Yes, feedback
Martocchio and Rosales (2017)	Voiceover instruction	No	No	No	No	Ex. (NR)	Yes	Yes, 3–5 per phase	Yes, 90%	Yes, 90%	Yes, feedback
McCulloch and Noonan (2013)	On-screen text, voiceover instruction	No	NR	No	Yes	Ex. (NR)	Yes	No	Yes, 88%	NR	No
Mitteer et al. (2018)	Voiceover instruction	No	Yes	No	No	Ex. (1 per step)	Yes	No	No	Yes, 85%	No
Moore and Fisher (2007)	Video only	No	NR	No	No	Ex. (NR)	NR	Yes, NR	No	Yes, 80%	Yes, feedback

(Continues)

TABLE 3 (Continued)

Study	Components	Self-paced	Exp. present	Practice during training	Interactive questions/activities	Examples (#)/non-examples (#)	Repetition of training required	Confederate/ Number of scripts	Performance criterion required (for training)	Mastery criterion	Additional training required
Rosales et al. (2015)	On-screen text	No	NR	No	No	Ex. (1)	Yes	Yes, NR	No	Yes, 90%	Yes, feedback
Shuler and Carroll (2019)	Voiceover instruction	No	NR	Yes	No	Ex. (10)	Yes	Yes, NR	Yes, 88%	Yes, 80%	Yes, feedback
Spiegel et al. (2016)	On-screen text, voiceover instruction	No	Yes	No	No	Ex. (NR)	Yes	Yes, 1	No	Yes, 90%	No
Tyner and Fienup (2015)	Voiceover instruction	No	Yes	Yes	No	Ex. (1 per step)	No	No	No	NR	No
Vladescu et al. (2012)	Voiceover instruction	No	NR	No	No	Ex. (NR)	Yes	Yes, 31	No	Yes, 90%	No
Weldy et al. (2014)	Voiceover instruction	No	NR	No	No	Ex. (1 per step, then full SPA)	No	No	No	Yes, 90%	Yes, Rewatching the video

TABLE 4 Summary of study characteristics for computer-based instruction

Study	Self-paced	Exp. present	Practice during training	Interactive questions/activities	Examples (#)/non-examples (#)	Repetition of training required	Confederate/Number of scripts	Performance criterion required (for training)	Mastery criterion	Additional training required
Blackman et al. (2019)	Yes	No	No	Yes	Ex. (NR)	No	No	No	NR	No
Eldevik et al. (2013)	Yes	Yes	Yes	Yes	Ex. (11)/non-ex. (16)	No	No	No	NR	No
Geiger et al. (2018)	No	Yes	Yes	Yes	Ex. (NR)/non-ex. (NR)	No	Yes, NR	Yes, 90%	Yes, 85%	Yes, feedback
Gerencser et al. (2017)	Yes	No	Yes	Yes	Ex. (1–6 per step)	No	Yes, 4	No	Yes, 90%	No
Gerencser et al. (2018)	Yes	No	Yes	Yes	Ex. (2–11 per step)	No	No	No	Yes, 90%	Yes, feedback
Higbee et al. (2016)	Exp. 1: Yes Exp. 2: Yes	Exp. 1: Yes Exp. 2: Yes	Exp. 1: Yes Exp. 2: Yes	Exp. 1: Yes Exp. 2: Yes	Ex. (NR)	Exp. 1: Yes Exp. 2:Yes	Exp. 1: Yes, NR Exp. 2: No	Exp. 1: Yes, 8/10 on posttest Exp. 2: Yes, 8/10 on posttest	Exp. 1: Yes, 85% Exp. 2: Yes, 85%	Exp. 1: Yes, feedback Exp. 2: Yes, feedback
Ingvarsson and Hanley (2006)	Yes	No	No	Yes	Ex. (NR)	No	No	Yes, 100%	NR	Yes, feedback
Marano et al. (2020)	Yes	No	No	Yes	Ex. (2–4)/non-ex. (2–4)	No	Yes, 4	Yes, 100%	Yes, 100%	No
Nosik et al. (2013)	Yes	Yes	No	Yes	Ex. (NR)/non-ex. (NR)	No	Yes, responses randomized without replacement	Yes, 80%	NR	No
Nosik and Williams (2011)	Yes	NR	No	Yes	Ex. (NR)	No	Yes, responses randomized without replacement	Yes, 100%	Yes, 100%	Yes, video feedback
O'Grady et al. (2018)	Yes	NR	Yes	Yes	Ex. (NR)	Yes	No	Yes, 90%	Yes, 90%	No
Pollard et al. (2014)	Yes	Yes	Yes	Yes	Ex. (NR) Non. Ex. (NR)	Yes	Yes, 5	Yes, 80%	Yes, 85%	Yes, feedback

(Continues)

TABLE 4 (Continued)

Study	Self-paced	Exp. present	Practice during training	Interactive questions/activities	Examples (#)/non-examples (#)	Repetition of training required	Confederate/Number of scripts	Performance criterion required (for training)	Mastery criterion	Additional training required
Schnell et al. (2018)	Yes	Yes	Yes	Yes	Ex. (NR)	Yes	N/A	Yes, 100%	Yes, 90%	No
Scott et al. (2018)	Exp. 1: No Exp. 2: No	Exp. 1: Yes Exp. 2: Yes	Exp. 1: Yes Exp. 2 yes	Exp. 1: Yes Exp. 2: Yes	Exp. 1: Ex. (NR) Exp. 2: Ex. (NR)	Exp. 1: Yes Exp. 2: Yes	Exp. 1: No Exp. 2: No	Exp. 1: Yes, 80% Exp. 2: Yes, 80%	Exp.1: Yes, 80% Exp. 2: Yes, 80%	Exp. 1: No Exp. 2: No
Wainer and Ingersoll (2013)	Yes	No	Yes	Yes	Ex. (NR)	No	No	No	Yes, 80%	Yes, modeling
Wolfe and Slocum (2015)	Yes	NR	Yes	Yes	Ex. (NR)	No	No	No	NR	No

TABLE 5 Summary of study characteristics for non-computer-based self-instruction

Study	Self-paced	Exp. present	Practice during training	Interactive questions/ Activities	Examples (#)/ non-examples (#)	Repetition of training required	Confederate/ Number of scripts	Performance criterion required (for training)	Mastery criterion	Additional training required
Al-Nasser et al. (2019)	Yes	NR	NR	No	None	No	Yes, NR	No	NR	No
Arnal et al. (2007)	Exp. 1: Yes	Exp. 1: NR	Exp. 1:No	Exp. 1: Yes	Ex. (NR)	Exp. 1: No	Exp. 1: Yes, NR	Exp. 1: Yes, 100%	Exp. 1: Yes, 90%	Exp. 1: No
Dixon et al. (2009)	Yes	NR	Yes	Yes	Ex. (NR)	No	N/A	No	NR	No
Fazzio et al. (2009)	No	NR	No	Yes	Ex. (NR)	No	Yes, NR	Yes, 100%	Yes, 90%	Yes, modeling and feedback
Gutierrez et al. (2019)	No	NR	No	No	Ex. (NR)/non-ex. (NR)	No	Yes, NR	No	Yes, 90%	No
Miltenberger and Fuqua (1985)	NR	NR	No	Yes	Ex. (NR)/non-ex. (NR)	Yes	Yes, 12	No	Yes, 90–100%	No
Ramon et al. (2015)	Yes	No	No	Yes	Ex. (NR)	No	Yes, NR	No	Yes, 85%	Yes, modeling
Severtson and Carr (2012)	Yes	Yes	No	No	Ex. (NR)/non-ex. (NR)	No	Yes, NR	Yes, 90%	Yes, 90%	Yes, video model, feedback
Shapiro et al. (2016)	No	NR	No	No	Ex. (NR)	Yes	Yes, 4	No	Yes, 90%	Yes, modeling and feedback
Summers and Hall (2008)	Yes	NR	No	No	Ex. (NR)	No	No	No	NR	No
Thiessen et al. (2009)	Yes	Yes	Yes	Yes	Ex. (NR)	Yes	Yes, 3	Yes, 100%	Yes, 80%	No
Tyner and Fienup (2015)	Yes	Yes	Yes	No	Ex. (NR)	No	No	No	NR	No
Tyner and Fienup (2016)	Yes	Yes	Yes	No	Ex. (NR)	No	No	No	NR	No

2.1.10 | Interobserver agreement and procedural integrity

All experiments included in this review (100%) included measures of interobserver agreement. More than half of the experiments (56.9%) included measures of procedural integrity to ensure the independent variable was implemented as intended, whereas fewer experiments did not include measures of procedural integrity (43.1%).

2.2 | Video modeling

The characteristics of the experiments that assessed video modeling procedures are summarized in Table 3. Eighteen experiments assessed video models for training staff to implement a variety of procedures. Most experiments incorporated voiceover instruction (55.5%), whereas a smaller percentage included on-screen text (11%), and some experiments included both voiceover instruction and on-screen text (22.2%). None of the experiments used video models that allowed participants to complete the training at their own pace, whereas a small number of experiments included self-guided practice (16.7%) or interactive questions or activities (11.1%). Additionally, the majority of experiments required that participants re-watch the video multiple times (77.7%). Only one experiment (Howard & DiGennaro Reed, 2014) included both examples and non-examples of the target response. Across experiments, training required an average of 1.2 hr and 1–15 sessions. Most experiments (77.7%) included a mastery criterion of at least 80% correct responding for implementation of the target skill, but few experiments (16.7%) required a mastery criterion to complete initial training. Overall results suggest that video modeling had mixed outcomes. Video modeling resulted in positive results in about half of the experiments (44.4%) and mixed results in most experiments (55.5%). Video modeling resulted in negative outcomes in only one experiment (5.5%), which consisted of a video model with on-screen text. Overall, the majority of participants who experienced video modeling met the mastery criterion following initial training (83.3%). Half of the experiments included additional training (i.e., feedback or feedback with modeling) following video modeling to ensure participants learned the target skills (50%).

It is difficult to determine whether voiceover instruction or on-screen text increased the efficacy of video modeling because the different characteristics of training were not directly compared. However, based on the results of all video modeling studies, no characteristic was consistently associated with entirely positive results (e.g., some experiments had positive results with voiceover instruction and on-screen text, whereas others had mixed results). Therefore, the influence of the inclusion of on-screen text or voiceover instruction on video modeling efficacy cannot be determined without additional research.

2.3 | Computer-based instruction

The characteristics of the 19 experiments that evaluated CBI for staff training are presented in Table 4. The training procedures in most experiments were self-paced (89.4%), and all experiments required that participants engage in interactive activities throughout the training. A small number of experiments (17.2%) included both examples and non-examples of the target responses. Participants were required to meet a mastery criterion to complete training in approximately half of the experiments (47.3%). If participants did not meet the mastery criterion for training initially, participants were required to repeat the training in a small number of experiments (26.3%). A relatively small amount of experiments reported the use of confederates during training (36.8%). Most experiments (68.4%) included a mastery criterion for implementation of the target skill. Mean training time was 1.91 hr across the experiments that reported mean training time and training required 1–40 days. The majority of experiments required participants to meet a mastery criterion for the target skills (68.4%), which ranged from 80%–100% correct responding. Less than half of the experiments resulted in positive outcomes for all participants (42.1%; e.g., Berkman et al., 2019; Gerencser et al., 2017; Marano et al., 2020), while a slightly higher percentage of experiments resulted in mixed

TABLE 6 Summary of study characteristics for self-instructional package

Study	Self-paced	Exp. present	Practice during training	Interactive questions/ activities	Examples (#)/ non-examples (#)	Repetition of training required	Confederate/ Number of scripts	Performance criterion required (for training)	Mastery criterion	Additional training required
Al-Nasser et al. (2019)	Yes	NR	No	No	Ex. (NR)	No	Yes, NR	No	NR	No
Arnal et al. (2007)	Exp. 2: Yes	Exp. 2: Yes	Exp. 2: No	Exp. 2: Yes	Ex. (NR)/ non-ex. (NR)	Exp. 2: No	Exp. 2: Yes, NR	Exp. 2: Yes, 100%	Yes, 90%	Yes, observing video plus feedback
Berkman et al. (2019)	Yes	Yes	Yes	Yes	Ex. (NR)	Yes	N/A	No	NR	No
Du et al. (2016)	Yes (for manual), no for video	NR	No	Yes	Ex. (NR)	No	No	Yes, 90%	Yes, 100%	Yes, feedback
Graff and Karsten (2012)	No	No	No	No	Ex. (NR)	No	Yes, 4 per SPA	No	Yes, 90–100%	No
Hansard and Kazemi (2018)	No	No	Yes	Yes	Ex. (NR)	No	Yes, 4	No	Yes, 90%	No
Luna et al. (2019)	No	Yes	No	No	Ex. (1+ per step)	Yes	Yes, NR	No	Yes, 90%	No
Salem et al. (2009)	Yes	Yes	Yes	Yes	Ex. (NR)	Yes	Yes, NR	Yes, 50%	Yes, 80%	No
Thomson et al. (2012)	Yes	Yes	Yes	Yes	Ex. (NR)	Yes	Yes, 3	Yes, 100%	Yes, 80%	No
Tyner and Fienup (2016)	Yes	Yes	Yes	No	Ex. (NR)	No	No	No	NR	No
Wightman et al. (2012)	Yes	No	Yes	Yes	Ex. (NR)	Yes (if mastery not achieved in test)	Yes, 3	Yes, 100%	Yes, 80%	No
Young et al. (2012)	Yes	Yes	Yes	Yes	Ex. (NR)	Yes (if mastery not achieved in test)	Yes, 3	Yes, 100%	Yes, 80%	Yes, video and feedback

outcomes (47.3%; e.g., Geiger et al., 2018; Gerencser et al., 2018). A small percentage (10.5%) of experiments resulted in negative outcomes for all participants (Higbee et al., 2016; Nosik & Williams, 2011). Of the experiments that reported the number of participants who completed CBI, most participants met the mastery criterion after initial training (79.3%). Some experiments (36.8%) also included additional training modifications after participants did not meet mastery following initial training, including providing feedback (e.g., Geiger et al., 2018) and modeling (i.e., Wainer & Ingersoll, 2013).

2.4 | Non-computer-based self-instruction

Table 5 shows that 13 experiments assessed non-computer based self-instruction procedures. Approximately half of the experiments included interactive activities for participants to complete during training (46.1%). Only one experiment included self-instruction in the form of a task analysis (Dixon et al., 2009). The remaining experiments involved the use of manualized self-instruction (e.g., Fazzio et al., 2009; Gutierrez et al., 2019). A small number of experiments included examples and non-examples of correct responding (23%). A small percentage of experiments (30.7%) required participants to meet a mastery criterion to terminate training. Of the experiments that taught skills relevant to working with consumers, only one did not use confederates during training (Summers & Hall, 2008). Mean training time was 1.7 hr, based on the nine experiments that reported training duration. Additionally, training required 1–5 sessions to complete. Most experiments reported the use of mastery criterions for participant performance of the target skills (61.5%), ranging from 80–100% correct responding. Overall, some experiments reported positive results (30.7%; e.g., Dixon et al., 2009; Gutierrez et al., 2019). Approximately half of the experiments reported mixed results (46.1%; e.g., Arnal et al., 2007; Ramon et al., 2015). A small number of experiments reported negative results (23%; e.g., Al-Nasser et al., 2019). Based on the experiments that reported mastery criterions, more than half of the participants achieved mastery level responding following initial training (61.8%). Some experiments provided additional training to participants after the mastery criterion was not met initially (30.7%), including modeling and feedback (e.g., Severtson & Carr, 2012) and modeling alone (i.e., Ramon et al., 2015).

2.5 | Self-instructional packages

Twelve experiments, listed in Table 6, assessed self-instructional packages for training participants. One-quarter of experiments involved written instructions enhanced with pictures or diagrams (e.g., Al-Nasser et al., 2019; Graff & Karsten, 2012). Half of the experiments involved manual and video-based training (e.g., Thomson et al., 2012; Young et al., 2012). One-quarter of experiments involved written instructions or a task analysis with pictures and video modeling (e.g., Berkman et al., 2019; Hansard & Kazemi, 2018). Most experiments were self-paced (75%) and included interactive activities (66.6%). Only one experiment included examples and non-examples to demonstrate skill implementation (Arnal et al., 2007). Du et al. (2016) was the only experiment that taught a skill involving direct work with a consumer that did not use confederates during training. Half of the experiments required participants to meet a performance criterion for training (50%). Mean training time was 2.84 hr for the experiments that reported training duration, and training required between 1 and 15 sessions to complete. The majority of experiments required participants to meet a mastery criterion for implementation of the target skill (75%), which ranged from 80%–100% correct responding. Overall, results were positive for all participants in one-third of experiments (33.3%; e.g., Graff & Karsten, 2012; Hansard & Kazemi, 2018). Results were mixed in most experiments (66.6%; e.g., Al-Nasser et al., 2019; Tyner & Fienup, 2016). Of the total participants who received training via self-instructional packages, the majority of participants met the mastery criterion following initial training (80.4%). Only a few experiments provided participants with additional training after the mastery criterion was not met (25%), including receiving feedback alone (i.e., Du et al., 2016) and watching a video and receiving feedback (e.g., Young et al., 2012).

3 | DISCUSSION

We conducted a literature search to identify all staff training experiments that used asynchronous training techniques in which a staff trainer's presence was not required for training. A total of 54 articles, including 58 experiments, met the inclusionary criteria for this review. The types of training techniques identified included video modeling (often with on-screen text or voiceover instruction), computer-based instruction, non-computer based self-instruction, and self-instructional packages. Additionally, an analysis of the dependent variables measured in each experiment suggested that discrete trial instruction and stimulus preference assessments were the most commonly targeted skills.

The results of this literature review, as well as the findings of the previous literature, may provide direction for practitioners who are responsible for training staff. Gerencser et al. (2019) conducted a similar review of the literature by identifying all experiments that used asynchronous strategies to train staff to implement behavioral technologies based on the principles of behavior analysis with individuals with developmental disabilities. Both literature reviews found similar results regarding the effects of each training procedure on participant outcomes. For example, self-instructional packages typically had better performance outcomes than self-instruction alone. Video models and CBI resulted in mastery-level responding for most participants across both literature reviews. This means that practitioners can select the training procedure that best means their individual needs for training most target skills. For example, if an organization has limited financial resources or limited time to dedicate to creating CBI, the practitioners can use a combination of enhanced written instructions and video models. Both reviews also found that the complexity of the target skill may impact which training strategy practitioners should use. For example, simple written instructions or models may be appropriate for training skills with fewer steps and less need to differentially respond to consumer behavior (e.g., graph creation). However, practitioners should likely train skills that are relatively more complex, (e.g., functional analysis procedures), with more comprehensive training packages, such as self-instructional packages or CBI.

A summary of the implications of the results of the literature review and how these results may translate into recommendations for future research is warranted. Although the present review included experiments that trained staff in any field, only one experiment was identified that taught a skill that was not relevant for working with individuals with developmental disabilities (Howard & DiGennaro Reed, 2014). This suggests that there is a need for more behavior analytic research on asynchronous training strategies in other disciplines. In a survey of professionals from across the United States, 91% of employees reported that their company used a form of video-based training (Kaltura, 2019). However, despite the ubiquitous use of asynchronous training techniques across disciplines, behavior analysts have not assessed the use of asynchronous training techniques for training skills unrelated to human service staff, indicating a need for further research. For example, behavior analysts might consider working with individuals of other professions (e.g., medical professions) to help train staff. Additionally, the majority of experiments focused on training staff to conduct DTI and SPAs. Although these skills are important and widely used in behavior analytic programming (Graff & Karsten, 2012), it is also important that researchers assess the most effective and efficient staff training methods for training other skills. The Behavior Analyst Certification Board's fifth Edition Task List (Behavior Analyst Certification Board, 2017) identifies a variety of skills that individuals seeking certification must learn and may provide direction for skills that future research could target. For example, applicants are expected to be familiar with derived stimulus relations, suggesting that future researchers might train staff to design and implement equivalence-based instruction. Although multiple experiments taught participants to visually or analyze or create graphs (e.g., O'Grady et al., 2018; Tyner & Fienup, 2016), no experiments focused specifically on training data collection or measurement procedures, which is an important skill for behavior analytic practitioners. Although personnel supervision and management skill are also included on the fifth Edition Task List, only one experiment (Shuler & Carroll, 2019) taught a skill related to managing staff by training participants to deliver performance feedback. Additional research is warranted to train a variety of other skills.

Another important area for future research includes evaluating the different features of asynchronous training techniques to determine whether they affect efficacy. Skinner (1954, 1958) suggested that training should involve active engagement, be learner paced, include mastery criteria, require the production of responses (rather than selecting a response via a multiple choice format), include immediate and individualized feedback, and proceed in systematic steps. Researchers should evaluate each of these components of instruction. The majority of experiments in this review required active responding during training (58.6%). Although researchers suggest that active responding should be included during training, additional research is needed to empirically evaluate its influence. Such research may compare training with and without an active response requirement, as well as evaluating the type of active responding that is required. For example, an experiment may evaluate the impact of including quizzes with open-ended questions during training compared to including quizzes with multiple-choice options. Less than half of experiments required participants to meet a mastery criterion during training (43.1%; e.g., answering all questions in a test correctly before implementing the target skill). Researchers should assess whether participants should be required to demonstrate responding at a predetermined criterion before training ends. Additionally, only a small percentage of experiments included in this review (17.2%) incorporated both examples and non-examples of correct responding during training. Research to assess the influence of including non-examples during training is warranted to determine whether the incorporation of non-examples is beneficial.

This literature review also identified areas for improvement in future research, including providing more detail about the training procedures and including measures of generalization, maintenance, and social validity. Many studies did not report whether the experimenter was present during training (41.3%) and many studies reported that the experimenter was present during training (34.4%). The presence of an experimenter during training may influence participant responding due to reactivity, thus potentially impacting the efficacy of the intervention (e.g., impacting on-task behavior; Palmer & Johnson, 2019). Given that the purpose of asynchronous training is to eliminate the need for a trainer's presence, it is important that researchers evaluate such trainings without the experimenters remaining present during training. However, there are some potential problems with conducting research without an experimenter present, including difficulty with data collection and inability to evaluate whether participants are appropriately using the training materials. For example, participants may attend to a video model only if the experimenter is present. If the experimenter is not present, participants may not attend and training with a video model may not result in mastery-level performance. Therefore, it is important that experimenters report all relevant training characteristics including information regarding experimenter presence. In situations where it is not practical for the experimenter to not be present, future researchers who are evaluating asynchronous training procedures may consider modifying their procedures to best simulate an environment where an experimenter is not present (e.g., observing sessions through one-way mirrors, scoring data from video).

Only about half of the experiments included in this review included measures of generalization to skills not directly taught. Of the experiments that did assess generalization, only half demonstrated positive results for all participants. These results indicate that researchers should program for generalization to promote the likelihood of responding occurring in untrained contexts and ensure that measures of generalization are included in additional research. For example, researchers who train skills with confederates should also assess performance of the skill with actual consumers. Similarly, less than half of the experiments in this review included maintenance probes following training, with just over half of those experiments showing positive outcomes. Researchers should assess maintenance and design experiments to promote maintenance of skills over time (e.g., fading the delivery of feedback during training). Just over half of the experiments included in this review assessed procedural integrity, while all experiments included measures of interobserver agreement. Therefore, researchers should ensure that measures of procedural integrity are included in future research. The inclusion of social validity measures is another area that future researchers should target. The majority of experiments did include social validity measures, but a large number of experiments did not assess social validity of the procedures and outcomes. Although it is important that training strategies are effective, it is also important that staff express satisfaction with the procedures that are used to ensure the results and procedures are acceptable to the individuals receiving training. This makes it important that researchers include social validity measures in future research.

Some additional avenues for future research include assessing asynchronous procedures that incorporate the use of technology that has not yet been used for staff training (e.g., virtual reality technology). Also, the majority of experiments included in this review were conducted in the United States. These results suggest that additional research is warranted in areas outside of the United States, which is particularly important given the relative lack of behavior analysts in other geographic locations. Conducting and disseminating research in other geographic locations may allow more individuals worldwide to access quality behavior analytic services. Researchers should also consider creating more standardized training procedures, rather than creating their own unique training materials. For example, many researchers evaluated unique training procedures to train participants to implement SPAs, rather than modifying and evaluating one standardized training procedure. Researchers should consider standardizing training procedures to optimize training and determine whether a technique meets the criteria for evidence-based practice (Hitchcock, Kratochwill, & Chezan, 2015). For example, after a researcher conducts a study that indicates an intervention results in mastery-level responding, it may be beneficial to make those materials available online for other researchers to evaluate and potentially make modifications to optimize the training. Then, the researchers involved with creating the materials can make the materials available online for free or for purchase so clinicians, schools, and agencies can use the materials. By creating more standardized training, researchers and trainers can ensure that staff are implementing procedures consistently and reduce the monetary and time commitments that are often necessary to create training materials. This literature review also extends research on asynchronous staff training procedures by providing a review of all experiments that did not require the simultaneous presence of trainees and trainers. Specifically, the present review extends the work of Gerencser et al. (2019) in a number of ways. First, this review includes all asynchronous training procedures, including skills not implemented directly with consumers and skills not related to work with individuals with developmental disabilities. For example, the present review included skills that are relevant for behavior analytic service providers (e.g., creating or analyzing graphs) that do not involve direct work with consumers. Additionally, the present review includes experiments that taught skills that are relevant for staff in multiple fields (e.g., training volunteers in a dog shelter), rather than restricting the search to experiments related to behavior analytic programming. By including more experiments, this review provided a more comprehensive analysis of the literature on asynchronous training strategies and identified multiple areas where additional research is warranted. The present literature review identified more than double the number of studies identified by Gerencser et al. (2019), with the first literature review identifying 22 experiments and the present study identifying 58 experiments.

Some of the results of the present review also differed from those of Gerencser et al. (2019). For example, Gerencser et al. (2019) found that non-computer based self-instruction did not result in mastery-level responding for most participants, whereas the present review found positive results for most participants. The present literature review found that experiments successfully used non-computer based self-instruction to teach skills that do not require direct work with consumers (e.g., Dixon et al., 2009), whereas non-computer based self-instruction did not have positive outcomes for training skills that do involve direct work with consumers (e.g., Al-Nasser et al., 2019). This difference suggests that non-computer based self-instruction may have positive outcomes when training skills that do not require staff to respond to consumer responses (e.g., graph creation), but that other training techniques may be more beneficial for training skills that may be considered relatively more complex (e.g., responding to consumer behavior during DTI). Although both literature reviews found that the most commonly targeted skills were SPAs and DTI, the present literature review also identified many other skills that were successfully taught with asynchronous training procedures (e.g., graph creation, mand training). Therefore, this literature review provides a more comprehensive overview of the research on asynchronous training procedures by including the full range of skills that have been taught through this type of training. The overall mixed outcomes across the experiments included in this review can also inform recommendations for reviewers of the staff training literature. It is difficult to determine which staff training strategy is the most effective due to limited experiments that directly compared multiple training procedures. Three experiments compared a standard non-computer based self-instructional package to an enhanced self-instructional package and determined that a self-instructional package had more robust improvements when training staff (Al-Nasser et al., 2019; Du et al., 2016; Tyner & Fienup, 2016). Tyner and Fienup (2015) compared video modeling with voiceover instruction and text-based self-instruction for training staff to create graphs and found that video modeling with voiceover instruction resulted in better performance outcomes. Berkman et al. (2019) extended this line of research by comparing video modeling with voiceover instruction and a self-instructional package for creating graphs and found that both procedures resulted in mastery-level performance. These results suggest that self-instructional packages may have better results than non-computer-based self-instruction alone. However, additional research is needed to further compare the various training procedures. Group design experiments may provide a viable method for directly comparing multiple training procedures to identify the most effective training procedures for teaching a variety of skills. Very few experiments included in this review evaluated asynchronous training procedures using group designs and even fewer experiments directly compared multiple asynchronous training strategies. It is difficult to compare different training strategies using single-subject research designs, due to the potential for multiple treatment interference or carryover effects, and the inability to compare different treatments across groups. Group designs are also commonly used in research in other fields, so the use of group designs may allow for more dissemination of findings across other fields.

It is possible that particular strategies may have better results when training certain skill types. The relative simplicity of the skill (e.g., number of steps or the need to differentially respond to consumer behavior) may influence the type of training that should be provided. For example, it may be possible to train relatively simple skills (e.g., SPAs) through video modeling, but more complex skills (e.g., conducting functional analysis procedures) may require more extensive in-vivo training. If that is the case, trainers may choose to spend more time training more complex skills in person and use asynchronous training techniques to train the relatively less complicated behavioral technologies. Researchers should evaluate the efficacy of asynchronous training strategies for training skills of varying complexities.

The overall results of the various experiments also suggest that trainers have a variety of options to choose from when training staff and should assess trainee preference and subsequent performance outcomes when providing training. It is possible that individual staff members may respond differently to various training procedures or have a preference for a particular training technique. For example, some people may prefer instruction that is self-paced and requires active responding (e.g., CBI), whereas others may prefer alternative types of training (e.g., video models). Relatedly, many experiments did not report the participants' field of study (43.5%) or participants' prior experience with the target skill (15.7%). It is important that researchers report participant characteristics because certain characteristics or histories may indicate a particular training strategy will be most appropriate. Therefore, researchers should evaluate whether training strategies may have differential outcomes, under which conditions particular strategies may have the best outcomes, and which trainee characteristics may influence the relative efficacy of each training procedure. For example, researchers may evaluate the specific learning histories that affect the effectiveness of one strategy over another by conducting studies with participants of various backgrounds (e.g., staff with prior experience with the target skill, individuals with no prior experience) and assessing whether participant outcomes are different across groups. For example, it is possible that individuals who are familiar with the purpose of SPAs will respond differently following training than someone who has no prior experience with SPAs.

Because a limited number of staff trainers are available relative to the number of staff who require training, asynchronous training procedures offer an alternative to traditional staff training procedures that require in-person direct training. By eliminating the need for the presence of staff trainer, asynchronous training procedures may be more cost effective, increase the accessibility of evidence-based staff training, and allow more staff to be trained simultaneously (Gerencser et al., 2019). Therefore, it is important that researchers continue to extend this line of research.

ACKNOWLEDGMENTS

This paper was completed in partial fulfillment of the requirements for the Doctor of Philosophy in Applied Behavior Analysis by the first author under the second author at Caldwell University. The authors would like to thank Colleen Marano for her help with various aspects of this manuscript.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

DATA AVAILABILITY STATEMENT

Data Sharing: Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ETHICS STATEMENT

This article does not contain any studies with human participants or animals performed by any of the authors.

INFORMED CONSENT

This article does not contain any studies with human participants performed by any of the authors.

ORCID

Jason C. Vladescu https://orcid.org/0000-0003-4391-9511

Kenneth F. Reeve https://orcid.org/0000-0002-8434-9810

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How to cite this article: Marano KE, Vladescu JC, Reeve KF, Sidener TM, Cox DJ. A review of the literature on staff training strategies that minimize trainer involvement. *Behavioral Interventions*. 2020;1–38. https://doi.org/10.1002/bin.1727