

Video-Based Instruction in enhancing Functional Living Skills of Adolescents and
young Adults with Autism Spectrum Disorder and their transition to Independent
Living: A review.

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Assistive technology in vocational training of adults with autism and transition to life

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Abstract

Individuals with Autism Spectrum Disorder (ASD) deal with impairments in functional living skills. Video-based instruction (VBI) has been used for teaching and enhancing functional living skills for adolescents and young adults with ASD. This literature review of 19 relevant reports investigates various different types of VBI used in the studies. It explores the utilization and efficacy of VBI in enhancing the functional living capabilities of adolescents and young adults with ASD. Social skills were taught in most of the included studies. Only two studies focused on workplace social skills, three on vocational skills, and one on academic skills. The findings demonstrate that video modeling (VM) alone or in conjunction with other methods or strategies, is the method most often used in enhancement of functional living skills in adolescents and young adults with ASD.

Keywords: ASD, autism, video, VBI, adolescents and/or young adults, and skills

1. Introduction

Functional living skills are very important for individuals with ASD and their community participation. They refer to a wide range of abilities needed for an individual to perform daily living abilities at home, school, and work. In addition,

functional living skills encompass a variety of skills including social, vocational, behavior management, and academic skills (Benett & Dukes, 2014). Ayres and colleagues (2011) found that there is a connection between functional living skills and independent living for individuals with ASD, since independence of functional skills affects the way they act in environment.

Individuals with ASD have various impairments in social functioning, including stereotypical gestures, difficulty with eye contact, limited emotional and social reciprocity and inability to comprehend facial expressions and body language, and in addition, aggressive behavior is not uncommon (American Psychiatric Association, 2013). All these characteristics may lead to an inability to develop and maintain high-quality social relationships. **Adolescents and young adults with ASD face either unemployment or underemployment.** They have problems in adjusting to a new setting, and even when they are employed, they switch jobs frequently (Howlin et al., 2004). On the other hand, studies have shown that individuals with ASD may possess specific skills and abilities that are suited to certain jobs, and when they are appropriately employed and well supported, they seem to be capable of working effectively and being independent (de Schipper et al., 2016). In addition, many individuals with ASD continue to live at home after completing school and getting older, and fewer than 10% live independently (Howlin et al., 2004). **Even though they have to deal with their impairments throughout their lives, developing the ability to perform functional living skills on their own may enable them to take care of themselves, enhance their quality of life, and decrease their dependence on others** (Hong et al., 2015).

The American Autism and Developmental Disabilities Monitoring Network estimated the rate of ASD in the United States to be 1 in 68 (Baio et al., 2018), and similar

estimates have been made across Europe (Hughes, 2011). The increasing rates of diagnosis of ASD have led to research focus on the transition to adulthood, when the period of the educational services system ends. This transition involves completion of secondary school, and possible start of employment, continuation in post-secondary education, contribution to a household, participation in the community and experiencing personal and social relationships (Wehman et al., 2014). However, many students with ASD leave school every year without the necessary functional living skills for entering independent adult life, and they may experience poor outcomes in college completion, employment, independent living and social interaction (Roux et al., 2015; Wehman et al., 2014).

1.1. Technology-based interventions and people with ASD

Identifying effective educational interventions directed towards the acquisition of functional living skills by individuals with ASD continues to be a critical task for researchers, teachers and health practitioners (Delano, 2007). In recent decades, technology-based approaches and methods have been used in educational and therapeutic interventions for individuals with ASD in order to improve a variety of their skills, including social impairments, communication, recognizing emotions, maintaining social relationships, academic, daily living, and vocational skills (Bennett & Dukes, 2014). Studies have shown that individuals with ASD often show an intense interest in technology, both in using it and learning with it (Lin et al., 2013). For them, technology can replace other abilities, support development of a skill or help them to perform a task, and enable them to feel that they belong to a group and to take part in communal activities (Chirambira, 2013). In addition, technology is predictable, free from social and emotional transitions, and is mainly dependent on visual information. Individuals with ASD, who are supported by technology, may be able to

maintain their repetitive behaviors (e.g., repetitive body movements or behaviors) without this being inconvenient (Wojciechowski, 2017).

1.2. *Video-based instruction*

One effective instructional technology is video-based instruction (VBI), which has been associated with improvement in many skills, including cognitive ability, social skills and communication, academic, daily living, and vocational skills (Cannella-Malone et al., 2016; Keith et al., 2013). VBI involves words, pictures, and actions to promote the learning of a variety of skills (Mayer & Moreno, 2003). Besides, it offers the participants an appropriate model and a set of behaviors or skills. VBI allows the participants to observe and focus on the targeted behaviors/skills. For the purpose of the study, the researchers define VBI as strategies that incorporate visual cues to teach or maintain skills through model behavior.

VBI integrates technology such as video modeling (VM) and video prompting (VP). Other subcategories are video self-modeling and *in vivo* modeling. In VM and video self-modeling, individuals with ASD observe other people or themselves performing a behavior or a task successfully on video, and then imitate the targeted behavior/skill. In videos with other as a model an adult or a peer may be the model or a particular part of the model can be shown (point-of-view modeling). In video self-modeling the video is edited in order to show that the individuals with ASD performed the targeted skills or behavior independently. In *in vivo* modeling the individuals with ASD observe a live model performing the targeted behavior. Point-of-view VM is another type of video, recorded from the perspective of the learner, as if the learner has already experienced the event. The camera angle is presented at the participant's eye level and shows only what the person should see related to the targeted behavior,

activity or skill, including images of hands demonstrating a specific skill. Continuous VM presents a video in a “looping” format which automatically repeats playing of the video while the individual completes a task. Video-based group intervention is a social skills group intervention that uses VM for teaching skills to individuals with ASD during peer-to-peer interaction. Video-enhanced schedules combine instructional components of activity schedules and VM. Generally, VM may be more effective when introducing a skill for the first time, because the learner has the opportunity to watch the entire sequence of the steps uninterrupted and repeatedly (Taber-Doughty et al., 2011). In VP, individuals with ASD watch a sequence of steps in a video that is relevant to the targeted behavior or task. In between each step the students are asked to perform what they saw in the video. Each step of the video is shown as needed and feedback is provided by the researchers if needed (Kellems et al., 2016).

1.3. Previous reviews

Given the growing number of individuals with ASD who transition into adulthood, and the impairments they have to face with throughout their life, identification and use of effective instructional approaches to teach and improve their functional living skills is of great importance. Previous literature reviews focused on the efficacy of different instructional methods (e.g. technology-based interventions) as well as the improvement of specific type of skills. Bennett and Dukes (2013) reviewed the teaching of employment skills to individuals with ASD between the ages of 14 and 22 years, investigating the instructional tactics used to teach employment skills and their efficacy of them. They found only 12 studies that met the inclusion criteria and focused on teaching employment skills. None of these studies focused on social skills

needed for employment. They underlined the need of an increase in research studies focused on participants with ASD between 14-22 years old.

An increasing number of studies published since 2010 led Seaman-Tullis and Malone (2016) to revisit the subject and investigate interventions or teaching strategies used to teach vocational skills to individuals with ASD, and the setting in which the skills were taught. They found that there are several interventions that are effective in teaching vocational or pre-vocational skills to adolescents and young adults with ASD. These interventions used some forms of technology, which led to several advantages (provide independence in employment settings, review or repeat steps, cost effective in terms of materials and vocational training). They evaluated all the included studies and pointed out that maintenance measured in 57% and generalization in 33%.

Other reviews focused on the efficacy of VBI alone or in conjunction with other methods or strategies for adolescents and young adults with ASD. A recent review (Park et al., 2018) focused on different types of VBI used in research, especially VM and VP, analyzed the skills taught using those methods, and their effectiveness in teaching various skills to individuals with intellectual disability. They found that VM and/or VP interventions have positive effects in teaching skills (e.g. daily living, employment, leisure, and academic skills). The two methods were equally used and the most frequent skill taught for individuals with ID was daily living skills. Most of the studies used additional strategies and one third of them conducted generalization.

Another review (Hong et al., 2016) examined the effects of educational interventions (VM, audio cueing, behavioral in-vivo instruction, or visual cues) for teaching functional living skills (e.g. employment skills, self-help skills, house chores,

community access skills) to adolescents and young adult individuals with ASD. They found that most studies used VM to teach functional living skills and identified how the effects of VM were differentiated by participant diagnosis and the functional living skills. A more recent literature review (Munandar et al., 2020) examined the efficacy of VBI in improving employment skills required to secure and maintain a job for youth and young adults with ASD. Researchers found that VBI may be effective in improving job performance and social communication skills. Only three studies focused on job search skills and taught job interviewing skills. In addition most of the studies measured the effectiveness of the VBI in maintaining skills as well as a few studies investigated whether participants generalized the skills to different settings. Overall most of the included studies seem to help individuals with ASD to find and keep a job.

1.4. The purpose of the review

While VBI has been shown to be effective for enhancing functional living skills for individuals with ASD, most of these studies **focus on one type of skill** (e.g., vocational skills; Bennett & Dukes, 2013; Murandar et al., 2020; Seaman-Tullis & Malone, 2016), **a different disability diagnosis** (e.g. intellectual disability; Park et al., 2018), and various types of instructional approaches (Hong et al., 2017). Given the impairments individuals with ASD face with, the **utilization of VBI** related to supporting individuals with ASD, and their training in functional living skills, there is a need to better understand the current range of VBI research related to the training and the enhancement of functional living skills for adolescents and young adults with ASD. The review was based on the following research questions:

- For adolescents and young adults with ASD what functional living skills were taught through VBI?
- For adolescents and young adults with ASD what types of VBI (e.g., VM, VP) were used and what, if any, additional strategies were used?
- Do the studies of VBI to support adolescents and young adults with ASD in enhancing functional living skills meet the methodological quality standards?

2. Method

2.1. Research Procedures

Researchers implemented several steps to identify relevant peer-reviewed published studies that met the inclusion criteria. A search was made in PubMed, ResearchGate, Science Direct, Scholar Google and ERIC, using the keywords: ASD, autism, video, VBI, adolescents and/or young adults, and skills. The researchers combined ASD and video and adolescents and/or young adults and skills, ASD and VBI and adolescents and/or young adults and skills, autism and video and adolescents and/or young adults and skills, ASD and VBI and adolescents and/or young adults and skills. This resulted in a total of 348 studies. Then, the researchers read the titles and abstracts to exclude studies that did not include experimental results of VBI, and/or presented different age groups, and/or disabilities not including ASD. Duplicate articles were removed. Researchers screened the remaining articles by reading the full text to identify studies that met all the inclusion criteria.

An ancestral search was conducted by the researchers by examining references from the studies that met the inclusion criteria. No additional articles were added. In addition, researchers used “cited in” feature in Scholar Google to forward search each

of the included studies. They identified two studies through this search. Then, researchers performed a hand search in peer-reviewed articles (e.g., International Journal of Developmental Disabilities, Journal of Autism and Developmental Disorders). No additional articles were identified through the hand search. The included studies were identified to be 19 (Figure 1). Interrater agreement (IRA) during the electronic data base search, hand and ancestral search, and the screening was completed by having the researchers separately search and screen the articles. All the articles were reviewed by the researchers so as to provide reliability of the process. In case of disagreement on whether or not to include a study in the review, the researchers discussed and searched again if the paper met the above criteria. Finally, the obtained IRA was 100% after the discussion.

2.2. *Inclusion and exclusion criteria*

The studies had to meet the following criteria to be included in the review: a) peer-reviewed journals published in English in the years 2015-2020, b) at least one of the participants in the study must have been identified as having ASD, c) studies used VBI targeted to functional living skills (daily living, vocational, academic, and social skills), d) at least half of the participants in the study had to be 12-25 years old. Studies were excluded if they: a) were non-experimental (e.g., literature reviews, meta-analysis); b) did not include a VBI; c) did not target to functional living skills of adolescents and young adults with ASD. Dissertations were excluded too. To determine whether a study met the inclusion criteria, the two researchers evaluated all the studies separately. The disagreements between the researchers were discussed until they come to an agreement with both agreeing that the 19 studies met the inclusion criteria and the obtained IRA was 100%.

2.3. *Coding procedures*

Coding categories were implemented to map and synthesize the studies meeting the inclusion criteria. Specifically demographic characteristics were coded for number of participants, age, disability, and setting. Second, the studies were coded based on: a) the type of VBI (e.g., VM, when VM alone or in conjunction with additional strategies was used; VP, when VP alone or in conjunction with other strategies was used); b) the functional living skills (e.g. daily living skills, academic skills, vocational skills, social skills, and others); and c) whether VBI was implemented alone or in conjunction with other strategies (e.g., feedback, error correction, reward systems, least to most prompting). We coded the maintenance and generalization probe of the VBI too. The maintenance code was used for studies that included information regarding the participants' ability to maintain the functional living skills for a certain period of time post-intervention training. The generalization code was used when the study included the participants' ability to generalize the targeted skills.

Finally, every study was coded to assess its quality based on the Council for Exceptional Children (CEC) Standards for Evidence-Based Practices in Special Education (Cook et al., 2014). A set of 24 quality indicators (QIs) for group design studies and 22 QIs for single-subject studies was developed and addressed across eight areas: Context and Setting, Participants, Intervention Agents, Description of Practice, Implementation Fidelity, Internal Validity, Outcome Measures/Dependent Variables, Data Analysis. If a study met the methodological criteria, each QI was scored 1. In case a study did not meet the methodological criteria, the QI is scored 0. The overall scores are divided by the number of QIs and multiplied by 100%.

Two researchers separately reviewed the 19 studies to determine whether each of the studies met the coding categories and the CEC standards. The two researchers compared the results after completing the coding and the QI evaluation for all the studies. Every agreement or disagreement was scored for each item on the coding sheet. IRA was calculated by dividing the sum of agreements by the total sum of agreements and disagreements and multiplied by 100. The IRA for coding number of participants, age, disability, and setting was 100%. The percent of agreement for type of VBI was initially 90%; however upon discussion, it became 100%. Agreement for the functional living skills code (daily living, academic, vocational, social skills, and others), the package code (alone, in conjunction with other strategies; feedback, error correction, reward systems, least to most prompting), and the maintenance and generalization probe code was 100%. The IRA for QI evaluation ranged from 78% to 100%, with a mean of 85%.

3. Results

The first search yielded 350 results. The final selection resulted in 19 studies that met the inclusion criteria as well as the QIs of the CEC Standards for Evidence-Based Practices in Special Education.

3.1. Demographics

The studies included in the review, the research setting and the characteristics of the participants are shown in Table 1. There were a total of 76 participants included in the 19 studies; 47 were male and 29 were female. Participants ranged in age from 12 to 32 years old, and the median age of them was 18 years old. There were nine studies in which all of the participants had only ASD (N=27), whereas ten studies included participants who had diagnoses of ASD and comorbid diagnoses of intellectual

disabilities, aphasia, social anxiety, selective mutism, epilepsy, attention deficit hyperactivity disorder, generalized anxiety disorder, learning disabilities, down syndrome (N=49). Most of the studies (10/19) were conducted in a simulated setting (e.g., a classroom, an office).

3.2. *Targeted skills*

The studies targeted a variety of skills, including daily/living, vocational, academic, social, and other skills (see Table 2). Five studies focused on daily living skills such as setting the table, cooking, folding clothes, cleaning, personal hygiene (Aldi et al., 2016; Shepley et al., 2017; Thomas et al., 2020; Wertalik & Kubina, 2018; Wynkoop et al., 2017). Three studies focused on vocational (i.e., gardening, filling an envelope; English et al., 2016; Kim, 2018; Seaman-Tullis et al., 2018), one on academic skills such as teaching mathematic skills (Kellems et al., 2016), and two on other tasks such as exercise and origami (Fitzgerald et al., 2018; Shepley et al., 2018; Torres et al., 2018). Social skills were targeted within seven studies and included interaction with other people (i.e., approaching and greeting a pair of people, appropriate eye contact; Day-Watkins et al., 2018; O' Handley et al., 2015; offering assistance, asking for information; Plavnick et al., 2015; engagement in spontaneous social questioning, and commenting during natural activities, within the context of playing a game; Plavnick & Duenas, 2018); social perception skills, including observing the affective behaviors of others, discriminating relevant environmental stimuli and differentially reinforcing the affective behavior of another person (Stauch et al., 2018). Two out of the seven studies focused on workplace social skills and included social interaction in employment settings, and customer service (Kuo et al., 2019; Walsh et al., 2018).

3.3. *Types of VBI*

A range of VBI was used among the 19 studies (e.g., VM, VP, point-of-view VM, video-based group instruction, video-enhanced schedule). Seventeen intervention studies investigated the effectiveness of VM, as shown in Table 2, recording whether the use of VM increases the skills of the adolescents and young adults with ASD.

VM studies

Three of the studies evaluated a package consisting of VM plus another practice, and two evaluated point-of-view VM. In VM package studies, researchers used additional strategies (e.g., video feedback; English et al., 2016; structured reward system; Kuo et al., 2019; voiceover instruction, role play, feedback; Day-Watkins et al., 2018). All participants increased their scores after the treatment sessions and the implementation of VM package. Researchers in the point-of-view VM studies used additional strategies too (e.g. verbal or gesture prompts; Kim, 2018; gesture prompt and error correction; Aldi et al., 2016). The additional strategies were implemented when an incorrect response or no response occurred after the participant watched the video (Aldi et al., 2016) or when the participant was distracted from watching the video (Kim, 2018).

Video-based group instruction

Three of the included studies used video-based group instruction (Plavnick & Duenas, 2018; Plavnick et al., 2015; Stauch et al., 2018). Two of them used additional strategies (i.e. correct feedback; Plavnick & Duenas, 2018; receiving points and error correction; Stauch et al., 2018). Most of the participants of the video-based group instruction studies (11/15) improved their performance of social skills in each skill domain after implementation of video-based group instruction in conjunction or not with additional strategies.

Combination studies

Three studies combined VM and another method (social stories; O' Handley et al., 2015; activity schedules; Shepley et al., 2017; Torres et al., 2018; "ACCESS" program; Walsh et al., 2018). Two of these studies used additional strategies (vocal instruction and graduated guidance prompting; Torres et al., 2018; reward system, and least to most prompting; Walsh et al., 2018).

Comparative studies

Five out of the seventeen studies (5/17) were comparative studies. In these studies researchers compared the effectiveness of VM or a form of VM with another instructional method alone or in conjunction with additional strategies. In four of the studies, researchers compared the effectiveness of VM or a form of VM with another instructional method (i.e. Virtual Reality; Fitzgerald et al., 2018; Video-self prompting; Shepley et al. 2018; VP; Thomas et al., 2020; Teaching with Acoustical Guidance; Wertalik and Kubina, 2018). In the remaining study, researchers compared the effectiveness of using VM with additional strategies or Continuous VM with additional strategies or additional strategies alone (Wynkoop et al., 2017). Four out of five comparative studies used additional strategies (e.g., audio narrations and a prompt; Fitzgerald et al., 2018; verbal prompts; "Press the videos icon"; gesture; pointing the videos icons; physical prompt; guiding the participant's finger to press the videos icon; Shepley et al., 2018; Wertalik & Kubina, 2018; prompting and reinforcement; Wynkoop et al., 2017). Two studies used VP in conjunction with additional strategies (e.g., the system of least prompts; Kellems et al., 2016; error correction; Seaman-Tullis et al., 2018). In both studies participants showed

improvement in the percentage of steps completed correctly after implementation of the VP package with the additional strategies.

While VM was implemented across the 17 out of the 19 studies, the video interventions tended to focus on VM. **In particular, most of the daily living video interventions used a comparison of VM to another practice (n=3), one a VM package (n=1), and one a combination of VM plus another method (n=1).** The social video interventions tended to focus on video-based group interventions (n=3). Two used a VM package (n=2), and two combined VM and another method or program (n=2). Two of the vocational studies implemented VM (n=1) and point-of-view VM (n=1), and one VP (n=1). The academic study used VP (n=1). The remaining three studies focused on combining VM and activity schedules (n=1), and comparing VM to another method (n=2). Most of the studies (15/19) used additional strategies (e.g., a system of least prompts, error correction, and corrective feedback).

3.4. Maintenance/generalization

Of the 19 studies in the review, 13 conducted maintenance and/or generalization probes. In two of the studies, only maintenance phase was reported (Aldi et al., 2016; Kellems et al., 2016), in three studies only a generalization probe was conducted (O'Handley et al., 2015; Shepley et al., 2017; Stauch et al., 2018), and in the remaining eight studies both maintenance and generalization probes were conducted (Day-Watkins et al., 2018; English et al., 2016; Kim et al., 2018; Plavnick et al., 2015; Seaman-Tullis et al., 2018; Thomas et al., 2020; Torres et al., 2018; Walsh et al., 2018). During the maintenance phase most of the participants did not use any instructional method (one participant performed better using the video; Aldi et al., 2016) or additional strategies (e.g., prompts, instructions). Only in two studies

(Shepley et al., 2017; Torres et al., 2018) vocal praise was provided for the participant at the end of the session. In addition, the maintenance phase was conducted in the same settings as the baseline sessions.

In two studies researchers assessed generalization to novel stimuli (O' Hadley et al., 2015; Walsh et al., 2018) and three of the studies assessed generalization to a novel setting (Kim, 2018; Stauch et al., 2018; Thomas et al., 2010). Two studies assessed generalization to both novel stimuli and setting (English et al., 2016; Torres et al., 2018), one study assessed whether training on a single social skill could produce correct responding to three other novel social skills (Day-Watkins et al., 2018). In another study (Seaman-Tullis et al., 2018) researchers assessed whether the teacher would generalize the targeted skill to a novel task. No generalization probe was conducted for the adolescent with ASD. Shepley and colleagues (2017) assessed generalization through a single pretest session prior to the study beginning and three generalization posttest sessions after video activity schedules mastery. In the final study, Plavnick and colleagues (2015) measured the frequency with which participants performed the behaviors without first seeing the video in a novel setting.

During the generalization phase most of the participants did not use any additional strategies (e.g., prompts, instructions). Only in two studies (Shepley et al., 2017; Torres et al., 2018) verbal praise was provided for the participant at the end of the session. In addition, most of the studies did not use any form of technology during the generalization probe. Only three studies used technology to complete the generalization phase (Seaman-Tullis et al., 2018; Shepley et al., 2017; Walsh et al., 2018). Among the 13 studies in which maintenance and/or generalization probes were conducted, the researchers examined VM or a form of VM in eleven, and VP in two.

3.5. Methodological rigor

One of the included studies used a group design (e.g. modified pre/post-test group design) and eighteen used a single-subject design (e.g. multiple-probe or multiple baseline across behavior or skills or participants, adapted alternating treatments). Authors used CEC Standards for Evidence-Based Practices in Special Education (Cook et al., 2014). The percentage of QIs of the group design study met 71.4%. At the same time the QIs of the single-subject design studies met averaged 90.4%, with a range from 66.7% to 100%.

Table 3 and Table 4 present how the QIs were met across the single-subject studies and the group design study. Eight QIs were met by 100% for all the included studies: context and setting, participant description, description of intervention materials, systematic manipulation of independent variable, control for common threats to internal validity, socially important outcome variable, dependent variable definition and measurement, findings fully reported, and interobserver agreement. For QIs, that were applicable only for single-subject studies, one was met 100%. It was a single-subject graph. For QIs that were applicable only for group designs,

4. Discussion

The current review focused on understanding the range and the quality of VBI research associated with enhancing functional living skills for adolescents and young adults with ASD. Review was made of the skills taught, the type of interventions, with or without additional strategies, and maintenance and/or generalization. The literature search yielded 19 studies based on VBI, which were conducted with small samples of adolescents and young adults with ASD. Social skills were most frequently studied, and VM was the technique most commonly used. Most of the

studies used additional strategies, and conducted maintenance and/or generalization probe.

Researchers first examined what types of functional living skills taught through VBI. The results indicated that VBI was effective in teaching a variety of functional living skills such as social including verbal behavior (e.g., requesting materials, asking for information, engagement in spontaneous social questioning, and commenting during natural activities), and non-verbal behavior (e.g., eye contact, observing the affective behaviors of others), as well as daily living (e.g., cooking, cleaning, personal hygiene). As far as the social skills studies, two of them (Kuo et al., 2019; Walsh et al., 2018) evaluated the effectiveness of VM to increase workplace social skills. Characteristics of workplace social skills included communication and interaction skills in workplace (e.g., introduction of themselves, listening to others, asking questions).

The second research question related to the types of VBI (e.g., VM, VP), which were used to teach functional living skills to adolescents and young adults with ASD and what, if any, additional strategies were used. The researchers found that 17 of the included studies implemented VM, whereas two studies used VP. Obviously, VM was the most frequent method used in teaching functional living skills in this review. In particular, in five studies (5/17) researchers compared the effectiveness of VM with another method (e.g., virtual reality, video-self prompting, video prompting, teaching with acoustical guidance, continuous VM). Only in one of them, which compared VM to video-self prompting, researchers found that participants using video self-prompting reached mastery criterion in fewest sessions than participants using self-mediated video modeling. Moreover, most of the included studies used VM with additional strategies (15/19), including corrective feedback, praise, error correction,

voice-over instructions, a structured reward system, verbal/gestural prompts, the system of least prompts, and least to most prompts. In the current review 11 out of the 19 studies conducted a generalization phase. **More than half of the studies focused on the generalization of the acquired skills.** Three of them assessed generalization to a novel setting, and two studies assessed generalization to both novel stimulus and setting. In five out of the eleven studies participants conducted the generalization probe in a novel setting successfully. In the remaining six studies the skills were assessed in a simulated setting in which individuals with ASD interacted only with the instructor/researcher.

The third research question related to the quality of the studies across the eight areas of CEC Standards for Evidence-Based Practices in Special Education (Cook et al., 2014). Most of the studies met the QIs about: a) context and setting (e.g., providing information on context and setting); b) participants (e.g., providing information on demographics, disability, and risk status of participant); c) description of practice (e.g., describing the critical features of intervention); d) outcome measures (e.g., appropriately measuring the dependent variable to determine the efficacy of the intervention. Studies were least likely to meet the QIs in: a) intervention agent (e.g., providing the intervention agent description and the training or qualifications needed to implement the intervention).

Limitations and future directions

There are some limitations associated with the current review. First, the review included only articles published in peer-reviewed journals written in English. Chapters, theses, and dissertations were excluded. Despite **researchers'** effort to find all relevant articles that met the inclusion criteria, the process may have led to missing

articles. Furthermore, the keywords “video” and “VBI” were the only technology-related terms used. This might have narrowed the number of the VBI studies, since other VBI interventions may have been missed.

Future research should continue to explore VM and VP interventions. Most of the included studies focused on social skills (37%), and the importance of these skills, since peer groups become popular as they are getting older, might be the reason for this. These skills are difficult to teach, because slight changes in the environment might change the response (Ayres et al, 2017). In addition, social skills seem to be of great importance in employment for individuals with ASD. Students with high social skills are more likely to participate in employment compared to those with low social skills (Chiang et al., 2013). Furthermore, individuals with ASD, who have poor social skills including terminating inappropriately or interrupting conversations, lack of spontaneous language, incorrect use of language phrases, **find it difficult to gain and maintain an employment.** In particular, **fewer intervention studies targeted to workplace social skills than those targeted to daily living skills in this review.** Given the importance of workplace social skills, it is clear that future research should focus on increasing employment-related social communication skills in order to help individuals with ASD to **locate, gain and maintain an employment.**

References

*indicates articles included in the review

**indicates articles retained for further analysis

**Aldi, C., *et al.*, 2016. Examining the effects of video modeling and prompts to teach activities of daily living skills. *Behavior Analysis In Practice*, 9(4), 384-388.

American Psychiatric Association. 2013. *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

*Ayres, K. M., Lowrey, K. A., Douglas, K. H. & Sievers, C. 2011. I can identify Saturn but I can't brush my teeth: What happens when the curricular focus for students with severe disabilities shifts? *Education and Training in Autism and Developmental Disabilities*, 45(1), 11–21.

*Ayres, K. M., Travers, J. C., Shepley, S. B. & Cagliani, R. 2017. Video-Based Instruction for Learners with Autism. In Leaf J.B. (Ed), *Handbook of Social Skills and Autism Spectrum Disorder-Assessment, Curricula, and Intervention. Autism and Child Psychopathology Series*. Springer, Cham.

*Baio, J., *et al.*, 2018. Prevalence of Autism Disorder Spectrum among children aged 8 years old-Autism and developmental Disabilities Monitoring Network, 11 Sites, United States, 2014. *MMWR Surveillance Summaries*, 67(6), 1-23.

*Bennett, K. D. & Dukes, C. 2013. Employment instruction for secondary students with autism spectrum disorder. A systematic review of the literature. *Education and Training in Autism and Developmental Disabilities*, 48(1), 67-75.

*Bennett, K. D. & Dukes, C. 2014. A systematic review of teaching daily living skills to adolescents and adults with autism spectrum disorder. *Review Journal of Autism and Developmental Disorders*, 1, 2–10.

- *Bereznak, S., Ayres, K. M., Mechling, L. C. & Alexander, J. L. 2012. Video self-prompting and mobile technology to increase daily living and vocational independence for students with autism spectrum disorders. *Journal of Developmental and Physical Disabilities*, 24 (3), 269–285.
- *Charlop-Christy, M.H., Le, L. & Freeman, K.A. 2001. A Comparison of Video Modeling with In Vivo Modeling for Teaching Children with Autism. *Journal of Autism and Developmental Disorders*, 30(6), 537-552.
- *Chiang, H., Cheung, Y. K., Li, H., & Tsai, L. Y. 2013. Factors associated with participation in employment for high school leavers with autism. *Journal of Autism and Developmental Disorders*, 43(8), 1832–1842.
- *Chirambira, S. (2013). Early Childhood Learning Assistive Technologies. *International Conference on ICT for Africa 2013, February 20 -23, Harare, Zimbabwe*. Retrieved from https://pdfs.semanticscholar.org/590f/18afec56dc2dfb6cba3755ebc58ec691f6cb.pdf?_ga=2.72663189.700931851.1589901005-991507887.1582562215
- *Cook, B. G., *et al.*, 2014. Council for exceptional children standards for evidence-based practices in special education. *Remedial and Special Education*, 46(6), 206-212.
- **Day-Watkins, J., Pallathra, A. A., Connell, J. E. & Brodtkin, E. S. 2018. Behavior skills training with voice-over video modeling. *J Organ Behav Manage*, 38(2-3), 258-273.
- *Delano, M. E. 2007. Video Modeling Interventions for Individuals with Autism. *Remedial and Special Education*, 28(1), 33-42.

- *De Schipper, E., *et al.*, 2016. Functioning and disability in autism spectrum disorder: A worldwide survey of experts. *Autism Research*, 9(9), 959-969.
- **English, D. L., *et al.*, 2017. Effects of video modeling with video feedback on vocational skills of adults with autism spectrum disorder. *Developmental Neurorehabilitation*, 20(8), 511-524.
- **Fitzgerald, E., *et al.*, 2018. Comparing the effectiveness of virtual reality and video modeling as an intervention strategy for individuals with Autism Spectrum Disorder: Brief report. *Developmental Neurorehabilitation*, 21(3), 197-201,
- *Gardner, S. & Wolfe, P. 2013. Use of Video Modeling and Video Prompting Interventions for Teaching Daily Living Skills to Individuals with Autism Spectrum Disorders: A Review. *Research and Practice for Persons with Severe Disabilities*, 38(2), 73-78.
- *Hong, E. R., *et al.*, 2016. The effects of video modeling in teaching functional living skills to persons with ASD: A meta-analysis of single-case studies. *Research in Developmental Disabilities*, 57, 158–169.
- *Howlin, P., Goode, S., Hutton, J., & Rutter, M. 2004. Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry*, 45(2), 212– 229.
- *Hughes, V. (2011).). *Researchers track down autism rates across the globe*. Retrieved from <http://sfari.org/news-and-opinion/news/2011/researchers-track-down-autism-rates-across-the-globe>
- *Keith, R. V., *et al.*, 2013. Tablet-based video modeling and prompting in the workplace for individuals with autism. *Journal of Vocational Rehabilitation*, 38(1), 1-14.

- **Kellems, R. O., *et al.*, 2016. Teaching multi-step math skills to adults with disabilities via video prompting. *Research in Developmental Disabilities*, 58, 31-44.
- **Kim, J. 2018. Effects of point-of-view video modeling for Korean adolescents with autism to improve their on-task behavior and independent task performance during vegetable gardening. *International Journal of Developmental Disabilities*, 64(4-5), 297-308.
- **Kuo, C. C., *et al.*, 2019. Using Video Modeling Package on Improving Workplace Social Skills of Young Adults with Talent Traits and Autism: A Case Study. *Universal Journal of Educational Research*, 7(12), 2806-2816.
- *Lin, C., Chang, S., Liou, W. & Tsai, Y. 2013. The development of a multimedia online language assessment tool for young children with autism. *Res. Dev. Disabil*, 34(10), 3553-3565.
- *Mason, R. A., *et al.*, 2012. Moderating factors of video-modeling with other as model: A meta-analysis of single-case studies. *Research in Developmental Disabilities*, 33(4), 1076–1086.
- *Mayer, R. E., & Moreno, R. 2003. Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, 38(1), 43–52.
- *Munandar, V. D., Morningstar, M. E. & Carlson, S. R. 2020. A systematic review of video-based interventions to improve integrated competitive employment skills among youth and adults with Autism Spectrum Disorder. *Journal of Vocational Rehabilitation*, 53(2), 1-13.

- **O'Handley, R. D., Radley, K. C. & Whipple, H. M. 2015. The relative effects of social stories and video modeling toward increasing eye contact of adolescents with autism spectrum disorder. *Research in Autism Spectrum Disorders*, 11, 101-111.
- *Park, J., Bouck, E. & Duenas, A. 2018. The effects of Video Modeling and Video Prompting Interventions on Individuals with Intellectual Disability: A systematic literature review. *Journal of Special Education Technology*, 34(1), 1-14.
- **Plavnick, J. & Duenas, A. D. 2018. Brief Report: Effects of Video-Based Group Instruction on Spontaneous Social Interaction of Adolescents with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, 48(6), 2231-2236.
- **Plavnick, J., Kaid, T. & MacFarland, M. C. 2015. Effects of a School-Based Social Skills Training Program for Adolescents with Autism Spectrum Disorder and Intellectual Disability. *Journal of Autism Developmental Disorder*, 45(9), 2674–2690.
- *Quill, K. 1997. Instructional considerations for young children with autism: the rationale for visually cued instruction. *Journal of Autism and Developmental Disorders*, 27(6), 697-714.
- Roux, A. M., et al., 2015. *National Autism Indicators Report: Transition into Young Adulthood*. Philadelphia, P.A.: Life Course Outcomes Research Program, A.J. Drexel Autism Institute, Drexel University.

- *Seaman-Tullis, R. L. & Cannella-Malone, H. I. 2016. Vocational Skills Interventions for Adults with Autism Spectrum Disorder: A Review of the Literature. *Journal of Developmental and Physical Disabilities*, 28(3), 479-494.
- **Seaman-Tullis, R. L., Cannella-Malone, H. I. & Brock, M. E. 2018. Training a paraprofessional to implement video prompting with error correction to teach a vocational skill. *Focus on Autism and Other developmental disabilities*, 34(2), 107-117.
- **Shepley, S. B., Ayres, K. M., Cagliani, R. & Whiteside, E. 2018. Effects of Self-Mediated Video Modeling Compared to Video Self-Prompting for Adolescents with Intellectual Disabilities. *Education and Training in Autism and Developmental Disabilities*, 53(3), 264 –275.
- **Shepley, S. B., Spriggs, A. D., Samudre, M. & Elliot, M. 2017. Increasing Daily Living Independence Using Video Activity Schedules in Middle School Students With Intellectual Disability. *Journal of Special Education Technology*, 33(2), 71-82.
- **Stauch, T. A., Plavnick, J. B., Sankar, S. & Gallagher, A. C. 2018. Teaching social perception skills to adolescents with autism and intellectual disabilities using video-based group instruction. *Journal of Applied Behavior Analysis*, 51(3), 647-666.
- *Taber-Doughty, T., Bouck, E. C., Tom, K. & Jasper, A. D. 2011. Video Modeling and Prompting: A Comparison of Two Strategies for Teaching Cooking Skills to Students with Mild Intellectual Disabilities. *Education and Training in Autism and Developmental Disabilities*, 46(4), 499-513.

- **Thomas, E. M., De Bar, R. M., Vladescu, J. C. & Townsend, D. B. 2020. A Comparison of Video Modeling and Video Prompting by Adolescents with ASD. *Behavior Analysis in Practice*, 13(1), 40–52.
- **Torres, R., *et al.*, 2018. The Effects of a Video-Enhanced Schedule on Exercise Behavior. *Association for Behavior Analysis International*, 11(2), 85-96.
- **Walsh, E., Holloway, J. & Lydon, H. 2018. An Evaluation of a Social Skills Intervention for Adults with Autism Spectrum Disorder and Intellectual Disabilities preparing for Employment in Ireland: A Pilot Study. *Journal of Autism and Developmental Disorders*, 48(5), 1727-1741.
- *Wehman, P., *et al.*, 2014. Transition from school to adulthood for youth with Autism Spectrum Disorder: what we know and what we need to know. *Journal of Disability Policy Studies*, 25(1), 30-40.
- *Wertalik, J. L. & Kubina, R. M. 2017. Interventions to Improve Personal Care Skills for Individuals with Autism: A Review of the Literature. *Review Journal of Autism and Developmental Disorders*, 4(1), 50-60.
- **Wertalik, J. L. & Kubina, R. M. 2018. Comparison of TAGteach and Video Modeling to Teach Daily Living Skills to Adolescents with Autism. *Journal of Behavioral Education*, 27(2), 279-300.
- **Wynkoop, K. S., Robertson, R. E. & Schwartz, R. 2017. The Effects of Two Video Modeling Interventions on the Independent Living Skills of Students With Autism Spectrum Disorder and Intellectual Disability. *Journal of Special Education Technology*, 33(3), 145-158.

*Wojciechowski, A. & Al-Musawi, R. 2017. Assistive technology application for enhancing social and language skills of young children with autism. *Multimedia Tools and Applications*, 76, 5419-5439.

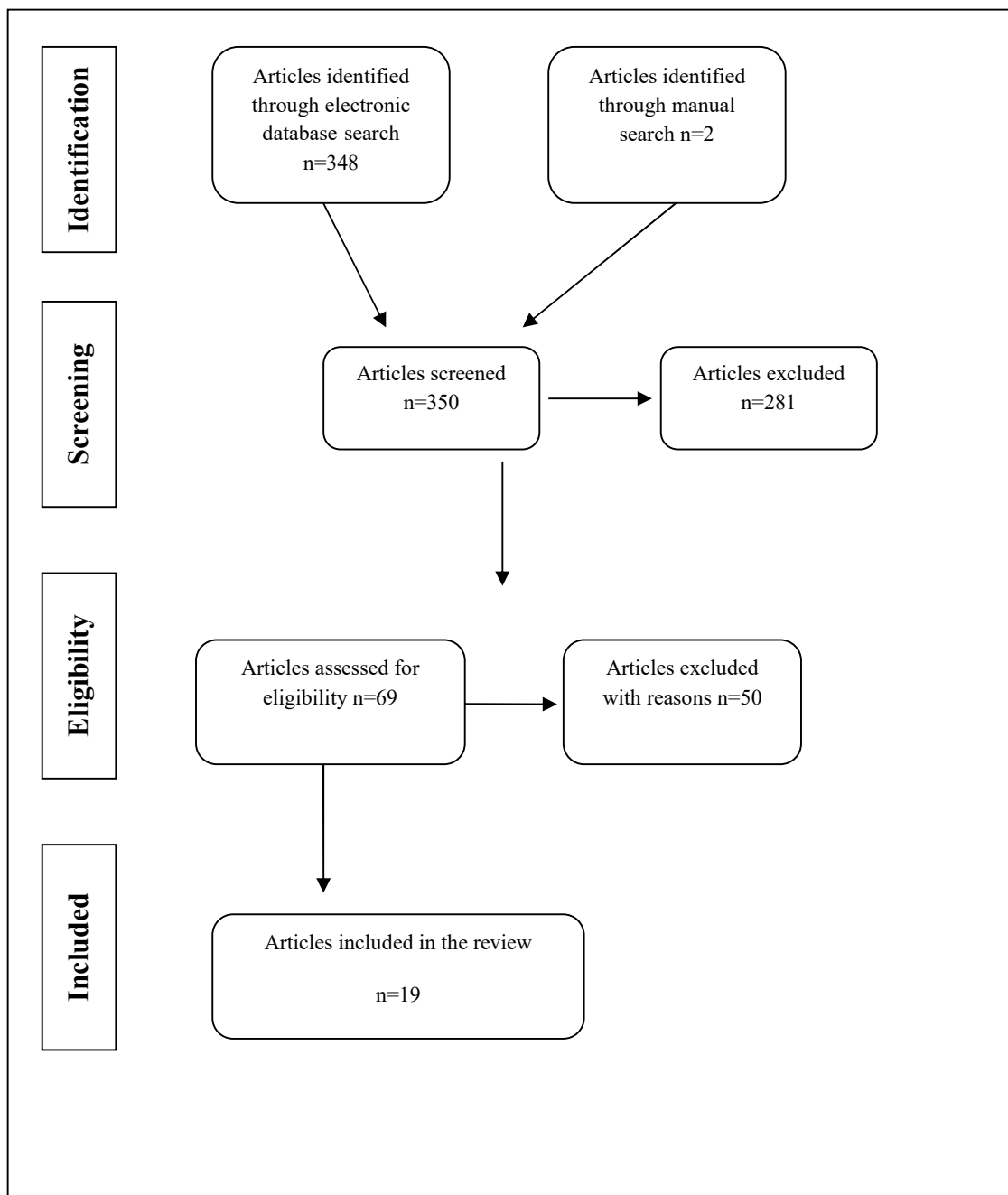


Figure 1 Choosing the analyzed research papers based on PRISMA flowchart.

Table 1 Review of the effectiveness of video-based Intervention (VBI) for adolescents and young adults with autism spectrum disorder: Studies included and characteristics of the study population

	Studies	Participants (number)	Age (years)	Disability	Setting
1.	Aldi et al. (2016)	2	18	ASD	Participant's residence
2.	Day-Watkins et al. (2018)	3	18 or older	ASD	Office
3.	English et al. (2017)	3	18-23	ASD (social anxiety, selective mutism, epilepsy)	A not-for-profit enterprise
4.	Fitzgerald et al. (2018)	2	25,31	ASD	University office
5.	Kellems et al. (2016)	9	18-21	ASD, ID,LD,HI	Room in a high school
6.	Kim J.(2017)	3	NM- (adolescents)	ASD	Rehabilitation service center
7.	Kuo et al. (2019)	5	22-32	ASD	Different setting for each participant
8.	O'Handley et al. (2015)	6	16-19	ASD, ID	Office in a community-based classroom
9.	Plavnick & Duenas (2018)	4	14-17	ASD, ID	Self-contained classroom for individuals with ASD
10.	Plavnick et al. (2015)	4	15-17	ASD	Facilitator's classroom
11.	Seaman-Tullis et al. (2018)	1	14	ASD	cross-categorical middle school classroom
12.	Shepley et al. (2017)	4	12-14	ASD, ID, DS	MSD classroom
13.	Shepley et al. (2018)	4	15-20	MoID, MID,SLI, ASD,	Teacher workroom
14.	Stauch et al. (2018)	5	15-17	ASD,ID	Classroom, cafeteria
15.	Thomas et al. (2020)	4	16-22	ASD	Kitchen of the school
16.	Torres et al. (2018)	3	12-13	ASD	Gym or fitness center of a private school for individuals with DD
17.	Walsh et al. (2018)	7	19-22	ASD, ID	Vocational rehabilitation training centre for adults with ID
18.	Wertalik & Kubina (2018)	3	17	ASD	Classroom, bathroom
19.	Wynkoop et al. (2017)	4	14-16	ASD, ID, seizure disorder, ADHD, anxiety	Participants' public high school (classroom for students with severe difficulties)

Note. NM= Not mentioned, ASD=Autism spectrum disorder, ID=Intellectual disability, ADHD=Attention deficit hyperactivity disorder, GAD=Generalized anxiety disorder, LD= Learning disabilities, HI=Health impairments, DS=Down syndrome, MoID=Moderate intellectual disability, MID=Mild intellectual disability, SLI=Speech language impairment

Table 2 Review of the effectiveness of video-based Intervention (VBI) for individuals with ASD: Studies included and study characteristics

	Studies	Skills					AT	Additional strategies	Maintenance/ Generalization
		Daily/ Living	Academ ic	Vocational	Social	Others			
1.	Aldi et al. (2016)	X					POV VM	gestural prompt, error correction	Yes/No
2.	Day-Watkins et al. (2018)				X		VM package	VMVO, role play, feedback Verbal prompt, error correction	Yes/Yes
3.	English et al. (2017)			X			VM with VFB /VP with VFB	Praise, corrective feedback,VFB	Yes/Yes
4.	Fitzgerald et al. (2018)					X	POV VM & VR	prompt	No
5.	Kellems et al. (2016)		X				VP	Voiceover instructions, system of least prompts	Yes/No
6.	Kim J.(2017)			X			POV VM	Verbal or gesture prompts	Yes/Yes
7.	Kuo et al. (2019)				X		VM package	Structured reward system	No
8.	O’Handley et al. (2015)				X		VM & social stories	-	No/Yes
9.	Plavnick & Duenas (2018)				X		VGI	Corrective feedback	No
10.	Plavnick et al. (2015)				X		VGI	-	Yes/Yes
11.	Seaman-Tullis et al. (2018)			X			VP	Error correction	Yes/Yes
12.	Shepley et al. (2017)	X					VidAS	-	No/Yes
13.	Shepley et al. (2018)					X	SMVM & VSP	System of least prompts (verbal prompt, gesture, physical)	No
14.	Stauch et al. (2018)				X		VGI	Receiving points, error correction	No/Yes
15.	Thomas et al. (2020)	X					POV VM & VP	-	Yes/Yes
16.	Torres et al. (2018)					X	VES	Vocal instruction, prompts	Yes/Yes
17.	Walsh et al. (2018)				X		ACCESS & VM	Reward system (Token, reinforces), corrective feedback, least to most prompting (i.e. gestural, verbal, visual/picture, model, and physical prompts)	Yes/Yes
18.	Wertalik & Kubina (2018)	X					TAGteach & VM	Auditory stimulus/verbal or gestural prompts, verbal instructions, behavior specific verbal praise,	No
19.	Wynkoop et al. (2017)	X					CVM+P&R, VM+P&R, P&R	Prompts (verbal & gestural task), least to most prompting, reinforcement	No

Note. AT=Assistive Technology, VM=Video Modeling, VP=Video Prompting, VMVO= Video modeling with voiceover instruction, VFB=Video feedback, POV VM=point-of-view video modeling, VGI= Video-based group intervention, VidAS= Video activity schedules, SMVM= Self-mediated video modeling, VES=Video enhanced schedule, VSP=Video self prompting, TAGteach=Teaching with Acoustical Guidance, CVM=continuous video modeling, P&R=prompting & reinforcement

Table 3 Quality Indicators for Single-Subject Studies of VBIs

Quality indicator	Aldi et al. (2016)	Day-Watkins et al. (2018)	English et al. (2017)	Fitzgerald et al. (2018)	Kellems et al. (2016)	Kim J. (2017)	O'Handley et al. (2015)	Plavnick & Duenas(2018)	Plavnick et al. (2015)	Seaman-Tullis (2018)	Shepley et al. (2017)	Shepley et al. (2018)	Stauch et al. (2018)	Thomas et al.(2020)	Torres et al. (2018)	Walsh et al.(2018)	Wertalik & Kubina(2018)	Wynkoop et al. (2017)
1.1 Context and setting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.1 Participant description	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.2 Participant disability or risk status	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.1 Intervention agent description	X	X			X	X	X	X	X	X			X		X	X	X	X
3.2 Intervention agent training/qualifications		X					X	X	X	X			X		X		X	
4.1 Description of intervention materials	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.2 Description of intervention materials	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X
5.1 Implementation fidelity	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
5.2 Treatment dosage/exposure	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
5.3 Comprehensive assessment of fidelity*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
6.1 Systematic manipulation of independent variables	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6.2 Baseline description	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
6.3 Limited access to treatment in baseline	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X
6.5 Three demonstrations of experimental effect	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
6.6 Sufficient baseline length and pattern	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X
6.7 Control for common threats to internal validity	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.1 Socially important outcome variable	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.2 Dependent variable definition and measurement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.3 Findings fully reported	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.4 Timing/frequency of outcome measures								X	X	X	X	X	X	X	X		X	
7.5 Interobserver agreement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

8.2 Single-subject graph	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Percentage of quality indicators met	95.2	90.5	85.7	66.7	90.5	90.5	95.2	100	100	90.5	90.5	85.7	100	85.7	100	76.2	100	85.7

Note. *This QI is not applicable if neither adherence (QI 5.1) nor dosage (QI 5.2) was assessed and reported. X=QI met, NA=QI not applicable; excluded in the calculation of percentages.

Table 4 Quality Indicators for Group Design Studies of VBIs

Quality indicator	Kuo et al. (2019)
1.1 Context and setting	X
2.1 Participant description	X
2.2 Participant disability or risk status	X
3.1 Intervention agent description	
3.2 Intervention agent training/qualifications	
4.1 Description of intervention materials	X
4.2 Description of intervention materials	X
5.1 Implementation fidelity	
5.2 Treatment dosage/exposure	
5.3 Comprehensive assessment of fidelity*	
6.1 Systematic manipulation of independent variables	X
6.2 Baseline description	X
6.3 Limited access to treatment in baseline	X
6.4 Description of assignment to groups	X
6.8 Overall attrition	X
6.9 Differential attrition	X
7.1 Socially important outcome variable	X
7.2 Dependent variable definition and measurement	X
7.3 Findings fully reported	X
7.4 Timing/frequency of outcome measures	
7.5 Interobserver agreement	X
7.6 Evidence of validity	X
8.1 Appropriate data analysis techniques	X
8.3 Appropriate effect size	X
Percentage of quality indicators met	71.4

Note. *This QI is not applicable if neither adherence (QI 5.1) nor dosage (QI 5.2) was assessed and reported. X=QI met, NA=QI not applicable; excluded in the calculation of percentages.

