EFFECTS OF USING TELEHEALH-BASED BEHAVIORAL SKILLS TRAINING TO TEACH CAREGIVERS TO IMPLEMENT THE COOL VERSUS NOT COOL INTERVENTION WITH THEIR CHILDREN WITH ASD

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Abstract

This study was conducted to first evaluate the effects caregivers' fidelity of the Cool Versus Not Cool (CNC) intervention using remote behavioral skills training (BST) and second, to evaluate subsequent treatment effects when caregivers implement intervention with their child with ASD. The components of behavioral skills training used were instruction, modeling, role-playing, and feedback. Past research has not evaluated the effects of the CNC intervention on children with ASD's social skills when implemented by their caregivers. Thus, this research was needed to evaluate the effectiveness of remote based BST and the effectiveness of caregiver-implemented CNC intervention. Results suggested that remote-based BST is a useful training strategy to train caregivers and to support caregiver-implemented CNC to improve children with ASD's social skills. During follow up and generalization conditions across dyads, caregiver and child skills maintained. During generalization, caregiver skills maintained when teaching new social skills for Caregiver 1 and Caregiver 2, but not entirely for Caregiver 3.

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CHAPTER 1

REVIEW OF LITERATURE

The Centers for Disease Control and Prevention (CDC; *Autism Spectrum Disorder, 2020*) estimates that 1 in 54 children are diagnosed with the lifelong developmental disability identified as Autism Spectrum Disorder (ASD). The CDC identifies common deficits among those with ASD that includes areas of social interaction, deficits in social communication, and challenging behavior. The fifth edition of the Diagnostic and Statistical Manual for Mental Disorders (DSM-V) designates deficits in social interaction and social communication as difficulty with reciprocal conversations, failure to respond to social cues, and difficulties developing and maintaining friendships (American Psychiatric Association, 2013). Moreover, Volkmar et. al. (2005) also stated that individuals with ASD often find it difficult to understand social norms, adjusting conversation based on a listener's behavior, react to and use nonverbal cues (e.g., eye contact, gestures, or other forms of body language), and often communicate with limited conversational skills as compared to their typically developing peers (e.g., missing social cues to change the topic of conversation).

Deficits in social interaction and social communication can affect the quality of an individual's relationships with others. For example, Kasari et al. (2011) evaluated social relationships by comparing 815 typically developing peers to 60 individuals with ASD. Participants' relationships were evaluated based on their quality of friendships, engagement with peers on the playground, initiations, and reports provided by teacher evaluation of social relationships and behavior for each participant. Results showed that individuals with ASD appeared to have fewer reciprocal friendships and poorer quality of friendships compared to their typically developing peers. Additionally, Bauminger et al. (2003) compared social interactions and loneliness between individuals with high functioning ASD and their typically developing peers. Included in the study were 18 children with ASD and 17 typically developing peers. Researchers assessed participant's loneliness using The Loneliness Rating Scale (Asher et al., 1984) which is a scale that rates children's feelings of loneliness and their feelings about their social interactions with others. Also, participants were observed and evaluated based on their social interactions. Findings showed that typically developing peers displayed higher rates of social engagement with peers than with the participants who had a diagnosis of ASD. Furthermore, 20% of the participants with ASD showed reciprocal friendships, while the majority of those participating faced challenges in developing meaningful relationships. Research shows that individuals with ASD are at higher risk of loneliness, have fewer reciprocal friendships, and have a poorer quality of relationships when compared to their typically developing peers. To address the barriers that inhibit those diagnosed with ASD in developing and maintaining relationships, social skills interventions can improve social communication skills resulting in sustained peer friendships.

Social Skills Interventions

Evidence-based practices are procedures that have copious research that shows the practice has positive intervention outcomes for individuals and improves an individual's quality of life due to intervention effects (Morin et al., 2020). Several evidence-based social skills interventions aimed at improving social interactions and communication with individuals with ASD have shown promise. These include Social Stories™ (Karkhaneh et al., 2010), Promoting Alternative Thinking Strategies (Crean & Johnson, 2013), Stop Observe Deliberate Act (Bock, 2007), the power card strategy (Hutchins et al., 2020), video-modeling (Acar et al., 2017), and the cool versus not cool intervention (Leaf et al., 2012).

Hutchins et al. (2020) conducted a single-case meta-analysis designed to examine the results of social skills interventions for students with ASD and emotional and behavioral disorders (EBD). Additionally, authors evaluated social skills interventions during the generalization and maintenance, along with the differential effects of social skills interventions based on methodological quality, disability, and intervention design. For studies to be included in the meta-analysis they had to evaluate social skill interventions primarily in a school setting, on participants who were children with or at risk for EBD or ASD, using a single-case research design intervention aimed to teach social skills, and were written in English. Social skills interventions included were Promoting Alternative Thinking Strategies (PATHS®), the power card strategy (PCS), Social Stories™, and Stop Observe Deliberate Act (SODA). Results from the social skill meta-analysis showed that there was a moderate overall effect across social skills interventions. The maintenance and generalization analysis showed that few studies included in the meta-analysis displayed data on follow up and generalization. Results that centered around the differential effects of social skills intervention showed little variability with respect to intervention design, intervention delivery, methodological quality, and disability. Limitations were that Hutchins et al. (2020) only included studies with school-based interventions and effects of social skills interventions were not differentiated on skill deficit or performance deficit.

Social Stories

Although social stories™ has been an identified evidence-based practice (e.g., Hume et al., 2021), this appears to not be a consensus, particularly related to where Leaf et al. (2015a) reported that there is a lack of empirical evidence to support the use of social stories™. Leaf et al.'s methodological review included 41 studies on social stories™ as an intervention for individuals with ASD. Studies were coded based on their research design to include case studies, reversal designs, and multiple baseline designs. Studies were classified as displaying either a clear demonstration of an effect, partial demonstration of an effect, or no clear demonstration of an effect. Outcomes showed that 41.4% of studies that were included, resulted in a partial demonstration of an effect and 51.2% of studies had showed no demonstration of an effect, whereas 7.3% of studies showed a clear demonstration of being responsible for improvement in social skills. Likewise, their findings exposed methodological flaws associated with research on social stories and encouraged future researchers who evaluate social stories™ to carefully attend to methods. Leaf et al. suggested that practitioners should implement other social skills interventions (cf. social stories™) while additional, methodologically sound research is carried out on social stories.

To answer Leaf et al.'s call for methodologically sound social stories™ research, Acar et al. (2017) conducted an empirical study that compared the effects of social stories to a video modeling-based social skill intervention for children diagnosed with ASD. Participants included three mothers, who delivered both interventions to their child, and also their children who ranged between the ages of 6-years-old to 10-years-old. A treatment comparison was evaluated using an adapted alternating treatment experimental design. Mothers were trained in a classroom, a rehabilitation center, and in their homes and all treatment sessions took place in each of the mother's homes. Target behaviors were selected based on surveys that were completed by both the participating mothers and each child's teacher. Target behaviors included identifying yourself (i.e., introducing yourself by stating your name), offering help, addressing someone when speaking to them, and picking up toys to play. Intervention consisted of modeling appropriate behavior. That is, video modeling included confederates who demonstrated appropriate behavior during a role-play scenario. Results showed that both interventions were successful in teaching social skills to the participants. Efficiency parameters that were included evaluated the number of training sessions required to meet a criterion, the number and percentage errors to criterion, and the duration of the total training time. Researchers could not determine one intervention as more effective than the other as the results varied. Results showed that social stories™ were more effective for one participant, whereas video modeling was more effective for the other two participants. Acer et al. (2017) had noted that their study was limited in that the researchers assumed that all target behaviors were of an equal level of difficulty rather than empirically evaluating whether this was indeed accurate.

Cool Versus Not Cool

An alternative social skill-based intervention that has been less researched, yet appears to be promising, is The Cool versus Not Cool (CNC) intervention. Though additional research is needed, to date, the CNC has appeared to be more effective than other, related social-skill interventions (e.g., social stories™) for children diagnosed with ASD (Leaf et al., 2016b). The CNC intervention consists of behavior demonstrations by a therapist. There are typically multiple demonstrations of one social skill (e.g., interrupting conversation). After each therapists' demonstration of a behavior, the child labels what is considered appropriate behavior (e.g., saying "excuse me" when interrupting a conversation) as "cool" and what is considered inappropriate behavior (e.g., yelling to interrupt a conversation) as "not cool." The child usually role plays the "cool" demonstrations of the social skill at the end of the session.

Leaf et al. (2012) evaluated the CNC intervention on three children diagnosed with ASD. Two to three target skills for each participant and specific to each participant were chosen based on reports provided by the participant's clinical supervisor and direct observation for a total of 8 social skills across participants. Targeted social skills included abduction avoidance, eye contact, changing the conversation, changing the game, joint attention, interrupting (target skill for two participants), an appropriate greeting. Data were collected on target skills using naturalistic probes. Skills were considered mastered when at least 80% of targets were met for three consecutive probes. When participants met the set criteria skills, skills were moved to maintenance. A multiple baseline design across social skills for each participant was used to demonstrate experimental control. Results showed that all three participants met mastery criteria for 50% of skills taught during the teacher demonstration only condition and all three participants met mastery criteria for an additional 37.5% of skills that were taught during the teacher demonstration plus role-plays. Seven out of the eight social skills taught met mastery criteria. Leaf et al. (2012) had recommended additional studies on the cool versus not cool intervention to determine the most effective way to implement the procedure so that all skills met set mastery criteria. Namely, they had proposed that future studies should consider including a description of the amount of time required to implement the CNC and whether role-plays should be included in the procedure in the future.

Leaf et al. (2016b) compared two social skills interventions that included social stories™ and the CNC. In the study, six different social skills were selected and taught to a 7-year-old boy with ASD that he had not previously displayed. The social skills included losing graciously, sportsmanship, interrupting appropriately, empathy, changing the game when someone is bored, and stopping to talk. Researchers developed scenarios and required the participant to respond correctly within 10 sec for each scenario. The scenarios included sighing during a game, beating the participant in a game, or instructing the participant to ask an adult a question who is engaged in a conversation with someone else. Data were collected on accurately completing the steps required for each targeted social skill. All data were collected during naturalistic probes and during these probes the therapist contrived situations for the participant to emit the selected target behavior that was appropriate for each context. Treatment effects were evaluated using an adapted alternating treatment design across the three targeted skills per intervention. Results showed that the participant met the mastery criterion for 100% of the steps during the CNC intervention, even though the participant did not meet mastery criterion for skills taught using social stories. Namely, the participant never displayed more than 80% accuracy on the skills that were taught using social stories™. Based on these outcomes the researchers had concluded that the CNC was more effective than social stories. Though additional research on CNC is needed, these findings offer preliminary evidence to suggest the CNC intervention may be a more effective alternative social skill intervention than social stories for individuals diagnosed with ASD.

In other CNC research, Leaf et al. (2015b) evaluated the effectiveness of teaching social interaction behaviors by integrating the domains of the social skills taxonomy. The five social skills based upon social skills taxonomy included social communication, social relatedness, social learning, social awareness, and social interaction that was originally described by Taubman et al. (2011). Participants included three individuals diagnosed with ASD who had deficits in social skills and who were unable to develop meaningful relationships with peers. During the study, each participant was taught a different social skill, such as assertiveness when a peer takes your toy, compromising on a game to play, and sharing snacks with peers. Naturalistic probes were used for data collection. To achieve mastery criterion, participants had to display 100% of the skills across three consecutive probes. A multiple baseline design across three participants was used to evaluate treatment effects. Results showed that participants reached mastery criterion for 100% of the social skill taxonomy-based targeted skills. A limitation that researchers had identified was that the study lacked an evaluation of generalization. That is, intervention effects were not evaluated across settings (e.g., home and community). Thus, the CNC intervention is a promising social skills-based intervention that calls for additional research to investigate if effects can be generalized.

Leaf et al. (2016a) evaluated the CNC intervention on eight individuals with ASD to teach social game play behavior. The participants' ages ranged from 3 to 8 years old. Each participant had significant delays in social skills as indicated by the Social Skills Improvement Scale (SSIS; Gresham & Elliot, 2008). The targeted social skills included appropriately playing three different group games that were The Sleeping Game, Fruit Salad, and Mouse Trap. To meet mastery criteria each participant was required to display targeted game play behaviors during three consecutive performance probes. Researchers evaluated treatment effects using a multiple baseline design across behaviors per each participant. Results showed that seven of the eight participants met mastery criteria across all three games, thus providing further evidence in support of the CNC intervention to teach social skills to individuals diagnosed with ASD. Despite these findings, the researchers recommend additional research to be conducted on the CNC, particularly related to investigating generalized effects when caretakers served as therapists.

In addition to social game play, the CNC intervention has been used to teach other social skills. For example, Leaf et al. (2016c) taught social communication skills to three individuals with ASD of the ages of 3, 4, and 6-years-old using CNC that was coupled with role play component. Researchers selected social skills using social skill taxonomy (Taubman et al. 2011). The participant's targeted social skills included how to chat with a friend, how to provide verbal support to a peer, and how to interrupt a conversation appropriately (i.e., waiting for a pause in the conversation). Treatment effects were evaluated using a multiple baseline across participants research design and data were collected during naturalistic probes. Results showed that the participants were able to meet mastery criteria for all skills. These findings expanded the type of social skills taught using the CNC intervention. Despite these promising outcomes, the researchers suggested that future research should evaluate effects of CNC taught by individuals who do not have prior Applied Behavior Analysis (ABA) experience.

In a further investigation expanding the range of social skills taught using CNC, Milne et al. (2017) evaluated the CNC's effect on teaching joint attention and peer to peer communication in a large group setting. Sixteen individuals between the ages of 3 and 7 with a diagnosis of ASD participated in the study. Treatment effects were evaluated using a non-concurrent multiple baseline design across skills and participants. Results showed that 14 participants met mastery criteria for both target skills, while two participants showed improvement in the target skills, but did not meet mastery criterion at the conclusion of the study. Authors had suggested that future research should evaluate methods used to train individuals to implement the CNC intervention.

Cool Versus Not Cool Training

Much less research focuses on training those who implement the CNC intervention. In one example, Ferguson et al. (2020) taught staff how to use the CNC intervention by using a teaching interaction procedure. Participants in the study included three therapists who were trained on the CNC intervention along with children who were each in need of an improved social skill repertoire. All adults had previous experience studying and implementing behavior analytic procedures. Each of the participating children were 5-year-old males. A non-concurrent multiple baseline design across participants was used to evaluate the teaching interaction procedure used to teach adult therapists the CNC intervention. Results showed that all therapists were able to implement 100% of the CNC intervention after five training sessions with researchers. Two out of the three children participants demonstrated acquisition of skills through the interventionist's sessions. The interventionist for the third child participant required additional feedback from the researcher for how to implement additional teaching to ensure that the child to meet acquisition of goals. In the study, only one of the child participants required additional teaching to establish skill acquisition. A possible reason for requiring additional teaching was that the child skill probes were assessed in a different environment than teaching sessions and therefore the child may have not generalized skills across settings. Overall, this early research shows that the teaching interaction procedure, a procedure similar to behavior skills training, appears to be promising when training interventionists the CNC intervention. Future research should study how to teach adults how to implement the CNC intervention who do not have a background in behavior analysis.

Telehealth

As a result of COVID-19, most in person educational and health services have been provided in a remote, online format. Following this trend, alternative remote-based methods of implementing behavior analytic interventions have adopted a telehealth format. Telehealth refers to any mode of communication that does not require direct physical contact (Wosik et al., 2020). Methods of telehealth might include video-conferencing, telephone, patient portals, and other virtual methods of communication (Wosik et al., 2020).

In the field of ABA, Fisher et al. (2020) evaluated parent implementation of early intensive behavioral intervention (EIBI) skills with a confederate child using a virtual training program. Using a randomized control trial, twenty-five parents of children with ASD and twenty-five confederates; adults who were told to act as a child and follow researchers' directions on how to react to cues, participated in the study. Parents chose an adult family member to act as a confederate. Researchers communicated and trained parents through telehealth-videoconferencing while parents completed the study in their homes. Specifically, parents were taught by the research team through telehealth-videoconferencing how to implement instruction delivery, respond to correct responses, respond to problem behavior, and prompt. Target skills were assessed during a pre-test session and post-test session. The online remote-based parent-training sessions consisted of role playing with feedback and nine online modules that parents viewed. Online modules consisted of training topics on ethics, least restrictive environment, vulnerable populations, preference assessments, positive reinforcement, verbal behavior, response prompting, natural environment teaching, compliance, preventing problem behavior, structured training strategies, and play-based training strategies. Results showed improvement in skills for the parents in the training group and no improvement or slight improvement in skills for the parents in the control group. Limitations of the study included that there was no set schedule for when parents needed to complete training modules, data were not taken for every skill taught in the training modules, and researchers did not assess parents' implementation of EIBI skills with their children. Future research should evaluate parent training as well as the child's skill acquisition for children with ASD when training parents through telehealth-videoconferencing.

The CNC intervention was studied through telehealth video conferencing by Cihon et al., (2021). The study included three children with ASD who were four and five years of age. All children had an in-person history of receiving the CNC intervention and the children had experienced ABA services through telehealth-videoconferencing prior to the study. The target social skill for all three children was changing the conversation when someone was bored. This was a new skill for all children. The interventionist had a Master's Degree in ABA and was currently pursuing her Doctorate in ABA as well. The interventionist also had years of experience with the CNC intervention. All sessions occurred through telehealth-videoconferencing using Zoom. Researchers used a nonconcurrent multiple baseline design across participants. The CNC intervention sessions with each child and the participant occurred about two to five times a week. The interventionists used a staff member to assist in the role-play segment of the procedure. The dependent measures involved splitting up the target behavior, changing the conversation when someone is bored, into 7 parts to determine if the child completed each step during probe sessions. Results showed that all children reached mastery criteria during the intervention condition and all children continued to show mastery of the skill in the maintenance condition. However, only two out of three children showed mastery of skill in the generalization condition. The researchers explained that limitations of the study included that the study was able to have a staff member assist in the role-play demonstrations which is not always an option, the study only evaluated one social skill, and all children had a history of receiving the CNC intervention in-person.

Current Study

Individuals with ASD often display deficits with social skills that affect their ability to form meaningful relationships and, in turn, this may result in loneliness (e.g., American Psychiatric Association, 2013; Bauminger et al., 2003). There are many social skills interventions for practitioners to choose from including, video modeling, Social Stories and the Cool versus Not Cool intervention. However, when Social Stories and CNC were compared to one another, the CNC intervention showed that treatment gains were greater for social skill acquisition compared to the gains made with Social Stories (Leaf et al., 2016b).

Empirical evidence shows that the CNC intervention improves social skills for individuals with ASD (e.g., Leaf et al., 2012; Leaf et al., 2015b; Leaf et al., 2016a; Leaf et al., 2016c; Milne et al., 2017). However, additional research is critically needed to assess optimal methods to train individuals on CNC who do not have previous experience with the intervention and in ABA (e.g., Leaf et al., 2016c; Milne et al., 2017). Telehealth allows health care workers a safe alternative to serve individuals through virtual means during the current pandemic and beyond (e.g., Wosik et al., 2020). Moreover, research has shown that telehealth can be an effective method to train individuals who do not have a background in applied behavior analysis to implement behavior analytic interventions with fidelity (e.g., Fisher et al., 2020).

The aim of this study was to evaluate the effects of the CNC intervention to improve social skills for individuals with ASD when implemented by caregivers who were trained using BST through telehealth-videoconferencing. Both the treatment fidelity of caregivers and the effectiveness of telehealth-based interventions on child outcomes was measured. Specific research questions investigated were:

1. What are the effects of behavioral skills training through telehealth to train caregivers to implement the CNC intervention with their children on caregiver treatment fidelity of the CNC intervention?
2. What are the effects of caregiver-implementation of CNC on children with ASD to improve social skills?
3. Can favorable effects of training and intervention be maintained over time and be generalized to new social skills when using the CNC intervention?

CHAPTER 2

METHOD

Participants

Caregivers and their children, referred to as dyads, participated in the study based on the following criteria: (a) the child had to have a formal diagnosis of ASD, (b) the child was between the ages of 3 to 17-years-old, (c) the child showed a deficit in social skills, (d) both the child and caregiver spoke English, (e) dyads had access to video recording and a video-conferencing, and (f) dyads had no previous experience with the CNC intervention. Dyads who were recruited for this study included child participants who received behavioral health services at a single service provider located in the Mid-Atlantic region. For child participants, formal assessment scores were gathered and used to help determine if they met inclusion criteria, these included the VB-MAPP scores and ADOS-2 Module 3 scores (Verbal Behavior Milestones Assessment and Placement Program; Sundberg, 2008; Autism Diagnostic Observations Schedule 2: Lord et al., 2012). Furthermore, interviews took place with caregivers to determine if they considered their child needed social skill support, and what specific social skills child participants lacked. Caregiver consent and children's assent were obtained prior to beginning the study and all study components were approved by the Temple University Institutional Review Board. There were no exclusion or inclusion criteria based on socioeconomic status, ethnicity, or gender. See Table 1 and below for demographic information about participating dyads.

Table 1

Participant Information

	Dyad 1	Dyad 2	Dyad 3
Parent	**Sex:** Female **Age:** 49-years-old **Profession:** Client Relationship Specialist in the Financial Industry	**Sex:** Female **Age:** 43-years-old **Profession:** Software Developer	**Sex:** Female **Age:** 54-years-old **Profession:** Biology Assistant Professor
Child	**Charlie –** **Sex:** Male **Age:** 15-years-old	**Brain –** **Sex:** Male **Age:** 10-years-old	**Luke –** **Sex:** Male **Age:** 14-years-old

Note. The table displays the sex, age, and profession of the parent in each dyad and the sex and age of the child in each dyad.

Dyad 1

Charlie was a 15-year-old male whose VB-MAPP barriers score displayed elevations on 12 of the 24 barriers and an overall score of 14 (Verbal Behavior Milestones Assessment and Placement Program; Sundber, 2008). This means that out of the 24 barriers (i.e., inappropriate behaviors, impaired mands, impaired intraverbals, etc.), Charlie showed a deficit for 12 of the 24 barriers. In addition, for each barrier the scoring ranged from 1 to 4 with the 4 being most significant impairment and Charlie scored a 14 out of 96. Charlie could communicate vocally. It was reported by Charlie's mother that Charlie had a social deficit where he often would not engage in peer chosen activities. On one occasion, Charlie's mom recalled a recent situation where Charlie was asked to play a game by a peer but said "no" to the peer. Charlie and his mom were considered Dyad 1.

Dyad 2

Brian was a 10-year-old boy whose Autism Diagnostic Observations Schedule 2 Module 3 observation notes indicated deficits in social communication, such as limited reciprocal conversation and a failure to inquire about other's thoughts or experiences. Also, Brian's VB-MAPP barriers score showed elevations of 10 out of the 24 barriers and an overall score of 11. Therefore, Brian scored a 11 out of 96. Brian's mom reported that he struggled to engage in conversational volleys (i.e., back and forth conversation) where the child would answer questions but fail to use follow up questions. Brian and his mom were Dyad 2.

Dyad 3

Luke was a 14-year-old male whose VB-MAPP score displayed elevations on 18 of the 24 barriers and an overall score of 36. Therefore, Luke scored a 36 out of 96, which indicates more barriers to treatment than shown with Charlie and Brian. It was reported by Luke's mom that Luke had a social deficit where he struggled to appropriately request preferred items, needs, and attention. Luke's mom explained that he often yelled or made noises to gain attention. Luke and his mom were Dyad 3.

Setting

During the caregiver training phase of the study, all interventionist (e.g., parents or caregivers) training sessions took place using telehealth videoconferencing. Health Insurance Portability and Accountability Act (HIPAA) compliant videoconferencing was done through Google Meet (https://meet.google.com/). Only the caregiver and the researcher were present during each interventionist training session.

Following the CNC caregiver training phase and during caregiver implementation phase with their child, all intervention sessions took place at each dyad's home and each session was recorded by the caregiver using their phones to be reviewed by researchers. The child and the caregiver in each dyad were the only individuals present during the sessions. The sessions took place in their family homes where there were possible competing stimuli (i.e., pets, toys, siblings, television, various noises, etc.) since it was a natural environment and not in a clinical setting.

Materials

During the caregiver training phase of the study, materials that were included during the interventionist training sessions were a task analysis of the BST procedure that was used to train interventionists, a slideshow for the training of the interventionists, task analyses of the CNC intervention specific to each child's target social skill, data collection sheets for the target social skills behaviors of the children, and props for the demonstrations during the CNC intervention. The demonstration props included an identifier used to signal which character the caregiver was playing to the child since the caregivers did not have an assistant to help with demonstrations (i.e., cards with colors for each character). See Appendix A for the description of the slides presented during the caregiver training phase.

Following the caregiver training phase and during the caregiver implementation phase of the CNC intervention, materials that were used included a task analysis of the CNC intervention specific to each child's target social skill, data collection sheets for the target social skills behaviors specific to each child for the caregiver's reference, and props for the demonstrations during the CNC intervention (i.e., cards with colors for each character). Dyad 1 had additional materials since the target social skill was engaging in a peer's chosen activity, a game was included during role-plays and demonstrations (i.e., board game, cards, etc.). See Appendix B for the general example of a task analysis of the CNC intervention and see Appendix C for the general example of the data sheet for the children's goals.

Experimental Design

A concurrent multiple baseline design across participating dyads was used to evaluate the effects of BST and the CNC intervention. During a concurrent multiple baseline design across participants, baseline conditions occur simultaneously across participants (Ledford & Gast, 2018). Baseline sessions occurred concurrently and dyads were randomly selected to determine in what order they would begin intervention. Using a concurrent multiple baseline design across dyads rather than one dyad at a time ensures that any, and all outcomes are not due to a sole characteristic of one dyad. A concurrent multiple baseline design across participating caregivers was used to evaluate the effects of training the CNC intervention using BST through Telehealth-Videoconferencing. Decision making procedures were based upon guidelines set by What Works Clearing House (2020) for concurrent multiple baseline designs. Thus, in the current study baseline conditions were conducted simultaneously across caregivers. Once three stable data points were present for all three dyads, then the first dyad entered the intervention condition, while the dyad 2 and dyad 3 continued in the baseline condition. Next, when three new consecutive data points were stable for all three dyads, the second dyad entered the intervention condition. This continued until the final dyad entered the intervention condition. Stability of data were based on visual analysis. Using visual analysis, data were evaluated based on trends, levels, immediacy of effect, and variability across conditions.

The secondary data path in the concurrent multiple baseline design across participants was used to determine the effects of the CNC intervention when delivered by caregivers contingent on children’s social skills. Baseline conditions were conducted simultaneously across children. The same criteria as the aforementioned data path were applied to both to guide decision making.

Dependent Variables

During the caregiver training phase of the study, the dependent variable included the percentage of accurately implemented steps of the CNC intervention. CNC steps were delineated procedure by using a task analysis of the CNC intervention found in Ferguson et al. (2020). The task analysis used to train caregivers has 25 steps and is displayed in Appendix B. The percentage of steps accurately completed was calculated by adding the number of correctly implemented steps, then dividing by the total number of steps (25) and multiplying by 100. Data on percent accuracy of caregiver's implementation of the CNC intervention were collected during baseline and intervention conditions, respectively. Generalization data was gathered using the same task analysis used to evaluate interventionists during the intervention sessions, but specific to the new target social skill. A follow up condition was implemented one week after the conclusion of the interventionist training phase for all caregivers.

During the caregiver implementation of the CNC phase with their child, the dependent variable measured was child participants' correct identification of "cool" demonstrations, correct identification of "not cool" demonstrations, and correct role plays of the "cool" demonstration. To measure child participant performance, a task analysis was developed and can be seen in Appendix C. For each child participant, targeted social skills were either a) not currently in the child participants' behavioral repertoire, or b) the child participant had demonstrated the skill in the past, but were in substantial need of improvement. To illustrate child participants' dependent variable, suppose the target skill was appropriately interrupting a conversation, the therapist would demonstrate an appropriate way to interrupt (e.g., saying excuse me during a pause in conversation to gain attention) along with an inappropriate way to interrupt (e.g., repeatedly yelling the person's name to gain their attention). The caregiver participants would then ask the children participants to label the demonstrations as either "cool" or "not cool," and to explain why the demonstration was “cool” or “not cool.” Then, the child participants would role-play the “cool” way of interrupting a conversation.

Charlie’s targeted social skill was engaging in a peer’s choice of game. Specifically, Charlie was taught to vocally agree to play the peer’s choice of game when asked (e.g., “yes” or “yeah, I will play”) and to physically participate in the game for a couple minutes or a few rounds of the game. Charlie’s generalization target social skill was appropriately playing with a dog. Specifically, Charlie had to gently pet the dog and give the dog space. A stuffed animal dog was used for the procedure. Brain’s target social skill was engaging in reciprocal conversation. Specifically, Brain was taught to answer another individual’s questions in conversation and to ask at least two questions to the other individual (e.g., “how are you?” or “what did you do today?”). Brian’s generalization target social skill was changing the conversation when someone showed signs of boredom (e.g., extended conversation pauses, looking in other directions, or one word replies) to a different topic. Luke’s target social skill was interrupting appropriately when his mother was engaged in a task (e.g., talking on the phone). Examples of appropriate interruption targeted for Luke consisted of saying “excuse me” and waiting quietly for his mother to finish her phone call. Luke’s generalization target social skill was initiating play with a friend. Specifically, asking a friend if he could join whatever game the friend was already playing in the demonstrations and role-plays (e.g., word searches).

Interobserver Agreement (IOA)

A second observer who was trained previously on data collection, reviewed the recordings of 33% to 50% of sessions across each dyad’s baseline condition and intervention condition. The observer is a Registered Behavior Technician (RBT) and is currently enrolled in a Master’s ABA program. IOA was completed for each dyad’s single maintenance condition and single generalization condition. Agreements were defined as both the observers and the researcher marking the same data for the dependent variables for the interventionists and the dependent variables for the children. IOA was calculated by dividing the number of agreements by the sum of agreements and disagreements and multiplying by 100. For Dyad 1, the baseline IOA results were 100%, the intervention IOA results were 100%, the follow up IOA results were 100%, and the generalization IOA results were 97.05%. For Dyad 2, the baseline IOA results were 100%, the intervention IOA results were 100%, the follow up IOA results were 97.05%, and the generalization IOA results were 97.05%. For Dyad 3, the baseline IOA results were 100%, the intervention IOA results were 98.52%, the follow up IOA results were 100%, and the generalization IOA results were 91.17%. The results across dyads and conditions of the IOA procedures showed 99.1% (range, 91.17%-100%).

Independent Variables

During the caregiver training phase of the study, behavioral skills training (BST; Brock et al., 2017) was used to teach caregivers how to implement the CNC intervention. Specifically, researchers evaluated the effects of tele-based BST on the caregiver participants' implementation of the CNC intervention with their respective child. During the caregiver implementation of the CNC phase with their child, the CNC intervention was implemented by the caregivers to teach their child the targeted social skill.

Baseline

During the caregiver training phase of the study, caregivers were asked to implement the CNC intervention with their child to teach the child their target social skills remotely. Sessions were recorded and sent to researchers to review. Specifically, the trainer stated, "implement the cool versus not cool intervention to the best of your knowledge to teach your child the social skill. Please do not look up any information regarding the cool versus not cool intervention." Data were collected on the percentage of CNC steps correctly implemented by the caregiver participants during baseline against the task analysis shown in Appendix B. Caregiver participants did not view the task analysis at any point during baseline.

In addition to reviewing recorded remote baseline sessions for the caregivers' data, data were collected on the child participants' social skills as well. During the caregiver implementation of the CNC phase with their child in baseline, data were collected on whether the child participants correctly or incorrectly labeled the interventionists' demonstrations. Also, data were collected on whether the child participants correctly or incorrectly role-played the "cool" (or accurate) demonstration of the target skill on the first try. If opportunities to respond did not occur, due to the caregiver not knowing how to implement the procedure, then the child's data were marked as zero. Once the first dyad showed stable responding for at least three sessions, then the first dyad moved into the intervention condition, while the other dyads remained in the baseline condition.

Cool v. Not Cool Tele-Based Intervention

During the caregiver training phase of the study, BST was used to remotely train caregiver participants. Specific BST components that were included during caregiver training were, instruction, modeling, role-playing, and feedback that were similar to BST components outlined in Higgins et al. (2017). BST took place in the form of a PowerPoint (Appendix D) presentation that was used to describe the CNC intervention. The PowerPoint presentation was based on the instruction used by Ferguson et. al. (2020). However, different from Ferguson et al., incorrect, and correct demonstrations were not included to align with standard BST instruction. All training sessions were conducted through telehealth-videoconferencing using a secure line of videoconferencing the presentation slides were screen shared and each slide was discussed by the researcher with the interventionists. Caregiver training sessions began with the researcher sharing their screen with the caregiver to review the slideshow. There were thirteen slides. The researcher read each slide to the caregiver participants. The order of information on the slides were as followed: (1) labeled the intervention that was reviewed (e.g., Cool versus Not Cool Intervention), (2) defined the CNC intervention and provided a general outline of the intervention, (3) provided the rationale for the CNC intervention, (4) provided detail of how to plan for the CNC intervention, (5) further described the outline of the intervention, (6) described the label the target social skill step of the CNC intervention, (7) described the demonstration steps of the CNC intervention, (8) described how the child should label each demonstration as cool or not cool, (9) described how the child should explain why each demonstration was cool or not cool, (10) described the role-play steps, (11) repeated step 5 and described the outline of the intervention again, (12) Showed a video model of the CNC intervention specific to each child's social skill, and (13) instructed the caregiver that it was their turn to role-play the CNC intervention until the demonstrated the intervention 100% correctly.

The last step of caregiver training was remote role-plays that included both caregiver participants' acting as themselves and the researcher acting as their child. Caregiver participants were presented with their child's target social skill along with the task analysis that included steps for how to implement the CNC intervention. After each role-play attempt, feedback or praise was provided on the caregiver participants'' performance. Role-plays continued after feedback until the caregiver participants role-played the CNC intervention 100% correctly. After each initial training session, the training sessions began with the researcher providing feedback to the interventionists on how to correct their mistakes made during their past sessions with their child before continuing with a review of the CNC procedure by going through the presentation slides.

Following each caregiver training session, caregivers then implemented the CNC intervention with their child. Sessions were recorded and sent to the researcher to review prior to the next caregiver training session. The task analysis of the CNC intervention was given to the caregivers to guide the caregivers through the intervention and the task analysis was used evaluate the caregivers' performance. The CNC intervention steps were as follows: (1) labeled the target social skill, (2) gave instruction to watch demonstrations and introduced props, (3-22) demonstrated 2 cool demonstrations and 2 not cool demonstrations and after each demonstration asked the child to label the demonstration and to explain why the demonstration was cool or not cool, (23) instructed the child it is now their turn to role-play the cool way, (24) provided praise or feedback depending on the results of the role-play, and (25) continued the role-plays until the child demonstrated it correctly, the first two role-plays were independent attempts, the third role-play you prompt the child through the role-play, and you should not exceed three role-plays. If the child correctly role-plays independently on the first try, then you did not need to continue with role-plays. All CNC dyad sessions were recorded using caregiver's cell phones. Recorded video was scored by trained research assistants on caregivers' implementation of the CNC intervention. Data were also collected on child participants' social skills to investigate the effectiveness of the CNC intervention on child's social skill gains with caregiver implementation. The author and trained research assistants scored data by viewing recorded sessions in which caregivers implemented CNC with child participants', respectively. In the event that caregiver participants emitted an error during the steps of the CNC intervention implementation with their children, corrective feedback in the form of describing the mistake and providing instruction on the proper way to perform the step, was given to the caregiver at the start of the next caregiver training session.

Generalization

Generalization took place following intervention for all dyads. Generalization of caregivers' skills were measured by instructing the caregivers to use the CNC intervention to teach a new social skill to their child. New social skills were chosen based upon the same criteria as described previously for the intervention social skill, the child should not have the skill in their repertoire or rarely utilized the skill. Researchers provided a new task analysis of the CNC intervention to the caregivers specific to the target generalization social skill. The task analysis was the same form (Appendix B) as used during intervention, but changed the skill type to teach the new social skill. There were no BST training sessions with the caregiver to implement the CNC intervention to teach the new skill and the only instruction offered to the caregiver was to use the new task analysis of the CNC intervention to teach their child the new social skill. Generalization to determine the extent to which child participants were able to accurately implement newly learned social skills when caregivers implemented the CNC intervention was measured. Using a task analysis shown in Appendix C, generalization of the child's skills was measured by collecting data on the children's answers and role-plays when their caregiver taught them the new target generalization social skill.

Follow Up

Follow up of skills of the interventionists implementing the CNC intervention were measured after the conclusion of the intervention condition. Follow up sessions took place one week after the conclusion of the intervention condition. The only instruction given to the caregivers was to implement the CNC intervention to teach their child their original target social skill that was targeted during the intervention condition. Similar to the intervention condition, data were collected on child participants' targeted social skills when caregivers implemented the CNC intervention. Follow up of skills of the children responding correctly during the CNC intervention and demonstrating correct role-plays were measured after the conclusion of the intervention condition. The follow up sessions took place one week after the conclusion of the intervention condition.

Treatment Fidelity

Treatment fidelity of the researcher's implementation of the BST caregiver participant CNC training was assessed by a secondary trained research assistant during 33% to 50% sessions across all baseline sessions and interventionist sessions include maintenance and generalization. The research assistant was a RBT and was also enrolled in a Master's of ABA program. The trained research assistant calculated fidelity by adding the number of steps completed correctly by the researcher, then dividing by the total number of steps in the checklist and multiplying by 100. The checklist for the training sessions is displayed in Appendix A and the checklist for the baselines sessions, generalization sessions, and maintenance sessions just asked if the researcher was present or not, since during those sessions the researcher should not be giving any instruction to the interventionists. The results of the treatment fidelity procedures showed 100% (range, 100%).

Social Validity

Social validity was assessed based on The Treatment Acceptability Rating Form (TARF; Reimers & Wacker, 1988). The rating form consisted of questions that pertained to how the interventionists felt about the effectiveness, duration, disruption, willingness to participate, and difficulty of CNC. Each question was presented as a statement and the interventionists were directed to rate each statement using a 5-point Likert scale (e.g., 5 = strongly agree). The questionnaire also included a place for interventionists and children to include other additional comments. See Appendix E for the caregiver's social validity questionnaire. Additionally, social validity data were collected on child participants by asking them to rate each statement by circling a smiley face (e.g., Happy face, neutral face, or sad face). See Appendix F for the children's social validity questionnaire.

CHAPTER 3

RESULTS

Findings shown in Figure 1 indicate a functional relationship between BST telehealth-videoconference training and caregivers shown by the percentage of steps of the CNC intervention implemented correctly by caregivers. Also, results displayed in Figure 2 indicate a functional relationship between caregiver-implementation of the CNC intervention and correct responding of CNC questions by the child participants. However, Luke, the child participant in Dyad 3, showed fewer gains when compared to other child participants which will be further discussed.

Dyad 1

During the baseline CNC condition for caregivers, Caregiver 1 displayed 0% during all their baseline sessions to suggest that intervention was necessary to teach the caregiver how to implement the CNC intervention. During the CNC intervention condition for caregivers, Caregiver 1 showed an increase in the percentage of steps of the CNC completed correctly during the first intervention session. After the initial caregiver training session, Caregiver 1 completed 36% of the steps correctly. All remaining caregiver skills intervention sessions consisted of 100% fidelity of implementation of the CNC steps. Mean implementation fidelity for Caregiver 1 during intervention was 94.67% (*SD* = 18.48%). During follow up, Caregiver 1 demonstrated 100% correctness with the steps of the CNC intervention and 100% correctness during generalization with the steps of the CNC intervention.

During the baseline CNC condition for child participants' performance, Charlie demonstrated 0% correct responding to CNC questions, likely due to Caregiver 1's lack of correct implementation of the CNC intervention during baseline. Thus, baseline data coupled with stakeholder reports provided evidence to support CNC intervention with Charlie. When evaluating the effect of Caregiver 1's CNC implementation on Charlie's social skill during the intervention CNC condition for child participants, Charlie showed an increase in the percentage of questions answered correctly. During the initial child performance intervention session, Charlie demonstrated 11% correctness with the steps of the task analysis. During all remaining sessions for the CNC intervention condition for child participants, Charlie exhibited 100% correctness, respectively. Mean percent correctness of the targeted social skill during intervention for Charlie was 92.58% (*SD* = 25.69%). During the generalization CNC condition for child participants and the follow up CNC condition for child participants, Charlie demonstrated 100% correctness, respectively.

Dyad 2

During the baseline CNC condition for caregivers, Caregiver 2 demonstrated 0% correctness during all baseline sessions. The results of the baseline CNC condition for caregivers indicated that intervention was required to teach Caregiver 2 how to implement the CNC intervention. During the intervention CNC condition for caregivers, Caregiver 2 showed an increase in the percentage of steps of the CNC completed correctly their first intervention session. During the initial intervention CNC condition session Caregiver 2 completed 84% of the steps correctly and during the her second intervention session she completed 100% of the steps of the CNC intervention correctly and continued at 100% for the rest of the intervention condition. Mean implementation fidelity for Caregiver 2 during intervention was 98% (*SD* = 5.66). During the generalization CNC condition for caregivers and the follow up CNC condition for caregivers, Caregiver 2 received 100% for implementing every step of the CNC intervention correctly for each session.

During the baseline CNC condition child participants, Brian received 0% for all of his baseline sessions, likely because Caregiver 2 did not implement the CNC intervention, so Brian did not have an opportunity to respond. These results indicated that an intervention was necessary. During the intervention CNC condition for child participants, Brian showed an increase in the percentage of questions answered correctly during his first intervention sessions. During Brian's initial intervention CNC condition for child participants session, he increased to 67% of steps completed correctly and during his second intervention session he increased to 100%. Brian continued at 100% until his sixth intervention session where he scored 89%, but returned to 100% during his seventh and eighth intervention session. Mean percent correctness of the targeted social skill during intervention for Brian was 94.50% (*SD* = 11.76%). During the generalization CNC condition for child participants session and the follow up CNC condition for child participants session, Brian answered and demonstrated 89% of the steps correctly.

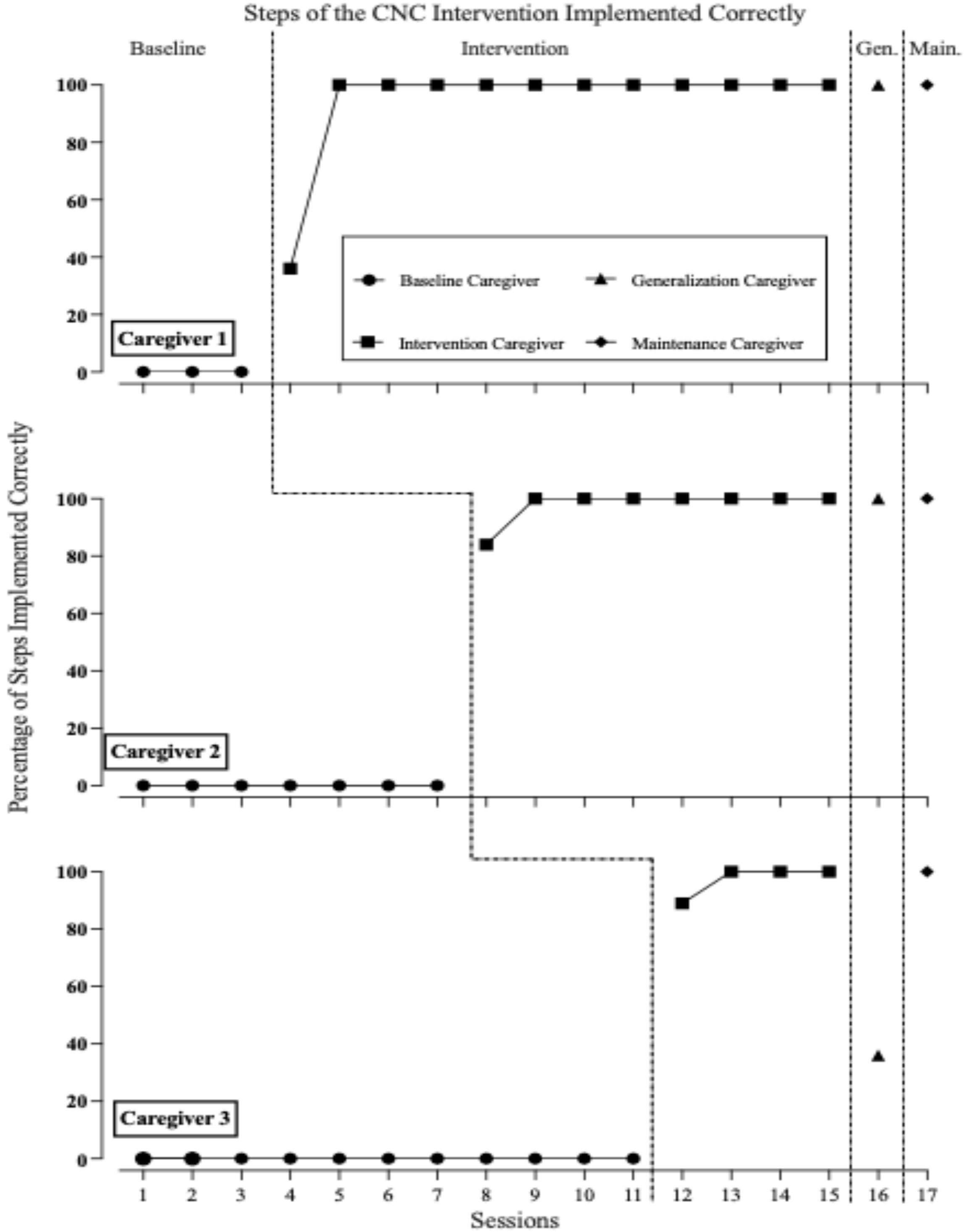
Dyad 3

During the baseline CNC condition for caregivers, Caregiver 3 received 0% for implementing the steps of the CNC intervention correctly for all of their baseline sessions. The results of caregiver skills baseline condition indicated that an intervention was needed to teach the caregiver how to implement the CNC procedure. During the intervention CNC condition for caregivers, Caregiver 3 showed an increase in the percentage of steps of the CNC completed correctly their first intervention sessions. During the third caregiver's initial session for the intervention CNC condition, she completed 88% of the steps of the CNC intervention correctly and during the caregiver's second intervention session she completed 100% of the steps of the CNC intervention correctly and continued at 100% for the rest of the intervention condition. Mean implementation fidelity for Caregiver 3 during intervention was 97.25% (*SD* =

5.50). Caregiver 3 demonstrated 36% of the steps of the CNC intervention correctly during the generalization CNC condition for caregivers. %. In addition, during the follow up CNC condition session, Caregiver 3 displayed 100% of the steps of the CNC intervention correctly and

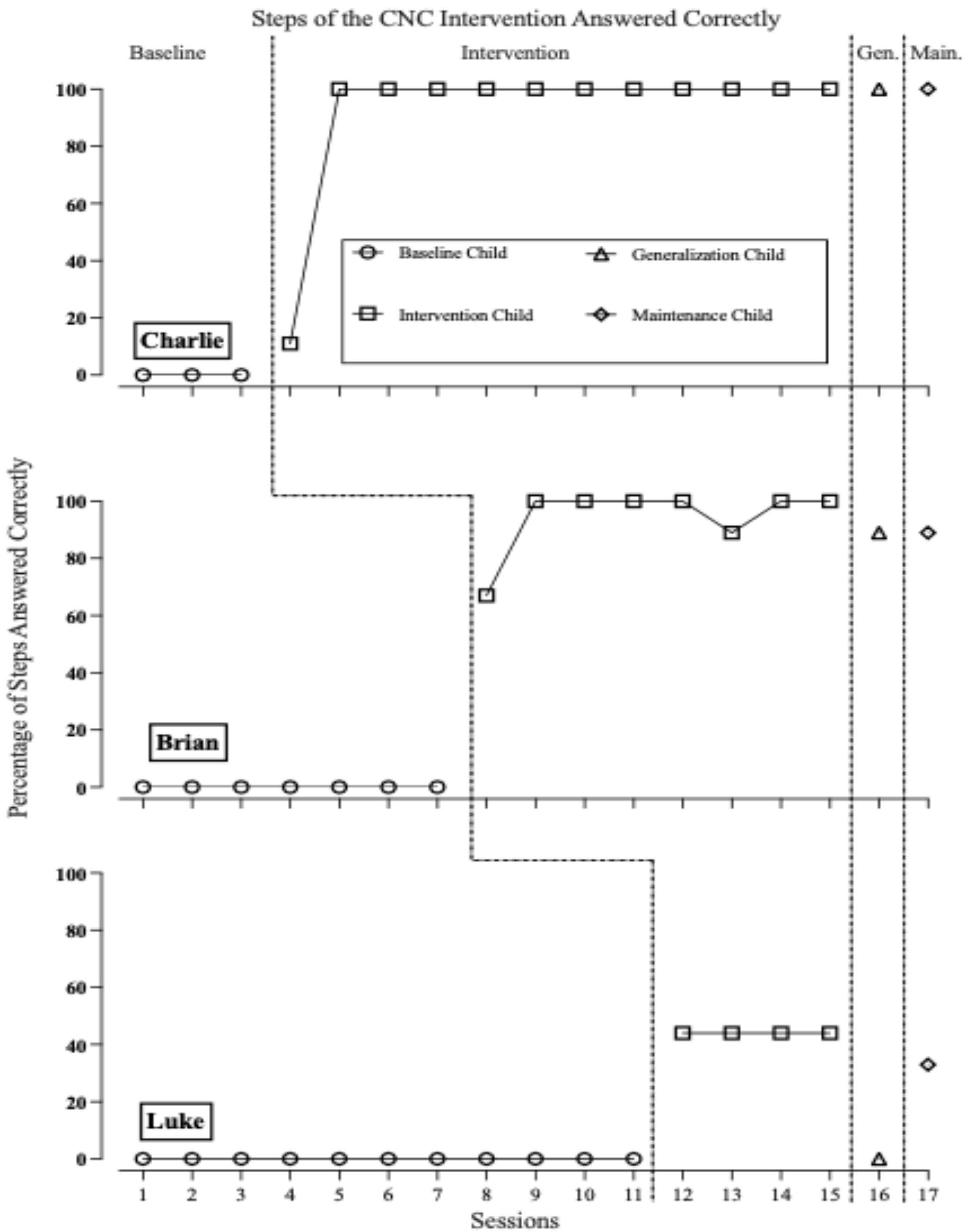
During the baseline CNC condition for child participants, Luke received 0% for all of his baseline sessions, likely because Caregiver 3 did not implement the CNC intervention so Luke did not have an opportunity to respond. These results indicated that an intervention was necessary to teach his caregiver how to implement the CNC intervention in order to determine Luke's skills. During the intervention CNC condition for child participants, Luke showed an increase in the percentage of correct answers during his first intervention sessions. During Luke's initial intervention session he increased to 44% and continued at 44% for the rest of the intervention condition sessions. Mean percent correctness of the targeted social skill during intervention for Luke was 44% (*SD* = 0%). Luke received a score of 0% for answering the CNC questions correctly during the generalization CNC condition for child participants. Luke scored 0% due to the fact that Caregiver 3 told Luke the answers of the labeling and explanation questions without asking Luke for his response. Therefore, Luke only had an opportunity to respond during the role-play and he did do the role-play correctly independently, resulting in a score of 0. In addition, during the follow up CNC condition session, Luke answered 33% of the CNC questions correctly during the follow up CNC condition session.

Figure 1



Note. The figure above displays caregiver participants' skill data during the baseline, intervention, generalization, and follow up condition.

Figure 2



Note. The figure above displays child participants' skill data during the baseline, intervention, generalization, and follow up condition.

Social Validity Results

Social validity data were collected from caregiver participants and child participants. Separate questionnaires were given to child participants and caregivers. The social validity questionnaires for caregivers were given to each caregiver to evaluate how the caregivers felt about the effectiveness, duration, disruption, willingness to participate, and difficulty of CNC and BST. The possible range of score for caregiver questionnaires were 0 to 40. The higher scores indicated that the caregiver believed intervention was effective, the process was not a disruption to their life, they were very willing to participate again, and they did not find any difficulty throughout the process. The questionnaire for caregivers is found in Appendix E. There were 8 statements and each statement was presented as a statement and the interventionists were directed to rate each statement using a 5-point Likert scale (e.g. 5 = strongly agree). The possible range in score was 8-40. The caregiver social validity results showed a range of 30- 40. The social validity questionnaire given to child participants were given to them to evaluate how they liked the CNC intervention and how they felt they did during the sessions. The scores possible from the child participants' questionnaire were 0 happy faces to 5 happy faces. A score of 5 happy faces indicates that the child participants enjoyed the CNC intervention, they felt they did well during the CNC intervention sessions, and they felt the CNC intervention helped them. The questionnaire for child participants is found in Appendix F. The child participants' social validity questionnaire results showed a range of 2-5 happy faces.

Caregiver 1 chose a score of 5 for each statement, indicating that they strongly agreed with all statements. Caregiver 1 also noted that she felt the CNC intervention was very helpful and that she can think of other social skills that she can teach her son using the CNC intervention. Caregiver 2 chose a score of 4 for statements 1, 2, 4, 6, 7, and 8 and she chose a score of 3 for statements 3 and 5. Caregiver 2's social validity results indicated that she agreed that the caregiver training sessions were successful in teaching her the CNC intervention, the CNC intervention was successful in improving her child's social skills, she would be willing to use the CNC intervention to teach her child other social skills, the CNC intervention was a good use of time, the study process was not a disruption to her family's life, and the intervention was not difficult to learn. Also, Caregiver 2 somewhat agreed with the statements that they would be willing to participate in similar tele-based BST sessions to learn other interventions and the caregiver training sessions were a good use of time. Caregiver 3 chose a score of 5 for questions 1, 5, and 8, a score of 4 for questions 3, 4, and 6 and a score of 3 for questions 2 and 7. Caregiver 3's results indicated that she strongly agreed that the caregiver training sessions were successful in teaching her the CNC intervention, the caregiver training sessions were a good use of time, and the CNC intervention was not difficult to learn. Also, Caregiver 3 agreed that she would be willing to participate in similar tele-based BST sessions to learn other interventions, she would be willing to use the CNC intervention to teach other social skills, and the CNC intervention was a good use of time. Finally, Caregiver 3 somewhat agreed that the CNC intervention improved her child's social skills and the study process was not a big disruption to her family.

Charlie and Brian circled a happy face for each statement receiving a score of 5. Charlie and Brian's social validity results indicated that they enjoyed the CNC intervention with their mom, they felt the CNC intervention helped them, and they felt that they answered questions and demonstrated role-plays correctly. Luke circled a happy face for statements 1 and 2, he circled a neutral face for questions 3 and 4, and he circled a sad face for statement 5 giving himself a score of 2 happy faces. Luke agreed with the statements that he understood the CNC intervention and that he enjoyed doing the CNC intervention with his mother. Luke felt neutral about the statements that the CNC intervention has helped him and that he answered CNC questions correctly. Finally, Luke disagreed with the statement that he did the role-plays correctly.

CHAPTER 4

DISCUSSION

The study was conducted to extend previous research on caregiver-implemented CNC intervention and to improve the social skills of children with ASD. The following research questions were asked; (1) what are the effects on treatment fidelity of caregivers when using behavioral skills training to train caregivers to implement the CNC intervention through telehealth, (2) what are the effects of caregiver-implementation of CNC to children with ASD on improving social skills, and (3) can favorable effects of training and intervention be maintained over time and be generalized to new social skills when using the CNC intervention. Three dyads were included in the study. Each dyad included a child with ASD and their mother who was trained and who implemented the CNC intervention with their child. Past research did not investigate training approaches to teach caregivers how to implement the CNC intervention. BST was used to train caregivers through telehealth-videoconferencing to implement the CNC intervention remotely with their children to improve their children's social skills. These findings support using BST through telehealth-videoconferencing to train caregivers to implement the CNC intervention with their children who have ASD to improve their child's social skills.

Effects on Treatment Fidelity of Caregivers When Using BST through Telehealth

Given the recent COVID-19 pandemic, evaluating telehealth-based interventions are important because telehealth has been used as a tool in which healthcare workers and their clients can communicate and provide treatment in a remote matter to ensure safety (Wosik et al., 2020). More specifically, there is limited research on teaching the CNC intervention to caregivers using telehealth technology and in person. Ferguson et al. (2020) evaluated CNC using the teaching interaction procedure, a similar procedure to BST, to train interventionists to implement CNC, however all interventionists had previous training and education in Psychology, behavior analysis, and ABA. In an effort to build upon Ferguson et al., in this study caregivers who had not received formal education training in aforementioned disciplines were trained on the CNC intervention using BST through telehealth-videoconferencing. First, results indicated that using BST through telehealth-videoconferencing was effective in improving the percentage of correct steps of the CNC intervention implemented by caregivers with their children. All caregivers were able to implement 100% of correct steps of the CNC intervention after receiving BST through telehealth-videoconferencing. The current results further support the effectiveness of tele-based caregiver training. Gerow et al. (2021) evaluated the effects of telehealth-based caregiver coaching on improving daily living skills of their children with ASD. Also, effects were immediate as improvement in skills occurred during the first intervention session for each caregiver. These results are important because they suggest that BST through telehealth-videoconferencing is an effective approach to train interventionists who do not have a history of ABA education, to implement the CNC intervention with children with ASD.

Effects of Caregiver-Implemented CNC on Children's Social Skills

Research on best methods to teach interventionists to implement the CNC intervention are limited and have primarily been conducted by a single research team. This study extended past research by training caregivers using BST on the CNC intervention while investigating collateral effects of caregiver implemented CNC on children's social skills. Furthermore, this study extended the specific social skills taught to caregivers and children using the CNC procedure when compared to past research. (e.g., Leaf et al., 2012; Leaf et al., 2015a; Leaf et al., 2015b; Leaf et al., 2016a; Leaf et al., 2016b; Leaf et al., 2016c; Milne et al., 2017 and Ferguson et al., 2020; Cihon et al., 2021). Additionally, this study addressed a limitation related to training resources as outlined by Chion et al. (2021) in that just one individual was used to train caregivers (cf. two individuals). Cihon et al. (2021) pointed out that researchers in their study had resources to have two actors during role-plays which is not always available in other training settings. Both children in Dyads 1 and 2 showed intervention gains with the targeted social skill; however, Luke in Dyad 3 did not show a similar magnitude of treatment effect. This might be due to Luke's assessment results that showed he had limited intraverbal skills and he was often prompt dependent. Thus, highlighting potential boundaries of the CNC intervention. Nevertheless, these results related to research question two are important because they provide support that caregiver-implemented CNC is an effective approach to improve the social skill repertoires of children with ASD.

Effects of Training and Intervention Over Time and Generalization Effects

In an effort to extend previous research on CNC using a telehealth model of training, the current study evaluated follow up and generalization effects of the intervention. Results indicated that caregiver skills and child skills developed during the intervention condition maintained over time after a week of no training. In addition, generalization results found from the study are conflicting. Caregiver 1 and Caregiver 2 could generalize 100% of their skills learned during the intervention condition to implement the CNC intervention to teach other social skills to their children with ASD, while Caregiver 3 partially generalized their skills, but did not meet 100%. Ferguson at al. (2020) addresses maintenance of interventionists skills 3 days after intervention for one interventionist, 13 days after for one interventionist, and 7 days after for one interventionist. Each interventionist demonstrated 100% of skills and child participants remained at the same percentage of correct responding as demonstrated in the intervention condition. In addition, Ferguson et al. (2020) examined generalization of interventionist skills by having each interventionist implement the CNC intervention with a different child where a different social skill was targeted. Three interventionists demonstrated 92.3%, 92.3%, and 77% of the CNC intervention correctly during the generalization condition, respectively. The current study adds to

Ferguson et al. (2020) results showing that CNC skills can be maintained and generalized when interventionists are taught using the teaching interaction procedure or tele-based BST. In addition, caregivers with no formal education in ABA were able to maintain and generalize skills similar to interventionists with experience in ABA.

Limitations

To the authors knowledge this study has three limitations. First, researchers did not include naturalistic probes to gather data on child participants' social skills. Therefore, data were not able to be collected on whether the child participants' were able to demonstrate the social skills learned through the CNC intervention in the natural environment. For example, the study did not explore if Charlie would except a friend's request to play the friend's choice of activity in the natural environment, if Brian engaged in back-and-forth conversation outside of the CNC sessions, and if Luke interrupts appropriately in the natural environment. Second, a generalization condition of child social skills displayed during the CNC intervention learned during the intervention condition across novel adults implementing the CNC intervention was not conducted. Therefore, data were not collected on whether the child participants were able to display correct responding to CNC questions when the intervention was implemented by other adults. This is important, because social skills should be displayed across environments and participants in the natural environment. It would be an important distinction to learn if child skills do not occur with other adults or individuals such as their father, siblings, aunts, uncles, or grandparents. Another step of the intervention would need to be added to teach the child participants to generalize their skills. Cihon et al. (2021) evaluated generalization of child skills by having a different interventionist implement the CNC intervention. Third, the follow up condition was implemented only one week after the intervention condition concluded. Therefore, data were not collected if skills maintained over longer periods of time. Podlesnik et. al. (2017)

highlights that long-term maintenance effects have limited research across behavioral treatments. Future research should determine the variables that influence long term maintenance effects of skills learned during intervention.

Directions for Future Research

To investigate unanswered questions related to CNC, future research could further the current literature base in several ways. First, future research should consider replicating this study, but target different social skills that have not already been taught using CNC and taught using a telehealth approach. This is important to learn more about the extent to which CNC is amenable when implemented using tele-based training and remote learning. Second, future research should include naturalistic probes of child social skills to determine if skills learned during the CNC intervention are able to generalize to the natural environment. Children diagnosed with ASD often show difficulty generalizing learned skills to novel contexts and environments; thus, it is critical to further investigate the effectiveness of caregiver implementation of CNC on generalized social skill responding of children. Third, future research should include other critical stakeholders such as teachers on their implementation of the CNC intervention to determine if this method of training and subsequent treatment is effective to teach child social skills. This is important because caregivers are not the only individuals interacting with the child participants daily. In addition, given a lesser magnitude of treatment gains exhibited by Luke, further investigation of treatment boundaries should be explored to identify specific characteristics of children in which CNC might be less effective when compared to alternative social skill training approaches such as Social Stories, Promoting Alternative Thinking Strategies, Stop Observe Deliberate Act, the power card strategy (Hutchins et al., 2020), and video-modeling (Acar et al., 2017). Last, future research should consider not restricting caregivers to look up the CNC intervention during the baseline condition in order to evaluate a baseline condition different than the one used in this study. The different baseline conditions just approach internal and external validity differently, therefore it would be important to determine if intervention effects on magnitude of data change between conditions would change.

Practical Implications

Results from the current study suggest that Board Certified Behavior Analysts (BCBAs) may arrange intervention to result in promising treatment gains when using BST through telehealth-videoconferencing to train caregivers to implement the CNC intervention with their children even post COVID-19. In addition, results displayed in the study support that BCBAs may instruct caregivers to implement the CNC intervention with their children remotely to improve their social skills. These findings are critical given that clinical behavior analytic services are not always widely accessible (Yingling et al., 2021). Finally, behavior analysts should move forward with some caution when having caregivers use the CNC intervention to teach a social skill that they were not trained to originally teach, since Caregiver 3 was not able to implement 100% of skills learned during the intervention CNC condition for caregivers. Therefore, the caregiver-implementation of the CNC intervention showed promising effects on improving children's social skills and BST through telehealth-videoconferencing is a successful intervention to teach the CNC intervention to caregivers.

Conclusion

The study expanded research on using the CNC intervention to improve child social skills by using BST through telehealth-videoconferencing to train caregivers on the CNC intervention to improve their child's social skills. Results suggest that BST telehealth-videoconferencing was successful in training caregivers to implement the CNC intervention with their children remotely. In addition, two out of the three child participants responded 100% correctly to CNC intervention and the third child participant improved responding from the baseline condition to the intervention condition with a lesser magnitude, indicating that caregiver-implementation of the CNC intervention appeared to be successful to improve social skills of the child participants. Also, caregiver and child skills maintained over time and Caregiver 1 and Caregiver 2 displayed all steps of the CNC intervention correctly during the generalization condition indicating that skills learned during intervention were maintained over time and generalized. Despite these results, research should continue to gather information on caregiver-implementation of the CNC intervention when caregivers are taught using BST to determine generalization and maintenance effects, effects of child social skills in natural environments, and effects on different targeted social skills. In conclusion, based on intervention data, IOA data, treatment fidelity data, and social validity data using BST through telehealth-videoconferencing to train caregivers to implement the CNC intervention with their children to improve their social skills is an appropriate intervention.

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The current study was pre-registered on the Registry of Efficacy and Effectiveness Studies (REES) website prior to implementation of the study.

APPENDIX

APPENDIX A

TASK ANALYSIS OF BEHAVIORAL SKILLS TRAINING

Slides	**Description**	Completed - ✔ Incomplete - **X**
1	Title Slide	
2	Label - Defined and outlined the CNC procedure	
3	Rationale - Provided benefits of the CNC procedure	
4	Detailed the planning of the CNC procedure (e.g., task analysis of the social skill)	
5	Gave an overview of the steps of the CNC procedure	
6	Informed the interventionists about the label step of the CNC procedure	
7	Informed the interventionists about the demonstration step of the CNC procedure	
8	Described how the interventionists will ask the child to label the demonstration	
9	Described how the learner needs to explain why the demonstration is cool or not cool	
10	Detailed how the interventionists should instruct the child to role-play	
11	Gave a second overview of the CNC procedure	
12	Played a video demonstration of the CNC procedure	
13	Informed the interventionists that they would now role-play the CNC procedure	

Note. The data sheet displays the task analysis of the behavior skills training procedure used when training interventionists to implement the CNC procedure with their child. The task analysis includes 13 steps. This analysis was also used to assess treatment fidelity.

APPENDIX B

TASK ANALYSIS OF THE COOL VERSUS NOT COOL PROCEDURE

Task Analysis of the Cool Versus Not Cool Procedure	
Steps	**Description**
1	Label the target skill (e.g., "Today we will practice the cool way of...)
2	Give instruction to watch your demonstration (e.g., Is this the cool way or the not cool way?)
3 - 22	Two cool and two not cool demonstrations
3	Demonstrate target skill
4	Ask the child to label the demonstration as cool or not cool
5	Provide praise if correct or feedback if incorrect
6	Ask the child to explain why the demonstration was cool or not cool
7	Provide praise if correct or feedback if incorrect
8-22	Repeat steps 3 through 7. Be sure to include two cool and two not cool demonstrations
23	Give instruction to the child that they will role-play (e.g., "It's your turn to practice ___ the cool way)
24	Provide praise if correct or feedback if incorrect
25	Instruct the child to role-play until they demonstrate the cool way correctly

Note. This data sheet displays the task analysis of the CNC procedure used by the interventionists when implementing the CNC procedure with their children. The task analysis includes 25 steps.

Appendix C

EXAMPLE CHILD PARTICIPANTS' DATA SHEET

Follow Up Questions/Conversational Volleys		
	Steps	Completed - ✔ Incomplete - **X**
1.	Labeled the first cool demonstration as cool	
2.	Explained why the first cool demonstration was cool	
3.	Labeled the second cool demonstration as cool	
4.	Explained why the second cool demonstration was cool	
5.	Labeled the first not cool demonstration as not cool	
6.	Explained why the first not cool demonstration was not cool	
7.	Labeled the second not cool demonstration as not cool	
8.	Explained why the second not cool demonstration was not cool	
9.	Demonstrated the Role-Play correctly on the first try	
	TOTAL:	

Note. The above data sheet displays the general form used for data collection for the children of each dyad during the CNC sessions.

APPENDIX D

SLIDES OF BST FOR CAREGIVER TRAINING SESSIONS

The Cool Versus Not Cool Procedure (CNC)

Temple University
Master of Science in Education in Applied Behavior Analysis Thesis Study
Student Investigator: Brittany Dumproff, BA, RBT
Primary Investigator: Art Dowdy, Ph. D., BCBA-D

1

CNC – Defined and Outlined

- CNC is a social skills intervention meant to teach individuals to identify appropriate (cool) behaviors and inappropriate (not cool) social behaviors
- Outline of the Procedure
  1. Label the target skill
  2. Instruction to watch demonstrations
  3. Two cool demonstrations and two not cool demonstrations
  4. Ask your child to label each demonstration as cool or not cool
  5. Provide praise if correct or feedback if incorrect
  6. Ask your child to explain why each demonstration was cool or not cool
  7. Provide praise if correct or feedback if incorrect
  8. Instruct your child to role-play the cool way with you
  9. Provide praise if correct or feedback if incorrect
  10. Instruct your child to role-play until they demonstrate the cool way 100% correctly

2

Rationale

- CNC has shown to improve social skills for individuals with Autism Spectrum Disorder
- Targeted researched social skills have included losing graciously, sportsmanship, interrupting appropriately, empathy, changing the game when someone is bored, sharing with peers, compromising on choosing a game, assertiveness when a peer takes your toy, participating in group games, talking with a friend, and joint attention

3

Planning of the Procedure

- Review task analysis of the CNC procedure
- Review target social skill
- Gather materials before beginning sessions (i.e., game, toy, symbols to show which character you are playing, etc.)
- Have a copy of the social skill task analysis and the CNC task analysis on hand to refer to during session

1.	Labeled the first cool demonstration as cool
2.	Explained why the first cool demonstration was cool - Said yes to a peer's choice and engaged in the peer's choice
3.	Labeled the second cool demonstration as cool
4.	Explained why the second cool demonstration was cool - Said yes to a peer's choice and engaged in the peer's choice
5.	Labeled the first not cool demonstration as not cool
6.	Explained why the first not cool demonstration was not cool - Said yes to a peer's choice, but did not engage in it or said no to peer's choice
7.	Labeled the second not cool demonstration as not cool
8.	Explained why the second not cool demonstration was not cool - Said yes to a peer's choice, but did not engage in it or said no to peer's choice
9.	**Role-Play** - Child agrees to play caregiver chosen activity (i.e., "Okay, let's play" "Yeah, I will play" "Okay!") - Caregiver and child engage in caregiver chosen activity for at least two minutes

4

	Cool Versus Not Cool Procedure for Playing a Peers Choice
	Steps
1.	Label the target skill (i.e., "We are going to practice the cool way to respond when a friend asks you to hangout or play with them.")
2.	Give instruction to watch your demonstration (i.e., "Is this the cool or the not cool way? Watch me. When I hold up the red card, that means I am acting as your friend. When I hold up the blue card, that means I am acting as you.")
3.	Demonstrate the "not cool" way; 1. Holding red card up* - Say "Hi ____, let's go play a card/board game." 2. Holding up blue card*- Say "No, I am going to play video games by myself." 3. End of demonstration
4.	Ask the child to label the demonstration as cool or not cool
5.	Provide praise if correct or provide feedback if incorrect • "Great job, that was the not cool way of responding to a friends invitation to play with them" • "Nice try, but no, that was the not cool way of responding to a friend's invitation to play."
6.	Ask the child to explain why the demonstration was cool or not cool
7.	Provide praise if correct or provide feedback if incorrect • "Nice job, that was the not cool way, because I said no to playing with my friend in activity they chose" • "Good try, but no, that was the not cool way, because I said no to playing with my friend in activity they chose"
8.	Start a cool demonstration 1. Holding up the red card* Say "Hi ____, let's go play a card/board game!" 2. Switch to blue card* - Say "Hey, okay I will play a card/board game with you! 3. Play the game for a little bit.
9.	Ask the child to label the demonstration as the cool way or the not cool way
10.	Provide praise if correct or provide feedback if incorrect • "Nice job, that was the cool way!" • Good try, but that was the cool way!"
11.	Ask the child to explain why the demonstration was cool or not cool
12.	Provide praise if correct or provide feedback if incorrect • "Nice job, that was the cool way, because I told a friend I would play a game that they chose" • "Good try, but no, that was the cool way, because I told a friend I would play a game that they chose."
13.	Repeat steps 3 through 7
14.	Repeat steps 8 through 12
15.	Give instruction to the child that they will role-play (e.g., "It's your turn to playing a friends choice in game the cool way.") • The caregiver will play the red card role and ask to play a game. • The child will play the blue card role and engage in the friend's choice of game
16.	Provide praise if correct or provide feedback if incorrect. • "Great job, you did each step correctly, by saying yes to play a friend's choice of game and playing the game for a little while" • "Nice try, you said yes to playing, but you did not play the game with the friend for a little while."
17.	Instruct the child to role-play the cool way until all steps are correct (i.e., repeat steps 15 and 16)

5

Label Step

- The first step of the CNC procedure is to label the target skill
- Introduce the procedure and what you will be working on
  - "We are going to practice the cool way to respond when a friend asks you to play with them."

6

Demonstration Step

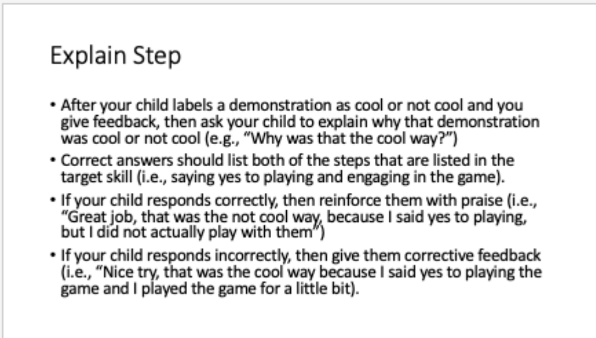
- Next, you will instruct your child to watch your demonstrations
- There should be a total of 4 demonstrations
  - 2 not cool demonstrations
  - 2 cool demonstrations
- The cool demonstrations should always be the same
- Cool demonstrations should follow the task analysis of the child's target skill (e.g., saying yes to engaging in the peer's choice and actually engaging in the choice).
- Use props to pair with each character you are playing in the demonstration
  - For example, in the later videos you will see me holding up a blue card when playing the child and I am holding up a red card when playing the peer
  - Keep the props the same throughout the study

7

Label the Demonstration Step

- After each demonstration, you should ask your child to label that demonstration as cool or not cool
- If they respond correctly, then reinforce your child with praise (i.e., "Great job, that was the cool way!")
- If they respond incorrectly, then give corrective feedback (i.e., "Nice try, but no, that was actually the cool way").

8



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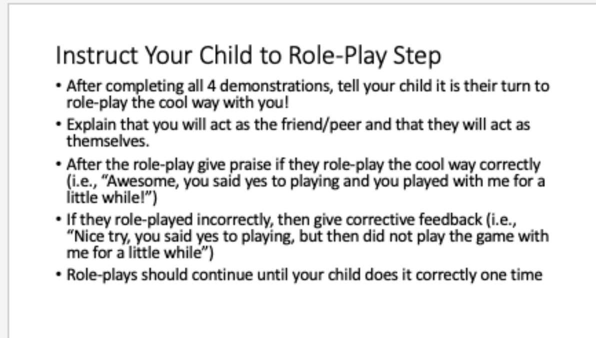

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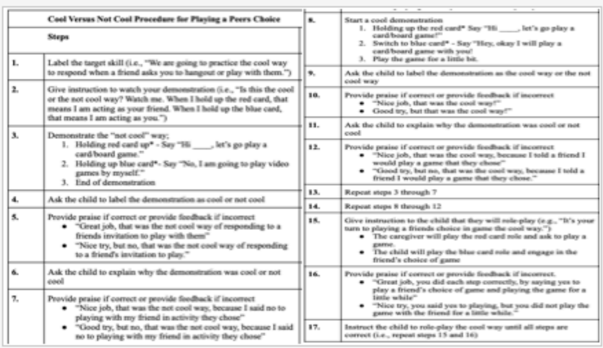
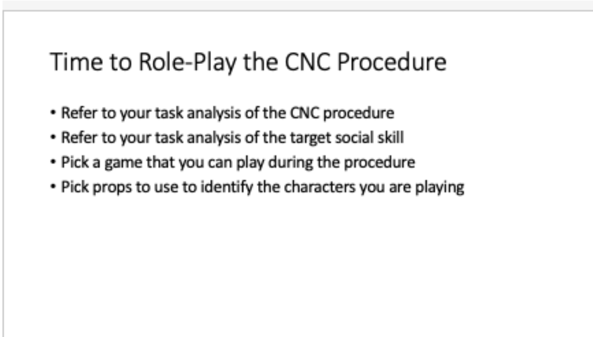


	Cool Versus Not Cool Procedure for Playing a Peers Choice
	Steps
1.	Label the target skill (i.e., "We are going to practice the cool way to respond when a friend asks you to hangout or play with them.")
2.	Give instruction to watch your demonstration (i.e., "Is this the cool or the not cool way? Watch me. When I hold up the red card, that means I am acting as your friend. When I hold up the blue card, that means I am acting as you.")
3.	Demonstrate the "not cool" way; 1. Holding red card up* - Say "Hi ____, let's go play a card/board game." 2. Holding up blue card*- Say "No, I am going to play video games by myself." 3. End of demonstration
4.	Ask the child to label the demonstration as cool or not cool
5.	Provide praise if correct or provide feedback if incorrect • "Great job, that was the not cool way of responding to a friends invitation to play with them" • "Nice try, but no, that was the not cool way of responding to a friend's invitation to play."
6.	Ask the child to explain why the demonstration was cool or not cool
7.	Provide praise if correct or provide feedback if incorrect • "Nice job, that was the not cool way, because I said no to playing with my friend in activity they chose" • "Good try, but no, that was the not cool way, because I said no to playing with my friend in activity they chose"
8.	Start a cool demonstration 1. Holding up the red card* Say "Hi ____, let's go play a card/board game!" 2. Switch to blue card* - Say "Hey, okay I will play a card/board game with you! 3. Play the game for a little bit.
9.	Ask the child to label the demonstration as the cool way or the not cool way
10.	Provide praise if correct or provide feedback if incorrect • "Nice job, that was the cool way!" • Good try, but that was the cool way!"
11.	Ask the child to explain why the demonstration was cool or not cool
12.	Provide praise if correct or provide feedback if incorrect • "Nice job, that was the cool way, because I told a friend I would play a game that they chose" • "Good try, but no, that was the cool way, because I told a friend I would play a game that they chose."
13.	Repeat steps 3 through 7
14.	Repeat steps 8 through 12
15.	Give instruction to the child that they will role-play (e.g., "It's your turn to playing a friends choice in game the cool way.") • The caregiver will play the red card role and ask to play a game. • The child will play the blue card role and engage in the friend's choice of game
16.	Provide praise if correct or provide feedback if incorrect. • "Great job, you did each step correctly, by saying yes to play a friend's choice of game and playing the game for a little while" • "Nice try, you said yes to playing, but you did not play the game with the friend for a little while."
17.	Instruct the child to role-play the cool way until all steps are correct (i.e., repeat steps 15 and 16)

11

12



13

Note. Above displays an example of the slideshow used by the researcher during the caregiver training sessions.

APPENDIX E

SOCIAL VALIDITY QUESTIONNAIRE FOR CAREGIVERS

Social Validity Questionnaire for Caregiver

Directions: Circle the number that best describes your response to each statement. The score of 5 means "strongly agree," 4 means "agree," 3 means "somewhat agree," 2 means "disagree," and the score of 1 means "strongly disagree."

1. The caregiver training sessions were successful in teaching me the intervention.	1	2	3	4	5
2. The intervention was effective in improving my child's social skills.	1	2	3	4	5
3. I would be willing to participate in the same caregiver training sessions to teach myself different interventions.	1	2	3	4	5
4. I would be willing to use the intervention to teach my child other social skills.	1	2	3	4	5
5. The caregiver training sessions were a good use of time.	1	2	3	4	5
6. The intervention used with my child was a good use of time.	1	2	3	4	5
7. The whole process of the study was not a big disruption to my family's daily routine.	1	2	3	4	5
8. The intervention was not difficult to learn.	1	2	3	4	5

Additional Comments:

____

____

____

Total:_____

Note. The above data sheet was the social validity questionnaire used to gather caregiver's opinions at the conclusion of the study.

APPENDIX F

SOCIAL VALIDITY QUESTIONNAIRE FOR CHILD PARTICIPANTS

Social Validity Questionnaire for Child

Directions: Circle the happy face if you agree with the statement, circle the neutral face if you do not have an opinion, and circle the sad face if you disagree with the statement.

Happy **Neutral** **Sad**

1. I liked doing the Cool Versus Not Cool Procedure with my Mom.

2. I understood the Cool Versus Not Cool Procedure.

3. I think the Cool Versus Not Cool Procedure has helped me.

4. I answered the questions correctly during the Cool Versus Not Cool game.

5. I did the role-play correctly during the Cool Versus Not Cool game.

Total Number of Happy Faces: ________

Note. The above data sheet was the social validity questionnaire used to gather the children participants' opinions at the conclusion of the study.