Behavioral Improvements Associated with Computer-Assisted Instruction for Children with Developmental Disabilities

Christina Whalen, Lars Liden, Brooke Ingersoll, Eric Dallaire, and Sven Liden

ABSTRACT

TeachTown is a new computer-assisted instruction (CAI) program that utilizes best-practices ABA to teach a variety of skills to young children. Study 1 investigated the effect of the software on the acquisition of receptive language, cognitive, and social skills by 4 children with autism and 4 children with other developmental delays using a pre-test/post-test design. Social validity with parents, teachers, and clinicians was also assessed. Study 2 used a multiple-baseline design across the 4 children with autism to investigate whether CAI impeded the children’s spontaneous use of language and social behaviors. Results suggested that the computer-assisted instruction actually enhanced social-communication and decreased inappropriate behaviors. Results are discussed in terms of the potential of using CAI programs for children with autism.

Keywords: Computer, Autism, Social-Communication, Language, Discrete Trial Training, Pivotal Response Training

Introduction

Children with autism and other developmental disorders exhibit significant difficulties learning through traditional teaching methods. One method that has had substantial effectiveness in the education of these young children is applied behavior analysis (ABA). ABA encompasses a variety of teaching strategies which are drawn from the learning literature and includes both highly-structured and more naturalistic teaching approaches (Schreibman & Ingersoll, 2005). ABA has been shown to be particularly effective in the education of children with autism who, due to social, attentional, and motivational deficits, have difficulty learning though traditional methods (National Research Council, 2001; Schreibman & Ingersoll, 2005). Most ABA teaching techniques involve intensive, one-to-one instruction. Although ABA has been shown to be extremely effective for teaching new skills to young children with autism, it is often prohibitively expensive due to the significant amount of teacher time and materials need to implement it effectively.

With recent advances in computer technology, there has been a strong interest in the use of computer-assisted instruction (CAI) in the education of children with disabilities. There are several reasons to be excited about the possibility of using computers to implement ABA interventions with young children with autism. First, using computers may help to reduce the number of staff and staff training saving families and school districts substantial amounts of money. Second, it can be implemented with a high degree of fidelity. ABA instruction requires significant staff training to be implemented effectively. A computer program which uses ABA principles can be designed to always provide appropriate prompts and reinforcement consistently. Third, programs that automatically collect data on the child’s performance may provide more accuracy and more comprehensive data than personal instruction. Fourth, computer instruction may be implemented by untrained providers, increasing the number of hours of intervention. Fifth, it is highly motivating for many children as has been demonstrated by the very profitable computer game industry for young children. This may be particularly true for young children with autism who have often been described as visual learners (Sherer, Pierce, Parades, Kisacky, Ingersoll, & Schreibman, 2001; Schreibman, Whalen, & Stahmer, 2000). If computers are more motivating for children with autism and they are able to attend longer, many skills can be taught with reduced behavior problems and increased learning time. Finally, because computers can store great
amounts of information, more exemplars of concepts can be presented which will reduce the cost of materials for treatment and potentially increase generalization.

Research that has examined the effectiveness of CAI for teaching children with autism and other developmental disorders has been promising (Bernard-Opitz, Sriram, & Nakhoda-Sapuan, 2001; Bosseler, & Massaro, 2003; Coleman-Martin, Wolff Hellar, Cihak, & Irvine, 2005; Kinney, Vidor, & Stromer, 2003; Moore, & Calvert, 2000; Simpson, Langone, & Ayers, 2004; Williams, Wright, Callaghan, Coughlan, 2002). In fact, current research is beginning to suggest that CAI may be more effective for teaching certain skills than direct instruction provided by a trained teacher. For example, Williams et al. (2002) compared CAI and teacher implemented instruction for teaching sight word reading to eight children with autism in a cross over design. The children learned significantly more sight words in the computer condition than the direct instruction condition. Additionally, it was found that the children attended significantly more during CAI than direct instruction, suggesting that CAI was more motivating to the children with autism. In a similar study, Moore and Calvert (2000) compared CAI and teacher instruction for teaching basic vocabulary skills. The children in the CAI condition learned significantly more vocabulary words than the children in the direct instruction condition. In addition, the children in the CAI condition attended more and were more motivated than the children in the direction instruction condition. Across children, the amount of time on task was positively correlated to the number of words learned.

Despite the promise of CAI for children with developmental delays, there is a legitimate concern that CAI may impede the development of spontaneous language and result in increased social withdrawal, particularly for children with autism (Bernard-Opitz, Ross, & Tuttas, 1990). To date, little research has examined this possibility. One study comparing the effect of CAI to direct instruction by a teacher noted that the participants with autism used more spontaneous gestures and verbal requests for help in the CAI condition compared to direct instruction condition. While this finding is promising, due to the small number of subjects in each condition, an empirical analysis of the results was not conducted (Williams et al., 2002). An additional concern is that skills learned on the computer may not generalize to other activities. Previous research has not adequately examined whether skills learned during CAI were used spontaneously in non-computer-based activities.

The goal of this research was to assess whether computer-assisted instruction impedes the use of language and social interaction in children with autism. In the first study, the effectiveness of TeachTown, an ABA-based, computer-assisted intervention program designed for use by preschool-aged children with developmental disabilities, was examined with eight children with autism and other developmental disabilities. In the second study, the four children with autism were observed during baseline play sessions and computer-assisted instruction with their parents. Language, social, and inappropriate behaviors were observed to determine whether the use of the computer led to decreased language use and/or social withdrawal. In addition, children were observed during generalization play sessions with their parents after treatment was begun to determine whether the use of CAI would have an effect language and social interaction outside of the treatment environment (computer).

Method – Study 1

Participants

Participants included four children with an autism spectrum diagnosis (ASD) and four children with other developmental disabilities (DD), including three with Down Syndrome and one with Soto’s Syndrome. Two children (one with ASD and one with DD) also participated during baseline but were unable to complete the study for personal and health reasons. Their data were not included in this report.

The average chronological age was 3 years, 9 months for the children with ASD and 4 years, 6 months for the children with DD. The average language-age equivalent for both groups was 1 year, 8
months using the MacArthur Communicative Development Inventory (CDI) (Fenson, et al., 1993). All participants with autism met criteria using the Childhood Autism Rating Scale (CARS) (Schopler, Reichler, DeVellis, & Daly, 1980) with an average score of 38. Additionally, these children had all received a diagnosis of autism or another autistic spectrum disorder from an outside physician or psychologist using DSM-IV-TR criteria (American Psychiatric Association, 2000). Table 1 summarizes the specific characteristics of each participant. All participants were recruited on a first-come, first-serve basis locally from parent groups, professional referrals, and the company website.

**Table 1: Participant characteristics at intake**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Diagnosis</th>
<th>Chronological Age</th>
<th>CARS</th>
<th>CDI Gestures</th>
<th>CDI Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damon</td>
<td>Autism</td>
<td>3-11</td>
<td>39</td>
<td>&gt; 1-4</td>
<td>1-8</td>
</tr>
<tr>
<td>Cameron</td>
<td>Autism</td>
<td>4-3</td>
<td>40.5</td>
<td>1-3</td>
<td>2-4</td>
</tr>
<tr>
<td>Bailey</td>
<td>Autism</td>
<td>3-4</td>
<td>40</td>
<td>1-2</td>
<td>1-5</td>
</tr>
<tr>
<td>Aaron</td>
<td>Autism</td>
<td>4-0</td>
<td>32</td>
<td>&gt; 1-4</td>
<td>1-9</td>
</tr>
<tr>
<td>Ellen</td>
<td>Down Syndrome</td>
<td>5-10</td>
<td>20</td>
<td>1-3</td>
<td>1-11</td>
</tr>
<tr>
<td>Frankie</td>
<td>Down Syndrome</td>
<td>4-3</td>
<td>25</td>
<td>&gt; 1-4</td>
<td>1-11</td>
</tr>
<tr>
<td>George</td>
<td>Soto’s Syndrome</td>
<td>4-4</td>
<td>32</td>
<td>&gt; 1-4</td>
<td>1-9</td>
</tr>
<tr>
<td>Heather</td>
<td>Down Syndrome</td>
<td>4-0</td>
<td>23</td>
<td>1-3</td>
<td>1-5</td>
</tr>
</tbody>
</table>

aChronological Age (CA) and MacArthur Childhood Developmental Index (CDI) age shown in years-months.
bRange of autism severity on the Childhood Autism Rating Scale (CARS): 15-29=non-autistic, 30-36=mildly-moderately autistic, 37-60=severely autistic

**Design**

A pre-test/post-test design was used to determine acquisition of the targeted concepts using the computer software for all eight participants. Acquisition was assessed using pre- and post-tests administered by the computer. These tests used novel stimuli that were not included in the training sessions to ensure that the children learned the concepts rather than simply recognizing the training stimuli.

**Setting and Materials**

The research was conducted in the homes of each participant. Each child used a computer supplied by the family, or if the family did not have one, a computer was provided during the child’s participation in the study. Some participants used touch screen monitors which were either provided by the child’s family or by the research team.

**Software**

The TeachTown software was designed based on best-practices from applied behavior analysis presented within a developmental framework. The software includes a comprehensive curriculum for children with developmental disorders and teaches receptive language, social understanding, self-help, attention, memory, auditory processing, and early academic skills. The program uses an intermittent reinforcement schedule and the child chooses the reinforcers and the order of activities. The reinforcers are designed by professional video game designers to be attractive to children with a wide range of interests and abilities. Each concept is introduced using errorless discrimination training where distracters are gradually faded in as the child progresses through the lesson. The software automatically adjusts to the child’s performance by providing prompts when the child’s performance decreases and fading prompts as the child’s performance improves.
To enhance generalization, the program uses a large variety of images for every concept and varies the verbal instructions for each trial. The software also includes a complete data tracking system that provides the adult with information about the child’s progress including prompts, errors, correct responses, and other valuable data.

Following baseline, each participant was asked to use the TeachTown software for three 15-minute sessions a week over an eight-week period. Data was collected automatically by the software regarding the amount of time the child used the software and on the child’s performance using the program.

**Dependent Measures**

Receptive identification of animals, food, clothing, transportation, toys, playground equipment, classroom objects, household objects, actions, people (boy, girl, mother, father, etc.), and occupations were targeted by the software program. In addition, matching identical and non-identical objects was taught. Social understanding was targeted using emotion identification and a unique eye gaze lesson. This lesson taught children to attend to eyes using a shaping paradigm that began with identifying where an arrow was pointing and gradually adding features that looked more and more like a face to identify where the eyes were looking. Pre-tests were used to assess each concept. If a child performed at less than 80% correct, they began drills for those concepts. The drills used errorless learning and gradually introduced distracters until the child identified the concept without prompting at 80% accuracy or better. When this occurred, the child completed the post-test for that lesson. The pre-tests and post-tests contained a completely different set of stimuli than the training drills (i.e. lessons) in order to assess generalization and ensure that the child had learned the concepts and not simply memorized stimuli.

**Social Validity**

The social validity of this CAI protocol was assessed by having parents and professionals view a demonstration of the TeachTown software and rate the program on a five-point, Likert-type scale. Fifteen adults participated, including five parents of children with autism, five special education teachers, and five clinicians. The five clinicians included two speech-language pathologists, two psychologists, and one occupational therapist. Table 2 (below) summarizes the mean responses of these individuals to 6 social validity questions.

**Results - Study 1**

The pre and post-test scores of all eight participants were automatically generated using the TeachTown software. There was no difference in performance for the children with autism vs. the children with other developmental delays. Across all participants, there was a significant change in the percent correct using the TeachTown software from the pre-tests ($M = 60.23$, $SD = 22.60$) to the post-tests ($M = 92.38$, $SD = 8.00$), $t(7) = -4.06$, $p < .01$. Specific results are summarized in Figure 1, next page:
Following the social validity demonstration, most parents, teachers, and clinicians gave the program high ratings in terms of the quality of the program, the appropriateness of the targeted goals and the appropriateness of the program for teaching needed skills. Parents and teachers indicated a strong interest in purchasing the program and clinicians indicated an average interest (see Table 2).

Table 2: Social Validity Ratings* Following TeachTown Demonstration

<table>
<thead>
<tr>
<th></th>
<th>Parent</th>
<th>Teacher</th>
<th>Clinician</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you like the general aesthetic and look of the interface?</td>
<td>4.6</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>Do you think the program generated appropriate goals?</td>
<td>4.8</td>
<td>4.8</td>
<td>4.3</td>
</tr>
<tr>
<td>What is your overall impression of the software?</td>
<td>5.0</td>
<td>4.8</td>
<td>4.6</td>
</tr>
<tr>
<td>How appropriate is this type of program for your child?</td>
<td>4.8</td>
<td>4.6</td>
<td>3.5</td>
</tr>
<tr>
<td>Do you feel like the supplementary activities and computer program are a good package for treating symptoms of the child’s disorder?</td>
<td>4.5</td>
<td>4.6</td>
<td>5.0</td>
</tr>
<tr>
<td>How likely would you be to purchase this type of program for the child?</td>
<td>4.5</td>
<td>4.6</td>
<td>3.4</td>
</tr>
</tbody>
</table>

*Rating Scale: 1 = did not like at all; 5 = extremely enthusiastic

Method – Study 2

Participants

The participants in study 2 were the same four children with ASD who participated in Study 1 (See Table 1).

Design

A single subject, multiple baseline design across participants was implemented (Kazdin, 1973). Parent-child dyads were videotaped for 15-minutes during baseline, CAI, and generalization. Baseline
sessions were conducted once a week for one to five weeks. Data from the computer-assisted instruction were collected during the first treatment session, after one month of intervention, and after two months of intervention. Data from generalization sessions were collected on the same days as the CAI.

Setting and Materials
All session were conducted in the child’s home. Materials for parent-child play interactions were toys and activities that the family already owned and participants were not given any instructions for purchasing any special materials for this study.

Baseline
During baseline, parents were told to “play” with their child and no other instructions were given. Play materials were provided by the parents and varied depending on what activities the parents chose to do with their child. Following baseline, each family was given a copy of the TeachTown early learning software and a binder with printed supplementary activities. The supplementary activities included suggestions of play activities that parents could engage in to help generalize concepts targeted during the CAI.

Treatment
During treatment, each child was observed with their parent while receiving computer-assisted instruction using the TeachTown computer software.

Generalization
During generalization, parents were told to play with their child, as they were in baseline. Most parents chose to engage in some of the supplementary activities with their child. As in baseline play, materials were provided by the parents, and varied depending on what activities the parents chose to do with their child.

Dependent Measures
Each child’s inappropriate language (e.g. verbal self-stimulation, making comments out-of-context); spontaneous commenting (i.e. making comments to adult with purpose of sharing interest, not requesting or imitating); length of sentences; inappropriate behavior (e.g. avoidance of adult, self-stimulation, tantrums, and mild self-injury); positive affect (i.e. toward the adult in a social context); and looking toward the adult were coded via videotapes using interval recording.

More than 75% of tapes were coded by a trained rater blind to the purpose of this study and to the diagnosis of the child. The remaining 25% of sessions, as well as interobserver reliability, was coded by the primary investigator in this study.

Interobserver Reliability
Interobserver reliability was assessed for 33% of all sessions evenly across participants (autism and developmental disorders) and across session types (play and computer sessions). Kappa statistic was utilized to assess reliability. All kappa statistics were between 79% and 91%. The advantage of using this statistic is that chance agreement is removed.
Results – Study 2

Language

During baseline, 3 of the participants (Bailey, Cameron, and Damon) exhibited low rates of spontaneous commenting and high rates of inappropriate language, with Bailey making no comments at all. One participant (Aaron) used higher rates of spontaneous commenting and relatively low rates of inappropriate language.

During treatment sessions, Aaron exhibited an increase in his use of spontaneous commenting but made no changes in his use of inappropriate language. Bailey exhibited a small amount of spontaneous commenting during the second treatment session, but this did not extend to other treatment sessions. He also exhibited a substantial decrease in his inappropriate language during the treatment sessions. Cameron and Damon both exhibited substantial increases in their use of spontaneous commenting and concurrent decreases in their inappropriate language during treatment sessions.

During the generalization sessions, Cameron and Damon continued to exhibit higher rates of spontaneous commenting and lower rates of inappropriate language. Bailey and Aaron did not exhibit changes in their spontaneous commenting. Bailey’s decrease in inappropriate language extended to the first generalization session but not the second. Aaron had a slight increase in his inappropriate language during the first generalization session but not the second (See Figure 2).

FIGURE 2, NEXT PAGE
Overall, the children showed more spontaneous commenting and less inappropriate language in treatment sessions than during either baseline or generalization play sessions (See Figure 3). They used slightly more spontaneous commenting during generalization play sessions than in baseline play sessions. In addition, less inappropriate language was also observed in generalization compared to baseline play sessions. The children with autism also used more words per sentence during treatment (M=2.14, SE=.61) than baseline (M=1.41, SE=.73) or generalization sessions (M=1.83, SE=.81).
Figure 3: Average use of language, social, and inappropriate behaviors for children during baseline, treatment, and generalization in Study 2. Error bars represent standard error.

Social Behaviors

During baseline, Bailey, Cameron, and Damon had low rates of looking to the adult (i.e. parent or caregiver), with Aaron exhibiting a slightly higher rate. Bailey also exhibited low rates of positive affect, while the other boys exhibited moderate rates.

During treatment, Bailey, Cameron, and Damon’s rates of looking to the adult increased. Aaron exhibited a higher rate by the final treatment session. Bailey showed much more positive affect toward the adult while using the computer than during baseline (See Figure 4, below). Although Aaron exhibited a slight decrease in positive affect at the beginning of treatment, by the last treatment session he exhibited more positive affect than during baseline. Only a slight increase in positive affect in the treatment sessions was observed for Damon, and this increase continued a rising trend during baseline. No changes in positive affect were observed for Cameron during the treatment sessions. During the generalization sessions, none of the children maintained their positive changes in looking to the adult and only Bailey maintained a modest increase in his positive affect.

Overall, more looking and positive affect toward the adult were observed in children with autism, while on the computer than during play sessions (See Figure 3). No real differences between baseline and generalization play sessions were observed for these behaviors.

Inappropriate Behavior

During baseline, Bailey, Cameron, and Damon all exhibited high rates of inappropriate behavior. With treatment, these children all showed a decrease in their inappropriate behavior. These changes were not maintained during generalization sessions for Bailey, but Cameron and Damon showed much less inappropriate behavior in generalization sessions than in baseline (See Figure 5). Surprisingly, Aaron exhibited a small increase in inappropriate behavior during the first generalization session, but it returned to baseline levels by the final generalization session. Overall, the children exhibited fewer inappropriate behaviors after treatment was implemented than during baseline (See Figure 3).
Figure 4: Inappropriate behaviors during baseline, treatment, and generalization for children in Study 2. Closed data points indicate baseline and treatment sessions; open data points indicate generalization sessions.
Figure 5: Social behaviors during baseline, treatment, and generalization for children in Study 2. Closed data points indicate baseline and treatment sessions; open data points indicate generalization sessions.
This study demonstrated that children with autism and other developmental disorders were able to learn receptive language, social, and cognitive skills via CAI using the TeachTown software program. These data are consistent with previous studies indicating that CAI is effective for teaching receptive language skills (Moore & Calvert, 2000) and extends this research by demonstrating that CAI can be used to target additional social and cognitive skills in preschool-aged children with developmental disorders. Because the pre- and post-tests in the TeachTown program used different stimuli than the training lessons, our findings suggest that the children indeed learned generalized concepts, an issue that previous research has not adequately addressed. Given that there was no difference in performance between the children with autism and children with developmental delay in this study, CAI may be appropriate for children with developmental disabilities more broadly.

Parents, special education teachers, and clinicians who work with children with developmental disorders rated the program highly overall. They indicated that the TeachTown program identifies appropriate teaching goals for young children with developmental disorders and provides an effective way to teach these skills. In addition, parents and teachers reported strong interest in purchasing and using this program with their children with disabilities. These findings suggest that computer-assisted instruction using TeachTown software is perceived as an appropriate method of instruction by relevant consumers and is likely to be easily disseminated.

The concern that the use of computers may inhibit spontaneous language and social interaction in children with autism was not supported by this research. In fact, the children increased their use of spontaneous commenting, looks to the parent, and positive affect while on the computer and decreased their inappropriate language and behavior compared to baseline play sessions. This pattern of increased expressive language and social skills during CAI compared to play differs from typically developing preschoolers, who have been found to use similar levels of expressive language during computer activities as during other learning centers in a preschool environment (Kelly & Schorger, 2001). This finding may suggest that the skills targeted by the TeachTown software facilitate more language and social interaction than computer games designed for typically developing preschool-aged children. Alternatively, it may suggest that children with autism, unlike typically developing children, are more motivated during computer activities than play, thus making CAI a particularly effective strategy for teaching social communication. More research is needed on the collateral effects of using computers for this population including not only comparing computer time to play time as was done in this study, but comparing children with autism to typically developing children and children with other special needs and comparing software-implemented intervention to other teaching approaches (e.g. table top DTT).

The concern that children with autism would not generalize skills to non-computer-based activities was also not supported. In the generalization play sessions, half of the children increased their spontaneous commenting and decreased their inappropriate language and behavior. Social skills did not generalize to play settings with the parent, however. This finding is not surprising given the extreme social deficits seen in this population and the fact that no parent training was provided to help parents elicit social skills from their children. It is anticipated that providing parents with some type of social skill training in addition to the TeachTown software would result in improved social interactions between the parent and child. Future research is needed to address this issue.

While these findings are encouraging, it is unclear what role the CAI played in these improvements. One possibility is that the children used the skills they learned during CAI in the generalization sessions with the parents. If so, it would indicate that CAI can lead to changes in skills outside of the computer environment and that receptive language generalized to expressive use. This finding would be especially exciting given that research on the generalization from receptive learning to expressive language in teacher-implemented discrete trial training is encouraging, with many children
generalizing from receptive to expressive language (Wynn & Smith, 2003). However, since the use of specific language targets taught via CAI was not measured, it is premature to draw this conclusion. Future research examining this possibility will be particularly important when using computers for treatment as skills learned on the computer tend to be mostly receptive.

A second possibility is that the computer program may have increased pivotal skills such as motivation and attention, which lead to improvements in language and other behaviors outside of the computer task. Motivation and attention to multiple cues are thought to affect a wide variety of other skills or behaviors and are a key element of naturalistic ABA programs such as Pivotal Response Training (Koegel & Koegel, 2006). The TeachTown program emphasizes multiple cues throughout the software program and increased motivation was observed while using the program for all participants. Several other studies examining CAI for children with autism have also reported increased motivation and attention during computer tasks (Chen & Bernard-Opitz, 1993). More research is needed to determine whether or not the use of CAI teaches pivotal skills which lead to wide-ranging improvements in skills not necessarily targeted by the software.

A third possibility is that the changes in the children’s behavior during generalization sessions were due to the parents’ use of the supplementary activities rather than the CAI per se. Although this possibility would limit the interpretation of the generalization findings, it would suggest that the supplementary activities are an important and effective component of the intervention. Future research should examine the role of supplementary, play-based activities in combination with CAI on child outcome. It is also important to look at which treatment programs may work best with the TeachTown program including ABA, education, communication, and developmental treatment models.

Although this research has important implications for the research and treatment of children with autism and other developmental disorders, there were several limitations. First, although this study showed efficacy of the software for 8 children, only a small portion of the curriculum was assessed, limited time in the treatment program was provided, and only a small number of children participated. Future research should look at the efficacy of this program for a longer period of time, for more hours each week, and with more children using a clinical trial group design. Second, although some social-communication and behavior generalized from computer to play situations, it is not clear how much the content learned in the software generalized to the natural environment. It is also not clear how much receptive skills generalized to expressive skills. Research is currently underway looking at some of these issues. Third, it is unclear whether or not the software, the supplementary activities, or the combination of both was responsible for the positive changes observed. Studies comparing the 3 possible conditions would help to unravel which aspects of the program are most effective. Finally, this research did not look at a diverse group of children and so it not clear what prerequisites are necessary for using the TeachTown program. Age of the child, developmental level, diagnosis, behaviors, etc. may all contribute to the ability to use this program. Research is needed which looks at the child characteristics that may predict which types of children may be best suited for the TeachTown program.

In sum, computer-assisted instruction for children with developmental disorders looks to be a promising and effective option, especially for ABA treatment. TeachTown is the first program to provide a comprehensive ABA program using software and play-based (i.e. generalization) activities. The program was designed with the intent to increase the accessibility of treatment to parents, schools, and clinics and to reduce the cost associated with providing treatment. Future research will assess whether this and other CAI programs are able to successfully meet these goals. In addition, future studies are needed that will assess how this technology may be used for other age groups, other skills, other treatment approaches, and other populations. The use of computers has become so prevalent in homes, schools, clinics, and community settings and computers are able to offer so many possibilities, it is crucial that researchers continue to investigate the benefits and limitations of this promising treatment.
References


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