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Generalization in Computer-Assisted Intervention for Children with Autism Spectrum Disorders

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The education industry has a lot of weight on its shoulders. With the ever-increasing number of students attending each year and the dwindling amount of funding and qualified teachers, the education industry is constantly on the lookout for ways to educate all types of children as efficiently as possible. Many researchers are thus searching for the most effective and efficient method for educators to treat students with autism spectrum disorders (ASDs). One popular method is the inclusion of computer-assisted intervention (CAI). Researchers believe CAI is able to meet many of the vast challenges facing students with ASDs in their learning.

CAI uses computer software to supplement a student's education and treatment goals. Primarily, CAI is used in drill-and-practice or tutorial settings. The major benefit of CAI is its ability to generalize concepts being taught by teachers in classroom environments. Using CAI is not only beneficial to students with ASDs or other special needs; all children can benefit from the creation of an environment that optimizes learning. For example, consider the importance of learning vocabulary for healthy perceptual and cognitive development (LaSasso & Davey, 1987; Massaro, 2006b). One might think that only students with language disabilities require direct instruction in vocabulary, whereas typically developing students will acquire vocabulary on their own. However, the accepted theory is that all students benefit from vocabulary instruction (Beck, McKeown, & Kucan, 2002). Similarly, children who use computers early in life have shown better school readiness and cognition compared with children who do not have computer exposure in the preschool years (Li & Atkins, 2006). Other benefits that have been reported include increased language and improved social interactions (e.g., Haugland, 1999). Although these benefits hold true for typically developing children, the benefits for children with ASDs may be even greater.

Research on the use of CAI for children with ASDs is extremely promising. Children with autism do not tend to respond well to traditional teaching strategies (Schreibman, 1988), which is why approaches such as applied behavior analysis (ABA) are so frequently used with this population. However, due to the

high costs of this and other treatments, as well as a shortage of qualified staff to implement them, more and more teachers are choosing new treatment choices for their classroom to accommodate children with ASDs (e.g., Schilling & Schwartz, 2004).

Although there is no conclusive evidence for any effective treatment for ASDs, research supports ABA techniques (e.g., Lovaas, 1987; Koegel et al., 1989) as effective methods for teaching these children. However, these services are often extremely time consuming, expensive, difficult to implement and maintain over time, and difficult to obtain. Visual teaching strategies such as video modeling, social skill programs, cognitive-behavioral therapy, and psychotherapy are also often used to treat children with ASDs. CAI has also emerged as an effective and motivating method for teaching this population.

Studies have demonstrated that children with autism may learn more quickly with a computer than with traditional teaching strategies. Bosseler and Massaro (2003) developed and assessed a computer-animated tutor to teach vocabulary and grammar to eight children with autism. Their program included receptive and expressive language activities. They were successful in teaching language to all participants, and generalization to the children's natural environment was reported.

Computerized techniques were also used to teach social understanding to children with autism via computerized Social Stories (Bernard-Opitz, Sriram, & Nakhoda-Sapuan, 2001). Children with autism did better with computerized visual Social Stories than without. In another computer-based intervention (Hetzroni & Tannous, 2004), children with autism were taught communicative functions using a specially designed software program that targeted form, use, and content of language. Children were able to learn the material and transfer skills to a natural classroom environment. This research offers promise of software-based interventions for children with autism and suggests that information learned on the computer may generalize to the classroom environment.

A CAI program for students with autism shares many principles of other ideal learning environments designed for all individuals across a variety of academic settings. Two of these shared principles are time on task and spaced practice. Given limited human resources, such as the dearth of qualified teachers and supportive staff, only technology can provide the needed pedagogy at any time. CAI grants children the opportunity to work on much-needed skills when it is most convenient for them. With CAI, there are no waitlists or cancellations of treatment sessions. Other benefits of CAI include increased motivation for using the computer (e.g., Moore & Calvert, 2000) and potentially faster acquisition of skills than with other types of learning (e.g., Williams, Wright, Callaghan, & Coughlan, 2002). There is also growing evidence that skills learned on the computer may generalize to the natural environment (e.g., Bosseler & Massaro, 2003; Hetzroni & Tannous, 2004). Key components for successful programs include

- *Multiple exemplars*—Several different examples of concepts should be taught.

- *Variety in methods used to teach concepts*—Examples include receptive identification, matching, or sorting.

- *Nonrepetitive trials*—Repeating the same trial over and over again may result in memorized responding rather than a generalized response, which the child can use in different contexts.

- *Customization*—The user should be able to tailor the program to the child's individual needs.

In addition to choosing appropriate software, it is absolutely essential to work on the skills the child is learning on the computer in naturalistic or functional ways (i.e., off the computer). Some software programs offer suggestions for off-computer activities, but these may not be necessary if the child's team is able to come up with good activities that are specifically tailored to keep the child motivated. Off-computer activities may include play, chores, self-help tasks, and community skills.

Along with the potential benefits of using CAI for children with ASDs, there are some limitations to what it can provide. Some children with autism are known to have difficulty with generalization and may develop a therapy register, which is a response set that develops during learning sessions (Johnston, 1988). The child's responses are activated by characteristics of the learning sessions, and skills are not observed at expected levels away from the computer. Other limitations of CAI include the potential for children to get bored with programs that do not provide enough variety, frustration from children who think of the computer as a reward rather than a learning tool, obsessive or restricted interest in the computer or specific parts of a computer program, and the potential for not generalizing skills to the natural environment.

A variety of CAI programs are available in the market that target many of the skills needed to teach children with ASDs. The majority of the products in the market are not scientifically based and do not conduct quality research. Fortunately, however, some of these programs do focus on scientifically based instruction. Companies such as Fast ForWord and Laureate conduct ongoing research on the efficacy of their products. Two other companies, Animated Speech and TeachTown, have developed CAI programs that are based on scientifically validated treatment approaches. These programs are designed to address language, cognitive, and social impairments. The following sections will discuss these programs—TeachTown: Basics, TeachTown: Skill Builder, Team Up With Timo: Vocabulary (and Timo's Lesson Creator), and Team Up With Timo: Stories—in terms of their attention to generalization in their product development, research, and future directions.

TEACHTOWN

TeachTown is a company dedicated to software development and clinical research. The company creates research-based software programs designed specifically for children with ASDs. Each of TeachTown's products use the scientific principles of ABA (i.e., applying the scientific principles of behavior analysis to issues that are socially important), developmental psychology, speech therapy, and special education to teach and generalize concepts.
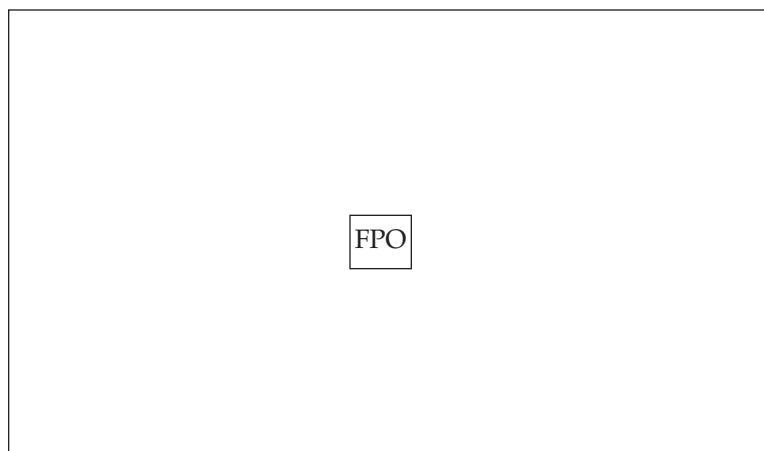
Figure 6.1.   Features of TeachTown software.

Children with ASDs commonly have trouble generalizing concepts and adapting the knowledge they have acquired to unfamiliar situations. To address this issue and increase generalization of the presented material, TeachTown's products are divided into two parts: on-computer lessons and off-computer activities (see Figure 6.1).

TeachTown: Basics, the company's first product, contains more than 500 on-computer lessons. The program was designed for children who are functioning in the 2- to 7-year developmental range and teaches language, social skills, academic/cognitive skills, play/imitation, motor skills, and life skills. Lessons within the program use discrete trial and ABA principles to teach everything from food and animal identification to early phonics and fractions.

On-Computer Lessons

A child's interaction with TeachTown: Basics during an on-computer session resembles the following example. The student's interface depicts a town scene, from which the student can choose which module he or she would like to study by selecting from one of five buildings (see Figure 6.2). Research has demonstrated that this child-choice technique keeps motivation high (Koegel, O'Dell, & Koegel, 1987). Although the student can select which module he or she would like to study, the software determines the list of modules that are available based on the current developmental needs of the student.

After selecting a module, the student begins a lesson. Depending on the student's previous history with this lesson, the lesson may be a pretest, a learning exercise, or a posttest. One fifth of the trials presented to the child will consist of maintenance tasks, during which material from previous modules that the student has already mastered are presented. Maintenance tasks help the student preserve previously learned skills and assist in keeping the student's motivation high (Koegel et al., 1989).

Reinforcement is presented intermittently throughout the trials. For testing purposes, the reinforcement is not contingent on the student responding correctly to the prompts. In a learning exercise, however, the reinforcement is dependent on

Figure 6.2.   The town (child's home page) in TeachTown: Basics.

a correct answer and will occur every three to five correct responses. Such reinforcement has been proven to be the most effective schedule for keeping responding high during a task (Neef & Lutz, 2001). When the child has earned a reward, TeachTown: Basics again uses child choice and lets the student choose which reward he or she will receive. Once the child has completed all trials for the lesson, the program returns to the town map where the student chooses another module. The process repeats until the learning session has expired.

Generalization in the on-computer lessons primarily occurs in the use of a variety of methods to teach targeted material. Lessons in the program take the form of one of three types: 1) receptive identification (e.g., "Can you find the blue bird?"), 2) matching (e.g., "Which face is the same?"), or 3) location identification (e.g., "Which way are the eyes looking?"). With these options available for lesson design, TeachTown: Basics is able to use different types of lessons to teach the same material. For example, when teaching early reading skills, the program introduces upper- and lowercase letters in receptive identification (i.e., comprehension) tasks and then asks the child to match an uppercase letter to its lowercase partner.

TeachTown varies the program's discriminative stimuli and exemplars during the discrete trials to help generalization. For example, one trial may ask, "Which one is an apple?" followed by the next trial asking "Do you see an apple?" The same lesson would also contain multiple photographs, drawn images, and animations of apples. Use of multiple exemplars is extremely important for improving generalization, as has been demonstrated in many research studies (e.g. Jahr, 2001; Reeve, Reeve, Townsend, & Poulson, 2007). This variety ensures that children are not memorizing labels for individual images or cues but rather are learning the entire concept of the material being presented. Over time, the child will learn to cue in to the relevant information in a sentence or image and not focus on its specific structure. In fact, the program includes more than 15,000 sounds and images.

Furthermore, the exemplars and discriminative stimuli used in the testing portions of a lesson are different than the set of assets used in the learning-and-teaching portion. In other words, the images and cues that are used to teach the child the material are completely different from the images and cues used to test

if the child learned what was taught. This process ensures that the child has learned the concepts and not simply memorized the images he or she learned during training in the lessons.

During a lesson, the child is also challenged to work on more than one concept at a time. For example, in the lesson Body Functions, the child is taught to receptively identify which body part is used for a particular function. In this lesson, the child simultaneously learns to identify eyes for seeing and ears for hearing. In other words, on one trial, the child may be asked "Which one do you use for seeing?" while the next trial may ask "Do you know which one we use for hearing?" This helps train the child to easily shift his or her attentions from one target to another.

Once released, TeachTown's next product will target children with autism with a developmental age of 6–11 years. Tentatively called TeachTown: Skill Builder, the new product will follow the same methodologies as TeachTown: Basics. Specifically, the design of TeachTown: Skill Builder includes discriminative stimuli (i.e., instructions to the child), discrete trials (i.e., breaks skills down to basic components and rewards correct responses), intermittent schedules of reinforcement (i.e., the child gets a reward periodically for correct responding), contingent reinforcement (i.e., the child must get the trial correct or is prompted to get access to rewards), child choice, interspersed maintenance tasks (i.e., tasks the child has previously mastered), and multiple exemplars (i.e., several different examples).

Off-Computer Activities

In correlation to the on-computer lessons, the off-computer activities in TeachTown: Basics are designed specifically to generalize concepts. Every off-computer activity shares a learning subject with an on-computer lesson. The goal behind the activities is to further generalize what the child is learning on the software by bringing in real-world examples and applications. In addition, the activities improve skills that are not taught in the software program, including expressive language, social interaction, self-help skills, imitation, play, and motor skills.

The off-computer activities are based on naturalistic teaching approaches. They consist of a list of materials that should be readily available and a set of easy-to-follow instructions. An adult can use these instructions as a guide on how to teach the targeted concepts and interact with the child in an engaging and productive manner. The activities can be either viewed within the software or printed for later use.

Research Supporting TeachTown

Using the off-computer activities in conjunction with the software program is likely to result in the most successful use of the TeachTown: Basics program. However, some evidence suggests that using either of these elements alone may result in some success as well. In fact, as part of a U.S. Department of Education Small Business Innovation Research grant, TeachTown performed two studies examining the efficacy of the computer-assisted intervention for four preschool and kindergarten children with ASDs and four children with Down syndrome (Whalen, Liden, Ingersoll, Dallaire, & Liden, 2006). In the first study, parents, clinicians, and researchers were given a questionnaire that asked about their current therapy and their opinion of CAI for children with ASDs. Following the questionnaire, a TeachTown representative gave an extensive demonstration on a CAI

program prototype. The participants were allowed to use the software if they were inclined under supervision. After being shown the software, participants were asked to fill out a longer questionnaire that polled their opinion about the interfaces, the modules, and other aspects of the software.

The data suggested that the perceived effectiveness of a software-based intervention for 3- to 6-year-old children increases after subjects have been shown how such an intervention might work. All participants felt that children would benefit from this type of software and from the parent–child supplementary activities. Teachers gave the highest ratings overall and felt that there was a great need for such a program in the schools. The information from this first study was used for the development of the TeachTown: Basics product.

In the second study, children were asked to use a prototype of TeachTown: Basics software and the off-computer activities for 2 months. Prior to using the program, the participating children were observed and videotaped in an interaction with a parent or other close adult. Communication, play, imitation, social skills, and challenging behaviors were coded by a trained research assistant, who was blinded to the purpose of the study.

Following pretreatment measures, each family was given a pilot version of the early intervention software and was asked to have their child play the game 3 days per week for a minimum of 15 minutes. Participating families were also asked to do the off-computer activities for an equal amount of time. The data from this study demonstrated early effectiveness of the TeachTown: Basics program for children with ASDs and Down syndrome. In addition, the research showed that for the four children with ASDs, dramatic increases in language and socialization occurred while using the software program compared with play interactions with their parents.

In addition to these early studies, TeachTown has upheld its dedication to clinical research with several other studies regarding TeachTown: Basics. In one study, 20 children with ASDs were observed using the TeachTown: Basics software to assess if the reinforcers (i.e., reward games) in the program were indeed reinforcing (Whalen & Cernich, in progress). In other words, did the rewards increase the child's attention and motivation to the computer? The data showed that children attended significantly more when the rewards were present versus when the lessons were present (see Figure 6.3). In addition, the children's overall attention was
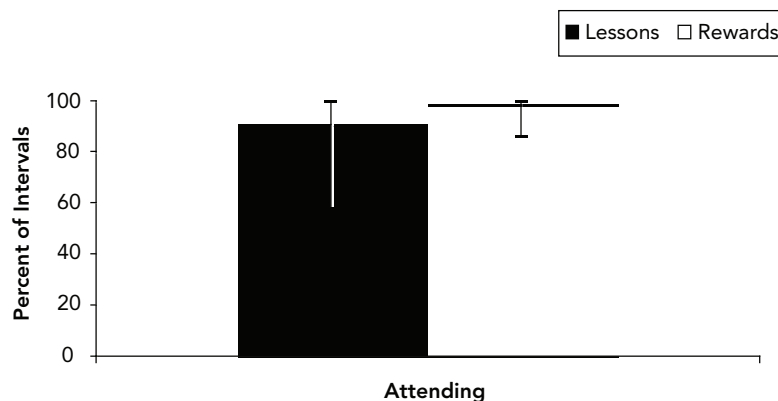
Figure 6.3.   Children ($n = 10$) attended significantly more ($p < 0.05$) when the rewards were present than when the lessons were present. Overall, attendance to the computer was high in both conditions.
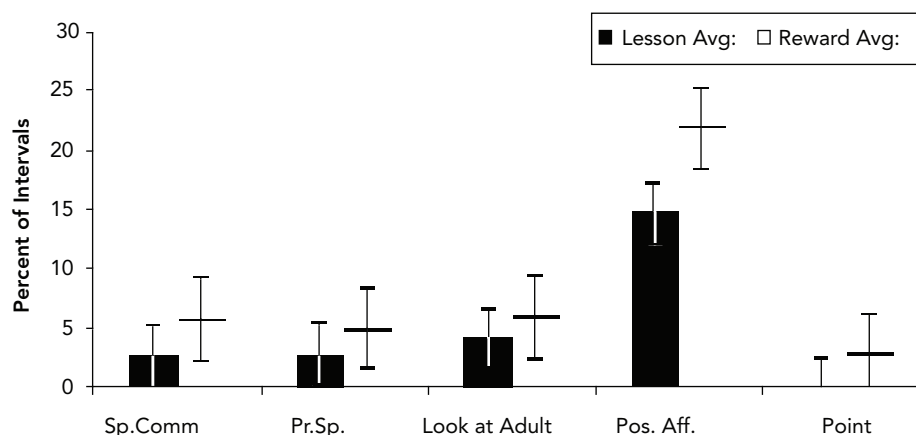
Figure 6.4.   Children (*n* = 10) demonstrated more spontaneous commenting, prompted speech, looking at the adult, positive affect, and pointing during the reward conditions than during the lessons.

high when using the program, despite a lesson or reward being present. Disruptive behaviors, such as walking away or noncompliance, occurred less during the rewards than during the lessons. Increased spontaneous commenting, prompted speech, looking at the adult, positive affect, and pointing were also observed during the reward games for the children who had an adult sitting with them at the computer (see Figure 6.4). Ten children were also observed in a structured teaching session with school staff; it was demonstrated that the reinforcers used in the software program were more effective than those used in structured teaching sessions.

San Diego Children's Hospital recently implemented a clinical examination of generalization using TeachTown: Basics (Stahmer & Geddes, in progress). Two children with autism who were included in a typical preschool participated in this study. Both children had strong vocabularies, as measured by the Receptive One-Word Picture Vocabulary Test (Brownell, 2000), scoring in the low average range. In addition, they had developmental skills in the typical range as well. The children used the on-computer and off-computer tasks in TeachTown: Basics to learn new receptive labels. Using the TeachTown: Basics software, specific receptive labels that the children had not mastered were chosen: birds (e.g., pigeon, toucan, owl, pelican) for one child and bugs (e.g., ladybug, caterpillar, fly, cockroach) for the other. A pretest was conducted using built-in assessments in the TeachTown: Basics software. In addition, generalization to new pictures not used in the software was assessed by having the children identify four different examples of each target word, which was accomplished by placing pictures in groups of four on a table and asking the child to, for example, "Hand me the pelican." For each of the children, pretests had to indicate a correct rate of less than 60% for each label, both on the computer and off the computer, in order to use those labels for training.

All labels were taught using the TeachTown: Basics computer program during two 30-minute sessions per week until, according to the computer assessment, the child mastered the labels. Two of the labels from each group were also taught using off-computer tasks recommended in the TeachTown: Basics program during two 30-minute sessions per week. Once the labels were mastered on the computer,
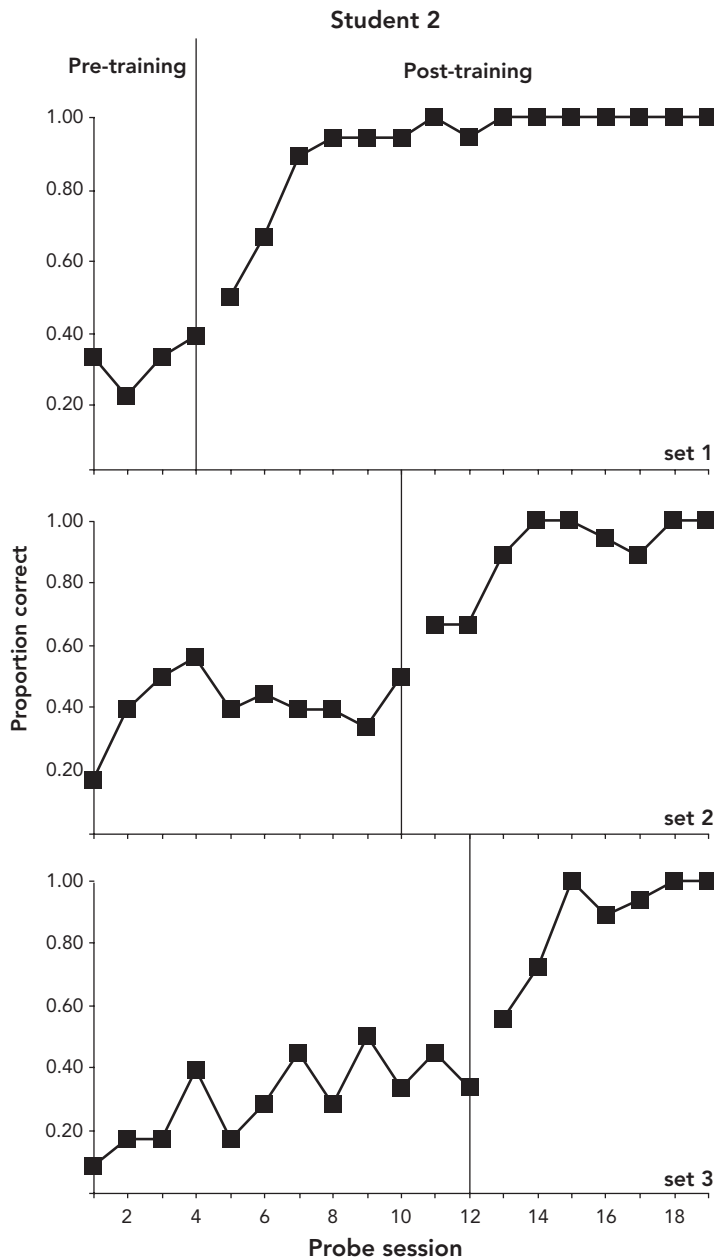
Figure 6.5.   Mean proportion correct during pretraining and posttraining probes for each of the three-word sets for one of the six students. The vertical lines separate the pretraining and posttraining. Once training was implemented, identification performance increased dramatically.

generalization was once again assessed using the novel pictures. It was hypothesized that for those labels in which off-computer activities were used, generalization would be increased and that time to mastery would be shorter.

The data, however, showed no differences between the time it took to master a lesson on the computer versus additional time spent off the computer (see Figure 6.5). In addition, the children were able to successfully identify the novel
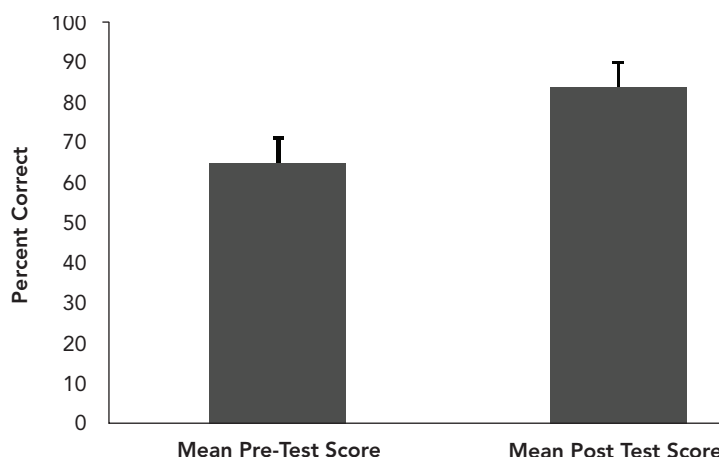
Figure 6.6.   Figure legend missing.

pictures with more than 80% accuracy in all cases. Although these data are only for two children and must be considered preliminary, it appears that for children with high-functioning autism, TeachTown: Basics may be used to increase vocabulary. It also appears that the children will generalize to new pictures using the computer activities alone. Anecdotal data from teachers further indicated that the children were able to identify the new labels correctly when the items were used in play and during classroom activities such as circle time.

Most recently, TeachTown has compiled the data from all of the students currently using TeachTown: Basics (Whalen, Liden, MacDonald, Thomas, & Lockhart, in progress). The purpose of this analysis was to determine how well TeachTown: Basics achieved its goals of helping this population learn and master new information. The TeachTown database consisted of 851 students who have been using TeachTown: Basics, ranging in age from 3 to 22 years old. Using a crossed random effects model, 11,208 instances of pretests and posttests were analyzed, with a mean pretest score of 65% and mean posttest score of 84% (see Figure 6.6.). The 18.5% improvement was significant ($t = 35.27$, $p < 0.0001$). Significant changes from pretest to posttest scores in the software were shown in all four learning domains (Receptive Language, Academic-Cognitive, Social Skills, and Life Skills), with Social Skills taking the highest number of trials, on average, to reach mastery. Both sexes performed equally well on the software; younger children showed more improvement, but improvement was demonstrated for all ages. Because this data was collected automatically through the TeachTown: Basics program, only anecdotal information on the generalization of skills learned in the program for these children is available. In follow-up research, standardized measures will be implemented in a clinical trial, along with data on generalization.

Possible Limitations

In addition to the encouraging data these research studies have provided for TeachTown: Basics, limitations and attributes within the program that may affect generalization have been discovered. For example, the two-dimensional stimuli

used in the on-computer lessons may or may not generalize to the child's natural environment. The basis of this theory is that, because the stimuli exist only in the limited space of a computer monitor, the learning encounter cannot be shaped by proximity or touch and is very different from encountering these stimuli in the natural environment. Another limitation of TeachTown: Basics is that all of the voices in the software are the same voice. This could limit the child's ability to respond to instructions in other voices. In addition, the software does not include all concepts and skills that children should learn in this age group. While TeachTown: Basics is a useful tool, other learning approaches must also be used for the child to reach full potential.

To increase generalization when using TeachTown: Basics, it is suggested that the off-computer activities included in the software be used just as often, if not more often, than the on-computer lessons for teaching children. If the off-computer activities are not appropriate for a particular child, it is suggested that the child's team adapt the off-computer activities to fit the child's needs. It is crucial that this be done for all concepts, especially those where the child may be experiencing difficulty. In addition, it is important to realize where there are holes in the curriculum and to spend time teaching the concepts that are not included. For example, TeachTown: Basics does not yet have a lesson for sequencing or sorting, which is an important skill for this age group. This type of lesson will be included in TeachTown: Skill Builder; however, until then it should be addressed independently of the program.

Generalization can also be enhanced by sitting with the child while he or she is using the software and working on expressive language skills, social interaction, and expanding what the child is learning. Using the expert-mode feature of the software may also allow opportunities for increasing generalization by choosing lessons that teach the same idea or concept but in different ways. For instance, there are lessons to teach letters and sounds through receptive identification and matching lessons. A reward can also be chosen for the child to have more exposure to letters. Although some research suggests that at least some generalization may occur without off-computer activities, incorporating these suggestions with regular use of the software is much more likely to result in overall success than using the software alone. See Appendix 6.1 for activities designed to supplement material that the child learns while using the TeachTown: Basics.

ANIMATED SPEECH CORPORATION

Animated Speech Corporation develops educational software to improve the quality of life of children who are developmentally at prekindergarten through Grade 4. To achieve this goal, the company uses Timo (see Figure 6.7), a powerful animated tutor that is derived from 20 years of government-funded research. The Team Up With Timo product line consists of three products: Team Up With Timo: Vocabulary, Timo's Lesson Creator, and Team Up With Timo: Stories (see Figure 6.8). Each of these products provides CAI for language acquisition skills and uses different methods to attain generalization.

Use of Timo, the animated tutor, in the Team Up With Timo products dramatically increases the rate of learning speech, reading, and other language skills. Research has shown that these programs increase vocabulary for children with

FPO

Figure 6.7.   Timo, the three-dimensional tutor who interacts with students and calls them by name.

FPO

Figure 6.8.   Timo products.

autism (Bosseler & Massaro, 2003), English language learners (Massaro & Light, 2003), children with speech and language impairments, deaf students (Massaro & Light, 2004b), those with reading delays (Swanson, Fey, Mills, & Hood, 2005), and typically developing learners acquiring language and literacy skills. Baldi, Timo's hairless predecessor, was proven highly effective in numerous peer-reviewed studies (e.g., Massaro, Cohen, Tabain, Beskow, & Clark, 2005; Massaro & Light, 2004b).

For generalization to occur, it is critical to consider the learning environment. The learning environment for generalization is important for all children, but especially for children with autism. Because of challenging behaviors such as lack of cooperation and motivation observed in some children with autism, a motivating environment is essential for developing language skills. The Team Up With Timo products use Timo to create such an environment.

Timo is interactive, friendly, and patient and can work at the child's pace. He greets the child by name and provides feedback and reinforcement. There are numerous anecdotal reports that students enjoy working with Timo and appear to
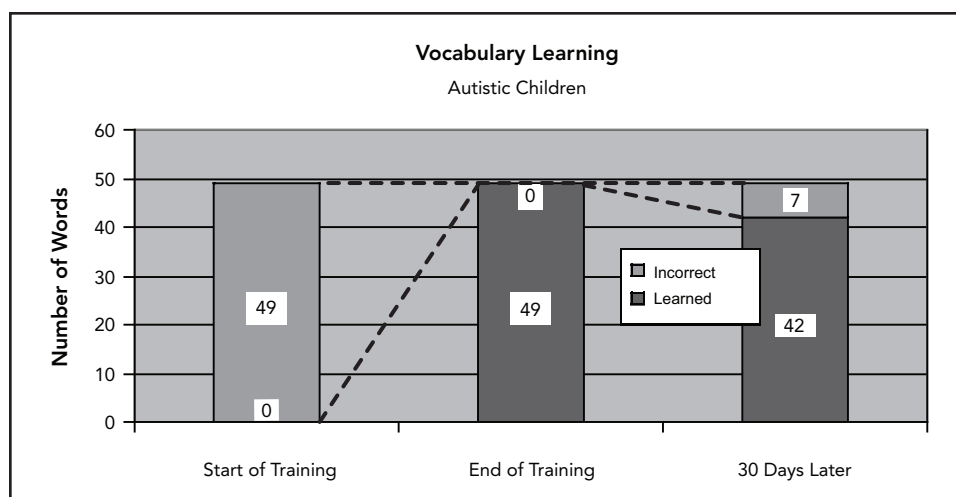
Vocabulary Learning

Autistic Children

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develop a relationship with him. Children have been heard to exclaim, "I want to work with Timo today" and "I love Timo." Because children are working with a tutor in the Timo programs, they are working with a face. Research has shown that some children with autism learn vocabulary and grammatical forms faster and show better retention working with a face than without a face (Massaro & Bosseler, 2006). Working with a face or a tutor also offers the child auditory and visual information. Using these two sources of information more closely replicates learning in the natural environment and is more informative than either alone.

Team Up With Timo: Vocabulary

Team Up With Timo: Vocabulary focuses on teaching both receptive and expressive vocabulary. The program includes a curriculum of 127 vocabulary-building lessons covering more than 650 words and images drawn from kindergarten through fourth-grade curricula. Timo's prompts, praise, and feedback teach children vocabulary words by identifying a picture, speaking, reading, or spelling. One of the core principles of Vocabulary is having multiple sources of information to teach vocabulary and increase perception, recognition, learning, and retention. By presenting the material in a variety of ways, Vocabulary increases generalization and decreases simple memorization. As in the previous implementations and tests of our pedagogy (Massaro, 2006b), in Vocabulary, students

1. Observe the words being spoken by a realistic talking interlocutor

2. Experience the word as spoken and written

3. See visual images of referents of the words

4. Click on or point to the referent or its spelling

5. Hear themselves say the word, followed by a correct pronunciation

6. Spell the word by typing

7. Observe and respond to the word used in context

Although half of the exercises involve multiple-choice testing, there is evidence that this experience boosts performance on later tests with other formats (Marsh, Roediger, Bjork, & Bjork, 2007). The other half of the tests involve either spoken or written generation of the students' answers, which facilitates learning (Metcalfe & Kornell, 2007). The test exercises can be viewed as learning exercises because testing has been demonstrated to increase learning and retention (McDaniel, Roediger, & McDermott, 2007).

Another feature of Vocabulary is that the tutoring can be individualized for each student. A profile is created for each student to specify which exercise should be included, the reward selection, and whether or not captioning should be on—an important concern for students with ASDs, deaf students, and hard-of-hearing students. This customizability allows the user to generate endless examples of concepts, change how the information is presented, and change what Timo says—all of which increase generalization possibilities.

Timo's Lesson Creator

Partnering with Vocabulary is Timo's Lesson Creator. Lesson Creator allows teachers or parents to produce completely new lessons for Vocabulary in minutes. Because vocabulary is essentially infinite in number, it is difficult to anticipate all of the vocabulary that a student will need. Teachers, parents, and even students can build original lessons that meet unique and specialized conditions. Users can incorporate new words illustrated by images from the Internet, digital cameras, or from 3,500 supplied Mayer-Johnson Boardmaker pictures. The result is highly customized and personalized lessons on any topic that can be shared with any Vocabulary user.

Lesson Creator provides a realistic learning situation that should generalize effectively to the real world. Multiple prompts and feedback can be used, which are selected randomly during the learning session. In addition to using custom images, Lesson Creator allows users to further increase generalization by customizing anything Timo says. For example, if a teacher is composing vocabulary lessons, he or she can set up the greeting and instructions, the questions, and the feedback for one set of words to give an appropriate framework for the learning. Perhaps one of the most efficient features of Lesson Creator is that new lessons can be created easily as modifications of existing lessons. Once this is in place, a teacher can simply insert new vocabulary content into the same framework to make additional lessons.

One of the biggest benefits of Lesson Creator is to use the program to generalize material students are learning elsewhere. For example, if a teacher is taking the class on a field trip to the local aquarium, he or she is able to create lessons about the marine animals ahead of time. This way, the children will become familiar with the animals and then experience them in a real-world situation. Lesson Creator can also be used at home, where a parent can prepare lessons with words in the child's current reading and names of relatives, schoolmates, and teachers. Lessons can also be easily created for the child's current interests.

Team Up With Timo: Stories

Animated Speech Corporation's third product, Team Up With Timo: Stories, teaches children by having them read a story along with Timo. Timo asks questions

for comprehension of content and concepts by engaging the student in story-based activities ranging from putting story events in sequence to simple problem solving. The broad goal of Stories is to improve expressive and receptive language skills and vocabulary through the process of retelling stories. Generalization is crucial because narrative skills lay the foundation for social and academic success. In Stories, six stories and correlated activities give children the opportunity to practice a range of skills including story comprehension, narrative skills such as retelling stories, speech-language skills, social thinking, and conversational modeling. For beginning readers, the pictures in each story closely match the action in the text to help the child understand the story.

Research has shown that being able to retell a story at age 4 years is predictive of later success in school. Storytelling also helps children participate in daily life with friends, family, and school. For these reasons, Stories follows the narrative-based language intervention approach of combining storytelling with skill-based activities. Children with ASDs and other communication disorders often cannot understand a story, speak in sentences, or organize information to retell others. Stories may help provide the communication skills that these children need.

When building language skills that generalize to other environments, Stories uses a few key ingredients to increase success. For example, an emphasis on engaging activities with multiple opportunities for mixed receptive and expressive tasks is necessary. Stories introduces 10 vocabulary words in each story. These vocabulary words are then practiced in six different language games that require differing levels of language processing of increasing complexity. The new vocabulary words are intermixed with words the child has already learned. To provide the expressive tasks in Stories, an adult can work with the child at the computer. During the story sequencing activity, the child tells the story to an adult while looking at the pictures and then retells the story when the pictures are turned over. In addition, to improve generalization, it is important to combine CAI with related activities in other settings. Stories has a list of extension activities for each story to be done away from the computer, such as reenacting the stories with toys and telling the story to an adult who is unfamiliar with the story. Strong reinforcement is also necessary, as well as visual support. For each game in the program, there is a visual reinforcement schedule that shows children how many trials they need to complete and a chart where children can see their progress; they also receive an animated sticker or puzzle piece for each correct response.

With Stories, generalization can be maximized for improved listening comprehension, vocabulary, and retelling skills by matching the child's background knowledge. This enables the child to expand on knowledge he or she already has and frees the child's processing resources to learn and practice linguistic forms and devote energy to retelling the story.

All of the stories use elaborated language. This means that all of the information presented is explicit and redundant. Writing the stories this way serves as a processing aid. Elaborated language reduces the need for inferencing and makes it easier for the child to understand the story. When the job of processing narrative discourse is made manageable for the child, he or she is more likely to learn and use skills away from the computer.

Frequency of opportunities to tell and share stories with others is also important. Stories provides explicit instructions so that adults can support storytelling and retelling throughout the day by scaffolding opportunities to recount daily

events and/or to retell the story from a lesson. This approach offers the child a blend of direct instruction and naturalistic teaching.

Research Supporting the Timo Programs

Stories and the other Timo programs are based on research and technology developed by Dr. Don Massaro. Massaro developed Baldi, Timo's bald-headed predecessor, primarily to research the value of visible speech in face-to-face communication (Massaro, 1998). Baldi provided realistic visible speech that was almost as accurate as a natural speaker (see http://mambo.ucsc.edu/psl/international.html). The tutor can be animated in real time and is able to say anything at any time in interactive applications (Massaro, 2004; Massaro, Ouni, Cohen, & Clark, 2005). One of the first applications of Baldi as an animated tutor was implemented for deaf and hard-of-hearing students at the Tucker-Maxon School of Oral Education. The school used Baldi in a variety of school exercises in mathematics, history, science, and social studies (Massaro, Cohen, & Beskow, 1999). Eventually, a lesson creator and tutor were developed for vocabulary learning, which evolved into Team Up With Timo: Vocabulary and Timo's Lesson Creator.

When Baldi was being developed, a great deal of research was completed to best understand the benefits of using a computer-animated tutor. Computer-animated tutors have the potential to provide students with autism with an effective learning environment because they can produce accurate visible speech, facilitate face-to-face oral communication, and serve people with language challenges. These embodied conversational characters can function effectively as language tutors, reading tutors, or science tutors. Animated tutors provide value because our perception and understanding are influenced by a speaker's face and accompanying gestures, as well as the actual sound of the speech (Massaro, 1998). Although the auditory signal alone is often adequate for communication, visual information from movements of the lips, tongue, and jaws enhance intelligibility of the acoustic stimulus (particularly in noisy environments that exist in many learning situations). Moreover, speech is enriched by the facial expressions, emotions, and gestures produced by a speaker. With these conclusions in mind, computer-animated tutors, such as Baldi and Timo, may have a significant benefit to learning.

Some individuals have raised concerns about whether an animated tutor's two-dimensionality hampers a child's learning process. Limiting the student's experience to the two-dimensional world of computer monitors may constrain learning relative to a live teacher. When addressing this concern, it is important to know if the visible speech from a three-dimensional face projected onto a two-dimensional surface is as informative as a live person seen in three dimensions. Surprisingly, research shows that there does not seem to be a direct comparison of these two conditions. In their study, Sumby and Pollack (1954) used a live talker, whereas Jesse, Vrignaud, and Massaro (2000–2001) used a video recording of the talker. The benefit that the participants received from visible speech appears to be roughly equivalent in the two cases. Finding conditions that matched as much as possible, the accuracy improved from about 30% with just auditory speech to about 58% when the three-dimensional visible speech was also present. This 28% improvement compares favorably with the 27% improvement using the

two-dimensional presentation. Thus, it appears that the benefit of a visible tutor exists for two-dimensional viewing as well as well as for a live presentation.

The success of two-dimensional media such as the television and the Internet, however, is real-world experimental proof of the sufficiency of two dimensions for learning. Furthermore, the use of video-based sign language interpreting in the classroom does not seem to present more of a challenge for deaf students than live classroom presentations (Marschark et al., 2005). Thus, tutoring on two-dimensional surfaces appears to be as effective as live tutoring.

Researchers also studied the effectiveness of Baldi with children with special needs. For this study, researchers created 84 unique lessons with vocabulary items selected from the curriculum of two schools (Bosseler & Massaro, 2003). Eight children diagnosed with autism, 7–11 years of age, participated in the study. The results indicated that the children learned many new words, grammatical constructions, and concepts. In addition, a delayed test given more than 30 days after the learning sessions took place showed that the children retained more than 85% of the words that they had learned. This learning and retention of new vocabulary, grammar, and language use is a significant accomplishment for children with ASDs.

Although all children in this study demonstrated learning from initial assessment to final reassessment, it is possible that the children were learning the words outside of the program. For example, the students may have been learning words from speech therapists or in their school curriculum. Furthermore, it is important to know whether the vocabulary knowledge would generalize to new pictorial instances of the words. To address these questions, a second investigation was completed. Once a student achieved 100% correct, generalization tests and training were carried out with novel images. The placement of the images relative to one another was also random in each lesson. Assessment and training continued until the student was able to accurately identify at least five out of six vocabulary items across four unique sets of images.

Although performance varied dramatically across the children and across the word sets during the pretraining sessions, training was effective for all words sets for all children. Figure 6.9 displays the proportion of correct responses for one of
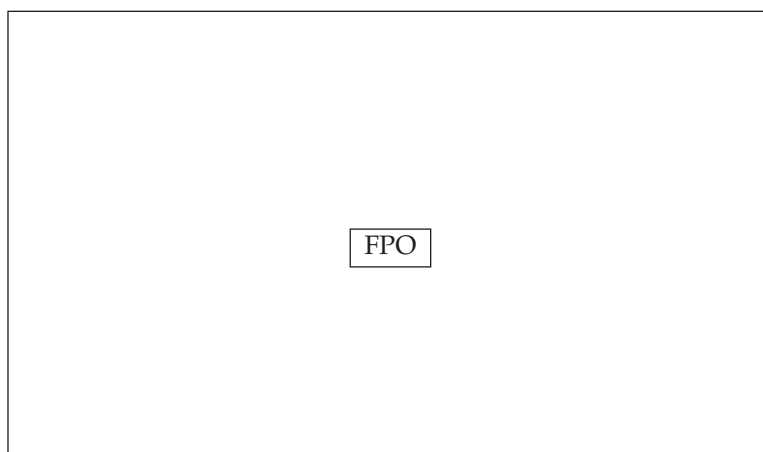
FPO

Figure 6.9. TK

the students during the test sessions conducted at pretraining and posttraining for each of the three word sets. The vertical lines in each of the three panels indicate the last pretraining session before the onset of training for that word set. Some of the words were known prior to training and were even learned to some degree without training. Given training, however, all of the students attained our criterion for identification accuracy for each word set and were also able to generalize accurate identification to four instances of untrained images. The students identified significantly more words following implementation of training compared with pretraining performance, showing that the program was responsible for learning. Learning also generalized to new images in random locations and to interactions outside of the lesson environment. These results show that the learning program is effective for children with ASDs, as it was for children with hearing loss.

In another study, Massaro (2006a) evaluated Team Up With Timo: Vocabulary for teaching vocabulary to English language learners. This experiment was particularly significant because it was the first research study that used Timo as the animated tutor rather than Baldi. Children whose native language is Spanish were tutored and tested on English words they previously did not know. Using a multiple-baseline design, the children learned the words when they were tutored but not words that were simply tested. This result replicates the previous studies with children with autism and hard-of-hearing children that used Baldi as the animated conversational tutor. Other experiments have demonstrated that Baldi's unique characteristics allow a novel approach to training speech production to both children with hearing loss (Massaro & Light, 2004a) and adults learning a new language (Massaro & Light, 2003).

Possible Limitations

Although research suggests that Timo and Baldi are quite effective at teaching, several factors may limit the efficacy of learning. One potential limitation is that the visual input the student receives is necessarily on a two-dimensional screen rather than existing as an actual a three-dimensional person. Important pedagogical characteristics of a three-dimensional world might not be adequately represented in just two dimensions. A second possible limitation is that the lessons use synthetic speech and facial animation. Although these properties make our tutoring agent capable of saying anything at any time, they might compromise the instructional dialogue in the tutoring situation.

To better understand the effectiveness of the programs, more research is needed. Although research has examined the effectiveness of CAI for receptive language with regard to children with autism (Moore & Calvert, 2000), Team Up With Timo: Stories also seeks to do more. One of the goals with Stories is to study how effectively it can help a broader population of children to develop expressive language skills. In addition, more research is needed to study the efficiency of CAI with increasing a variety of language in adults and increasing narrative skills in typically developing children, at-risk children, and children with speech and/or language disabilities (Harkins, Koch, & Michel, 1994; Whitehurst et al., 1988; Yoder, Spruytenburg, Edwards, & Davies, 1995; Zevenbergen & Wilson, 1996). Currently, only studies involving interactive picture books have been conducted.

Along with additional research, improvements can be made to increase generalization in the Team Up With Timo products. One enhancement for Team Up With Timo: Vocabulary could be for the program to ask the child to use both the

receptive and expressive language features of the software (i.e., have the child say the words, not just learn them receptively). In addition, working on vocabulary words outside of computer sessions will significantly enhance generalization. Currently, Timo's Lesson Creator can be used to increase the number of examples for each concept. The program allows the user to import as many images as he or she can find. To maximize generalization, it is suggested that a variety of drawing and photographs be used and that the customizable instructions offered by Timo vary throughout the trials. This will help the child to learn to respond to instructions in different ways.

SUMMARY

The use of computers to teach children with ASDs is growing in popularity and in necessity due to the increasing prevalence of the disorder and the expanding need for more accessible and affordable options for education and treatment. With the development tools that TeachTown and Animated Speech have created, new learning modules and features for existing products will be built with only modest development time and cost. Future products will address the needs of the ASD community, including products for all ages and programs and features to help parents, teachers, and service providers.

Despite the exciting advancements that have been made available in recent years, research is still needed to determine the efficacy of CAI, especially in terms of generalization. To date, most research has only looked at generalization in adult-presented tasks, which might be similar to the tasks on the computer. It will be important for researchers to set up generalization probes in unusual and less-structured situations to measure how well the child's skills generalize to the natural environment. Most studies have looked at generalization of language skills, but it is imperative that generalization of other skills also be studied, especially social skills. It is obvious that future research needs to study the effectiveness of CAI, but without generalization, it is questionable if the child has made any progress at all. Consequently, researchers must take a closer look at generalization of CAI; developers must also carefully consider how their programs address generalization issues and what tips they can provide to consumers to maximize generalization.

In sum, CAI promises to deliver more education and treatment options, effectiveness, increased accessibility, improved data collection, cost savings, greater motivation for the child, and—based on the research to date—at least some generalization off the computer.

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Chapter 6
Appendix

Appendix 6.1. TeachTown Generalization Activities

APPENDIX 6.1.

TeachTown Generalization Activities

The following are just a few of the activities designed to supplement material that the child learns while using the TeachTown: Basics computer program (http://www.teachtown.com). The activities are deliberately written to be very simple so that someone with no training can implement them immediately. However, when implemented with a proven methodology, such as Pivotal Response Training (PRT; see Chapter 2), they can be a valuable part of a therapy program. They can be printed directly from the software and should be used to maximize generalization as the child moves through the curriculum. Other than generalization, the activities also have the advantage of producing collateral effects (i.e., changes that are not directly targeted by the activities but which are likely to improve by using them) such as improved play, imitation, motor, self-help, and social interaction. These activities, when implemented with no parent training, have also been shown to decrease inappropriate behaviors (e.g., tantrums, avoidance) and inappropriate language (i.e., saying things that are out of context or self-stimulatory).

The *primary benefits* specify the targets that the activities were designed to teach in the natural environment including receptive language, cognitive/academic, social skills, and adaptive life skills. The *secondary benefits* are skills that the activities also target and may include joint attention or other social interaction, play, imitation, motor, or self-help skills. The *materials required* lists what objects are needed to implement the activity. These materials are toys and objects that are typically found in the homes and schools of many children. There are some activities that may require special materials, but even these are materials that can easily be found in toy or educational learning stores. It is appropriate to replace materials as the facilitator sees fit either due to availability or due to increasing the child's motivation for the activity. The *instructions* tell the adult how to engage the child in the activity and how to teach the skills that are targeted. The *advanced instructions* instruct the adult how to move the activity on so that it is more advanced or more age-appropriate for older children. These activities are meant to be shared with everyone on the child's team so feel free to copy and distribute these activities.

ACTION FIGURES

Supplements TeachTown Basics computer lessons: Actions

Primary benefits: Receptive vocabulary (verbs)

Secondary benefits: Expressive language, fine motor skill, object imitation, pretend play

Materials required: Action figures, dolls, or other toys that you can pretend to engage in movement

Instructions

Take a few dolls or action figures that the child enjoys and engage the child in play with the objects. On your turn, tell the child, "The doll is going swimming" and make the figure swim. On the child's turn, try to get the child to imitate your

action or, if the child is catching on, ask the child to do something different with his or her character (e.g., "The doll is RUNNING home!"). You may need to model the new action if the child does not get it right away. Once the child is able to imitate several actions, ask the child to demonstrate actions on his or her own (e.g., "The doll needs to jump") and model when necessary to help the child understand.

ANIMAL STAMPS

Supplements TeachTown Basics computer lessons: Multiple Cues—Color–Animals

Primary benefits: Identification of multiple cues (color and animals), responding to directions with multiple cues (following directions)

Secondary benefits: Expressive language, fine motor skills

Materials required: Rubber stamps of several types of target animals, at least two different target colors of ink pads, paper

Instructions

Say, "We are going to make a picture with lots of animals." Place three different stamps in front of the child. Then, show him or her two different colors of ink (you may need to show the tops of the containers as the ink may not appear to be the color that it is). If the child is unfamiliar with stamps, you may want to make a few practice runs before you start the activity. Prompt the child to choose a stamp and take his or her hand that is holding the stamp and guide it to the ink. Once there is ink on the stamp, guide the child toward the paper and press down on the child's hand to create the mark. Once he or she is capable of using the stamps correctly by him- or herself, start the activity. Say, "Let's make a blue cat." The child should pick the cat and the blue color. If the child needs help with this, verbally prompt him or her to first choose the animal and then give the child another prompt to choose the correct color. If verbal prompting does not work, use the hand-over-hand technique again but begin to fade your prompts until the child can do it independently. Once the child chooses the correct animal stamp and color, say, "Right! Make a blue cat on the paper." At this time, the child should press the stamp against the paper. On your turn, pick an animal and a color and say, "Look at mine; what is it?" Help the child to expressively identify the animal and the color. Show the child three other animals and have him or her pick one. Then, show two colors and have the child pick one.

Continue taking turns picking animals and different colors. You can use this time to ask questions about the animals and/or have the child use descriptive words about the animal or animal stamp.

BODY BATH

Supplements TeachTown Basics computer lessons: Body parts, body functions

Primary benefits: Receptive vocabulary (body parts), self-help/independence

Secondary benefits: Expressive language, fine motor skills

Materials required: Bath (or shower), sponge or washcloth, soap, a doll that can get wet

Instructions

When it is time for the child's bath (or shower), instruct the child to wash his or her body parts one at a time. Tell the child, "Time to wash your foot," or you can make it a fun song and say, "This is the way we wash our foot, wash our foot, wash our foot. This is the way we wash our foot, so we can get all clean." For your turns, you can wash body parts on a doll to help the child with generalization (e.g., "Molly needs to get clean. I'll wash her elbow.") You can also have the child wash body parts on the doll. Ask the child to label body parts, too (e.g., "What is this?"), and point to your finger, the doll's finger, or the child's finger. Continue taking turns and have the child identify body parts on him- or herself, the doll, and/or you.

Advanced Instructions

To work on functions, ask the child to show you, "What do you hear with? What do you see with?" and so forth. You can also try this type of activity with birds to enhance your student's learning on the bird computer lessons. Create a bird bath and follow the steps described previously. This activity is also fun in a deep sea bath with sea life and aquatic animals to enhance your student's learning on the aquatic computer lessons.

BOOK SOUNDS

Supplements TeachTown Basics computer lessons: Environmental sounds

Primary benefits: Auditory processing, identification of sounds in the environment, receptive vocabulary

Secondary benefits: Expressive language, pointing, prereading

Materials required: Children's books with pictures of things that make sounds in the environment (e.g., animals, vehicles). You can use flashcards or magazines or make your own book.

Instructions

Sitting with the child, say, "We are going to look at some pictures today!" Get the book and open it to the first page that has pictures of things that create sounds (e.g., a car would make a vroom, vroom sound; a turkey would make a gobble, gobble sound). Say to the child, "I will make a sound and see if it could be a noise that something in the book would make." Open the book to the first page (e.g., pictures of animals) and say, "Woof, woof." Pretend to search through the pictures on the page and say, "Where is the dog? A dog says, woof, woof." Turn to the next page that you want to use and say, "It's your turn now! What do you see?" Let the child answer and then ask the child what sound the object makes. Have the child look at the pictures and encourage him or her to point to the correct object.

If the child has difficulty, repeat the sound and prompt him or her to identify the object. Say, "Look, a doorbell makes a ding-dong sound." Continue to take turns and make sounds for the pictures in the book. Allow the child to choose the page you will target some of the time.

CLOTHES SHOPPING

Supplements TeachTown Basics computer lessons: Clothing; Multiple Cues–Clothing

Primary benefits: Receptive vocabulary (clothing)

Secondary benefits: Expressive language, fine motor skills

Materials required: Clothing catalogs (may also use clipart or coloring pages of clothes); scissors; glue; construction paper

Instructions

Before you do this activity with the child, find pictures of the target clothing in clothing catalogs. Using scissors, cut out the clothes and glue them to pieces of construction paper. (These pictures may also be laminated at a local office supply store in order to protect them.)

Draw a shopping cart, basket, or bag to paste the clothing items in. Arrange the pictures in groups of two or three different clothes per group on the floor or table. Say to the child, "We are going to shop for clothes." Bring the child over to the first group of clothes and say, "We need a hat. Put the hat in your cart/basket/ bag." Take a turn and say, "I'm going to put a shirt into the basket." Next, bring the child over to the next group of clothes and ask him or her to find a different article of clothing. Combine the groups of clothing as the child shops in order to continue the game. Continue until all of the clothes have been purchased. Ask the child to label the different clothing items by asking "What is this one?" to work on expressive language skills.

Advanced Instructions

When the child is ready to work on multiple cues, begin asking the child to discriminate between different colors and different items. For instance, say, "Put a red dress into the basket."

COLOR TRAIN

Supplements TeachTown Basics computer lessons: Colors

Primary benefits: Color identification

Secondary benefits: Expressive language, fine motor skills, following directions, organizational skills

Materials required: Bin to keep materials in, construction paper of various colors, crayons, glue, yarn

Instructions

Before beginning the activity with the child, cut the yarn into 2-inch pieces. In addition, cut the construction paper into circles for the train wheels and rectangles for the train cars.

Tell the child, "It is time to make a train!" Present three rectangular pieces of construction paper to the child. Each piece should be a different color. Ask the child, "Can you find the red piece?"

If the child responds correctly, say, "That's right. That piece is the red one." If the child does not answer correctly, point to the correct piece and say, "This piece is the red one."

Say, "Now it's time to put some wheels on the train." Place three circular pieces of construction paper in front of the child. Each piece should be a different color. If the child struggled to answer the previous question, you should present only two choices instead of three.

Ask the child, "Can you find the yellow piece?" If the child responds correctly, say, "That's right. That piece is the yellow one." If the child does not answer correctly, point to the correct piece and say, "This piece is the yellow one." Help the child glue the wheel onto the train.

Say, "We need to add another wheel to the train." Repeat the last few steps with another circular piece of construction paper. Once both wheels are glued onto the train car, present the child with three crayons. Each crayon should be a different color. If the child has struggled with correctly identifying colors, reduce the number of crayons to make it easier to answer the question without prompting. Ask the child, "Which crayon is the black one?" If the child responds correctly, say, "That's right. That crayon is the black one." If the child does not respond correctly, point to the correct crayon and say, "This crayon is the black one."

Ask the child "Do you want to draw people on the train?" It is acceptable if the child only scribbles with the crayon. Tell the child, "I love the people you are drawing. Can I draw a person?" Take a turn and draw your own person on the train. If the child seems to enjoy drawing people, ask, "Do you want to draw some more people?" Once the child is finished drawing people on that train car, help him or her glue a piece of yarn to the end of the train.

Continue to repeat these steps until you have three or four completed train cars. Glue the yarn from one train car to another to link the train cars together. When finished, hang the train on a wall to show the length of the train to the child.

Later, you can show the child the train again and ask him or her to show you the green train or the red wheel. This will further the child's understanding of color.

Advanced Instructions

If the child is verbal, ask the child to say the color of each piece of construction paper.

DRESS UP

Supplements TeachTown Basics computer lessons: Occupations

Primary benefits: Pretend play skills, receptive vocabulary, social interaction

Secondary benefits: Expressive language, fine motor skills

Materials required: A variety of objects that could represent pretend things (e.g., hat or broom for witch, plastic teeth for vampire, red nose or wig for clown, wings or wand for fairy)

Instructions

Say to the child, "Let's dress up as pretend characters!" Show two types of accessories and say, "Here is a broom! I will pretend to be a witch." Take the object and use it/put it on and act as the character (e.g., cackle like a witch and ride the broom). After a few seconds, remove the accessory and set it aside. Show the child

two other accessories and say, "Who do you want to pretend to be?" Encourage the child to choose an accessory and wear it or create an action.

If the child has difficulty say, "Here is a clown nose. Let's put it on your nose!" Take the accessory and help the child use it. Continue to take turns pretending to be different characters.

Helpful Hint

The materials may be obtained cheaply after Halloween from discount stores.

FARM BOOKS

Supplements TeachTown Basics computer lessons: Animals–Farm

Primary benefits: Receptive vocabulary

Secondary benefits: Expressive language, fine motor, following instructions, learning about books

Materials required: Photos, pictures, clipart, and so forth of farm animals; construction paper; scissors; glue; permanent marker; stapler with staples (or hole punch with paper fasteners)

Instructions

Gather the equipment and say to the child, "Let's make a book!" Show the child two pictures, each of a farm animal, and say, "I'll put the cow in the book." Take the picture, trim it if needed with the scissors, and glue it to a piece of construction paper. Label the picture with the permanent marker. Show the child two more pictures and ask, "Which animal do you want to put in the book?" When he or she identifies a picture exclaim, "You want to put the chicken in the book!" If the child does not respond, help him or her pick out a picture to work on. Take turns making the pages.

Once the pages have been constructed say, "Now it's time to put the book together." Stack the pages and place a blank piece of construction paper on top. Instruct the child on how to use the stapler or the hole punch and fasteners. The child may decorate the book cover. After you and the child complete the book, the book may be used to work on animal identification or naming the animals.

Helpful Hint

Remember that this can be done with all sorts of vocabulary words and categories (e.g., a food book, a vehicle book, things that are sweet book).

FIND THE TOYS

Supplements TeachTown Basics computer lessons: Play

Primary benefits: Receptive vocabulary

Secondary benefits: Expressive language, gross motor skills, social interaction

Materials required: An assortment of the child's toys

Instructions

Bring the child into a room where his or her toys are typically kept. Say to the child, "Let's find your toys!" In a sing-song voice (or to the tune of "Where is Thumbkin?") sing, "Where are bubbles? Where are bubbles? I'll find them. I'll find them." Find the object and set it in front of you.

Now sing the same tune to the child, "Where is the ball? Where is the ball? You find it. You find it." Encourage the child to retrieve the object and set it on the floor. If the child does not respond, take his or her hand and retrieve the object together. Ask the child what else you can find together to increase expressive language: "What would you like to find next?" You can also ask the child "What is this toy?" to work on expressive language skills. Continue taking turns to find different toys. At the end of the game, you can clean up the toys by singing, "Here's the doll. Here's the doll. I'll (You) put her back. I'll (You) put her back."

INSECT SEARCH

Supplements TeachTown Basics computer lessons: Insects

Primary benefits: Receptive vocabulary

Secondary benefits: Expressive language, pretend play, social interaction

Materials required: An assortment of plastic insects, a container or box to hold the objects, a small butterfly/insect net (optional)

Instructions

Before beginning the activity, place the insects around the room so that they are easily seen from a central area in the room (if the plastic insects are very small, consider spreading them around a table). Say to the child, "We are going to catch some insects (bugs)!" Look around the room and say, "I see an ant! I will go catch it!" Take the net (or use your hands) and "capture" the insect. Place it into the container. Show the box to the child and say, "See, I caught an ant!" Take the insect out of the container. Hand the child the container and net and say, "What insect do you see? Catch it and bring it back to me!" When the child shows you the captured insect say, "Great job! You caught a ladybug! Now it's my turn again!" If the child has difficulty, use two insects at a time and present them within reach. Continue to take turns.

Helpful Hint

Plastic insects can be obtained inexpensively from dollar stores, discount stores, or party stores.

JOB PROPS

Supplements TeachTown Basics computer lessons: Career Tools

Primary benefits: Functional relationships, pretend play

Secondary benefits: Expressive language, receptive vocabulary

Materials required: Assorted props for occupations (e.g., toy stethoscope for doctor, seed packet for farmer, book for teacher, bowl and spoon for cook, letter for mail carrier)

Instructions

After setting all of the props out, say to the child, "Look at all of these things that people use for their jobs!" Show two objects and say, "I'm going to find something cooks use." Look over the objects and say, "Here is a bowl and spoon. Cooks use these!" Using the objects, pretend to use them (e.g., make mixing motions using the spoon) and say, "See, I'm a cook!" Show two other objects and say, "Which would a doctor use? Can you pretend to be a doctor?" If the child does not respond, help him or her make the motions using the prop. Continue taking turns pretending with the props.

Advanced Instructions

Once the child masters the activity, offer him or her two props and ask the child to choose one. Have the child tell you what the prop is used for and who uses the prop. Then, have the child pretend to use it as that character.

MAKING MUSIC

Supplements TeachTown Basics computer lessons: Musical Instruments

Primary benefits: Pretend play, receptive vocabulary

Secondary benefits: Expressive language, fine motor skills

Materials required: A set of toy musical instruments. Materials may be found at discount, department, or toy stores.

Instructions

Say to the child, "We are going to make some music!" Show two instruments and say, "I will play the drums." Pick the correct instrument and play it for a few seconds. Show two more instruments and say to the child, "Can you play the guitar for me?" Have the child pick the correct instrument and play it for a few seconds. When the child responds correctly say, "Very good! You are playing the guitar!" If the child has difficulty, take away the incorrect choice and say, "See. This is the guitar. Can you play it for me?" Take turns playing all of the instruments.

Helpful Hint

Remember that this can be done in imitation programs and other receptive identification programs. Since we are working off the computer in these activities, try adding an expressive component to your activities. You might also see what the child will initiate when given the chance. For example, say, "Do what I'm doing." Give the child a chance to imitate you, then prompt him or her with "Your turn" to see if he or she will initiate a choice of an instrument.

NATURE HOP

Supplements TeachTown Basics computer lessons: Nature

Primary benefits: Receptive vocabulary

Secondary benefits: Expressive language, gross motor skills

Materials required: A large, paved area (e.g., sidewalk, driveway)

Instructions

Before beginning the game, create a hopscotchlike grid on the pavement by drawing several rows of two squares next to each other. In each square, sketch a simple drawing of objects you find in nature (e.g., rainbow, tree, cloud, sun). Bring the child to the beginning of the grid and say, "We are going to play nature hopscotch!" Say, "Look, at these two squares. I will jump to the flower." Make the correct jump into one of the squares in the first row. Say to the child, "It's your turn; can you jump to the rainbow?" Take turns jumping to the correct squares. At the end of the row of squares, turn around and jump back to the beginning, mixing up the items that you ask the child to jump to.

Advanced Instructions

To work on expressive skills, ask the child, "Now where do you want me to jump?" or "Where do you want to jump?"

NEW HOUSE

Supplements TeachTown Basics computer lessons: Household Objects

Primary benefits: Receptive vocabulary

Secondary benefits: Expressive language, fine motor skills

Materials required: Computer; printer; pictures, clipart, or photos of various objects that may be found in the house (furniture, appliances, household items); scissors; a large piece of poster board; markers; glue or tape

Instructions

Before beginning the activity with the child, draw an outline of a house on the piece of poster board. In the outline, divide the house into four or five rooms (bedroom, kitchen, living room, bathroom, dining room). Cut out the clipart (or pictures) of the objects and have them ready. Say to the child, "We are going to make a pretend house! Let's put your name at the top!" Using the marker, write the child's name at the top (e.g., Timmy's house). Show the child the rooms and tell him or her what they are (e.g., "Here is the bathroom"). Show two pictures and say, "Look, here is a sofa. I will put it in the living room." Take the adhesive and place the object in the correct room.

Present two pictures to the child and say, "Now, it is your turn! What do you want to put in the house?" Encourage the child to pick an item and glue or tape it

into the correct room. When the child completes the task say, "Great! The bed goes in the bedroom!" If the child has difficulty, show him or her one item and ask, "Where does the bed go?" Continue to take turns in order to finish decorating the house.

Advanced Instructions

To work on expressive language, ask the child "What is this one?" and then let him or her put the household item in the house.

PAPER DOLLS

Supplements TeachTown Basics computer lessons: People

Primary benefits: Fine motor skills, receptive vocabulary

Secondary benefits: Expressive language, pretend play skills

Materials required: Computer with printer (optional); paper, poster board, cardboard, or cardstock; scissors; glue; sticky tack (optional)

Instructions

Find a template of a paper doll that you can print out or draw one yourself. Create two paper dolls and several outfits that correspond with occupations (e.g., doctor/nurse, firefighter, farmer). Using the scissors, cut out the dolls and glue them onto the poster board in order to make them sturdier. Trim the dolls. Once the dolls are ready, assemble the outfits (more outfits may be clipped from magazines, old books, etc.). Say to the child, "Look at these paper dolls. Let's dress them!" Show two of the outfits and say, "My doll will be a doctor." Choose the outfit and put it on the doll. (Many paper doll cutouts have tabs to secure the clothing. However, using a little bit of sticky tack works well also.) Have the doll pretend to be the occupation that it is dressed to be (e.g., a doctor doll could pretend to examine the child). Show the child two other outfits and ask, "What is your doll going to be?" Have the child dress the doll. Exclaim, "Oh, your doll is a firefighter! Pretend to put out a fire!" Help the child act out the motions. Take turns dressing the paper dolls.

Advanced Instructions

You may also make a doll of each person in your family, the child's friends, and so forth. Create the body of the paper doll as you would in the previous instructions but instead of drawing a face, glue on a photo of an individual's head (make sure the head is proportional to the body). The paper dolls can also be used for other activities as well. You can ask the child to describe the different family members and name each person's likes and dislikes, or you can use the paper dolls as puppets when telling a story. You can also have the child dress the dolls according to the weather (e.g., What would you wear if it is sunny, rainy, snowy, windy, etc.)

Helpful Hint

Paper doll templates can be found in craft stores and on various web sites for purchase.

SHAPE BOX

Supplements TeachTown Basics computer lessons: Shapes

Primary benefits: Receptive vocabulary

Secondary benefits: Expressive language, shape matching

Materials required: Toys and household objects of different shapes. You will also need a fun box to keep all the shapes in.

Instructions

Take all of the objects out of the shape box and put them out of reach of the child (e.g., in another box). Pull out a shape and hide it in your hand and say, "What do I have?" Then, show the child the shape and verbally label it (e.g., "Triangle!"). On the child's turn, present several choices of differently shaped objects and ask the child to find the square. When the child picks the correct shape, say, "That's right, the cracker is a square" and prompt the child to put it away in the shape box. Continue taking turns until you fill up the shape box.

Advanced Instructions

You can also "hide" objects around the room and find shapes to put in the shape box. Say, "Can you find something that is a circle? Great, let's put it in our shape box!" It's okay if the child chooses objects that are not the ones you hid.

Helpful Hint

You can use all sorts of objects to represent the different shapes. Examples for a circle: ball, coin (make sure child does not put coin in mouth), orange. Examples for a square: CD case, cracker (play food), photograph. Examples for a triangle: pizza (play food), triangle from puzzle, triangle from shape sorter. You may also choose to cut out shapes with construction paper or use foam shapes (found at many craft stores).

STICKER ZOO

Supplements TeachTown Basics computer lessons: Animals–Zoo

Primary benefits: Receptive vocabulary

Secondary benefits: Expressive language, fine motor

Materials required: Stickers of animals, cardboard box (the zoo)

Instructions

Take out the zoo and show it to the child. Say, "Look, it's a zoo! Who belongs in the zoo?"

Take an animal sticker and show it to the child. Then say, "The zebra goes in the zoo" and put the sticker in the zoo. Present several stickers to the child and tell him or her, "Oh, you know what else goes in the zoo? The elephant!" Prompt the child to put the elephant in the zoo.

Continue taking turns putting animals in the zoo. Be sure to allow the child to remove the stickers and place the stickers on his or her own as much as the child is able, to help in the development of fine motor skills.

Advanced Instructions

You can expand this activity by using larger boxes with multiple habitats. The child can put like animals in their own habitats. Another way to expand this activity is by having multiple boxes, each with a different habitat. The child can put zebras with zebras, elephants with elephants, and so forth. You may even want to work on matching and have the child match toy animals to the correct animal stickers. If the child is verbal or able to make verbal approximations, have the child work on labeling the animals.

Helpful Hint

To make a zoo, draw black lines on a box like a cage at the zoo. If you have time and want to be more creative, create a natural habitat by drawing trees, water, and so forth on the box to create a modern-day zoo environment.

TOOL CARDS

Supplements TeachTown Basics computer lessons: Tools

Primary benefits: Fine motor skills, following instructions, receptive vocabulary

Secondary benefits: Expressive language

Materials required: Hardware catalog or circular (e.g., Home Depot); scissors; construction paper, card stock, or cardboard; glue; permanent marker; envelope

Instructions

Collect the materials and say to the child, "We are going to make some tool cards." Show the child the hardware catalog and say, "I'll find a hammer." Look through the catalog and find the object. Using the scissors, cut out the object. Help or instruct the child to glue the picture to the construction paper. Label it with the marker. Now say, "What tool do you want to pick?"

Hand the child the catalog and ask him or her to point to a tool. If the child is verbal, encourage him or her to say the name of the tool. If the child seems unsure, ask him or her to find a specific tool. Once the tool has been identified, help the child cut out the picture. As before, help him or her glue the picture to the construction paper and label the item. Continue taking turns to create more tool cards. Once you have finished making the cards, put them in an envelope and label them with the child's name (e.g., Timmy's Tools). The child may also want to decorate the envelope.

Advanced Instructions

These cards can be used for future work (e.g., identifying the tools, naming the tools, matching with real or toy tools).

TRANSPORTATION WASH

Supplements TeachTown Basics computer lessons: Transportation

Primary benefits: Receptive vocabulary

Secondary benefits: Expressive language, object imitation, pretend play, sensory development

Materials required: Bowl with soapy water, bowl with plain water, two washcloths, toothbrush, towel, transportation toys

Instructions

Tell the child it is time for the vehicle wash. Take one of the toys (e.g., a car) and say, "Clean the car." Put it in the soapy water. Take the toothbrush and say, "Scrub the car." The child may want to help at this point, and you should encourage it. Be sure to repeat *car* as much as possible. This is a good time to use the song: "This is the way we scrub the car, scrub the car, scrub the car. This is the way we scrub the car, so it can drive on home" (or something fun like that). Take the washcloth and say, "Wash the car." Rub the car with the washcloth. Again, let the child help if he or she wants. Put the car into the plain water and say, "Rinse the car." Then use the second washcloth and say, "Dry the car."

Advanced Instructions

Now you can work on other labels by asking the child to "Clean the airplane" or "Clean the truck." If the child is verbal, you can also ask the child to tell you the names of the vehicles and to tell you what he or she is going to do (e.g., "Scrub the train").

Helpful Hint

Use a towel to keep your floor clean and dry (or do the activity outside).

WHERE IS THE FAVORITE OBJECT?

Supplements TeachTown Basics computer lessons: Eye Gaze

Primary benefits: Following eye gaze (joint attention)

Secondary benefits: Social interaction

Materials required: miscellaneous toys, snacks, household objects

Instructions

Place favorite objects of the child around a room. Bring the child into the room and kneel or stand in front of him or her (depending on the child's height). Make sure you are in close proximity of the child's face (about a foot or so). Attempt to get the child to look at your face in a playful way "(Gasp.) Guess what I see? Elmo!" and look at the object you mentioned in a very obvious way. Make sure the child is attending and make sure the object is something that the child will find interesting. Allow the child to retrieve the desired item and engage him or her in a

social interaction with that toy for a few minutes. During this time, try to get eye contact as often as possible by taking turns with the desired object and by making the desired object socially interesting (sound effects are great for this). Try to get the child's eye contact again and look to another desired object in the room. Repeat the interaction described previously.

Advanced Instructions

Cover desired objects by hiding them behind pillows, under a piece of furniture, under blankets,and so forth so the child is not distracted by the motivating objects in the room until you are ready to show him or her the objects with your eye gaze and social interaction.