Use of Technology to Promote Literacy Skills for Students with Autism

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Abstract

The Individuals with Disabilities Education Act (IDEA) states that students with disabilities, particularly those on the autism spectrum shall have access to the general education curriculum, allowing all learners to reach academic standards (Lanter & Watson, 2008). Although, this act provides autistic students the opportunity to succeed in the educational system, teachers need strategies and successful tools to help students with autism reach the academic standards. The special activity is twofold: (a) To synthesize the research examining effectiveness of numerous instructional strategies and tools and (b) To design the manual based on this empirical evidence. Opportunities for literacy continue to be significantly reduced for students with moderate to high functioning autism due to the fact that educators may have a limited understanding about the relation between autism, literacy, and behaviour.

Keywords: autism spectrum disorder, technology, computer-assisted intervention, literacy, reading comprehension

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The Importance of Literacy

In the 21st century, literacy in the elementary school classroom has moved beyond the written word. Classroom instruction has been influenced by the society's rapidly growing technological advancements.

> The rapidly changing technologies require teachers to be more informed about how to use technology in the classroom in ways that make sense for learning and teaching, as well as broaden our own understandings of how children make use of these multimodal technologies (Flint, 2008, p. 344)

However, this does not change the notion that literacy skills are the foundation for "learning, independence, and quality of life for all individuals" (Carnahan, Williamson, & Christman, 2011, p. 54). The concept and interpretation of literacy has changed drastically due to the influence of technologies and the various perspectives associated with literacy. Our research review is specifically intended to address the use of technology in order to promote literacy skills for students with autism at the elementary level. Elementary school teachers working with moderate to high functioning individuals with autism will directly benefit from this manual, focused on the implementation of technological strategies to promote literacy, specifically reading and reading comprehension.

The importance of literacy development remains of value of the educational system; however how students learn, comprehend and analyze literacy varies. Students living in the 21st century are "constantly bombarded with visual, audio, and print technologies that provide endless possibilities for interpretation and meaning making" (Flint, 2008, p. 4). All learners need to develop the credentials of how to read and interpret literacy in and around their surroundings.

An important aspect of literacy development is reading. Reading is a skill that is

essential to "independence, employment, and daily living" (Travers et al., 2011, p. 326). Literacy development is crucial for all learners, including those with learning disabilities and those on the autism spectrum. Without the instruction of literacy, autistic students are at risk, and lack the skills necessary to become successful individuals in their everyday lives (Travers et al., 2011). By developing the basic foundation of literacy skills, students with autism will be able to "experience greater success in school, achieve greater independence, and have more opportunities to participate in their community" (Travers et al., 2011, p. 327).

Early Techniques for Reading Instruction

A functional reading instruction was design for students with ASD in the 1970s and 1980s. The design focused on sight word recognition, since research evidence had shown that individuals with ASD could recognize sight words. During this time frame, literacy was not considered to be a process of critical thinking. Sight words would enable students with ASD to become functional in society. However this model prevented students with ASD from expanding and developing their literacy skills and limited their reading and writing skills (Mirenda, 2003).

Facilitated communication was introduced in the early 1990s in North America. It is a communication technique for non verbal individuals with ASD. The goal for facilitated communication is to teach the individual with autism to type independently without the help of a facilitator. This enables some individuals with autism who are non verbal to read and spell. With this type of communication, "speech is not a prerequisite to literacy and it may be acquired from print exposure or from formal teaching" (Mirenda, 2003, p. 273).

Recent research in literacy development has introduced a balanced approach to literacy using a wide variety of technologies. A balanced approach to literacy provides the notion that students on the autism spectrum can develop and expand their literacy development and can

participate meaningfully alongside their peers (Mirenda, 2003, p. 274). This approach has incorporated a different outlook on literacy. A balanced approach to literacy views literacy as "an interactive process that includes listening, speaking, reading and writing in relation to everyday life" (Mirenda, 2003, p. 275). This approach strives to organize a theme-based instruction, which encourages cross-curricular connections to other content, key concepts and activities across the school day (Carnahan, Williamson, Christman, 2011).

No Child Left Behind

Literacy development continues to be a hot topic across North America. The drastic increase in literacy may stem from the inclusive school movement, public policy, the increase in parental involvement and education-related legislation (Kluth & Chandler-Olcott, 2008). Students with disabilities including those on the autism spectrum have become increasingly more evident in the public sectors. The Individuals with Disabilities Education Act (IDEA) provides students with disabilities and those on the autism spectrum access to the general education curriculum, allowing all learners to reach academic standards (Lanter & Watson, 2008). According to IDEA, there has been an increase of five times in the number of labelled children under the IDEA in the last 10 years since 2006 (Chandler-Olcott & Kluth, 2009).

In 1997, the Congress organized the National Reading Panel (NRP) which analyzed the literature of how children learned to read. The research focused on "developing efficient and effective academic instruction methods" for the inclusive and special education classroom (Ramdoss, Mulloy, Lang, O'Reilly, Sigafoos, Lancioni, Didden & El Zein, 2011, p. 1306). The NRP became an influence to improve literacy achievement specifically with primary students. Eventually, the results developed from the NRP, allowed George W. Bush to pass an education bill as a top priority (Kluth & Chandler-Olcott, 2008).

Finally, in 2002 the *No Child Left Behind Act* of 2001 was "reauthorized of the Elementary and Secondary Education Act of 1965" (Kluth & Chandler-Olcott, 2008, p. 31). A section of the No Child Left Behind (NCLB) includes "Reading First" which was developed from the report of the NRP, which includes the five components of reading: (a) phonemic awareness, (b) phonics, (c) fluency, (d) vocabulary and (e) comprehension (Kluth & Chandler-Olcott, 2008). The NCLB provides the opportunity and the possibility for all children to learn how to read proficiently.

Although, the NCLB provides the opportunity for all children to learn how to read, the act also mandates that all learners--including those on the autism spectrum--write the required standardized test. Very few of those students are given permission to be exempted from the annual reading tests. The NCLB promotes the industrial model of schooling which "focuses on standardization" (Flint, 2007, p. 7), this type of model acts as "an assembly line model with standardized materials and events" (Flint, 2007, p. 6). The industrial model creates uniformity and forces curriculum and content to be essentially the same for all students. Skill and efficient performance are two important factors in order to succeed within the industrial model. Flexibility in standardized testing is limited and teachers are pressured to comply with standards and benchmarks. Therefore, teachers become challenged to prepare students on the autism spectrum for the required standardized assessments.

Autism Disorder and Reading Comprehension

Society has placed preconceived notions about individuals who fall on the Autism Spectrum; generalized characteristics perceived about the distinctiveness of an individual with autism may depict an overzealous definition for the mainstream population. Autism Spectrum Disorder also known as Pervasive Development disorder is an umbrella term that encompasses a

variety of conditions, such as "classic autism disorder, Asperger Syndrome, pervasive developmental disorder/ not otherwise specified (PDD/NOS), childhood disintegrative disorder, Rett syndrome, and fragile X syndrome" (Kluth, 2009, p. 7). Research has provided evidence that the disorder is "a neurological disability that is presumed to be present from birth and is always apparent before the age of three; although ASD affects the functioning of the brain, the specific cause of ASD is unknown" (Perangelo, & Giuliani, 2004, p. 2). Individuals with autism may have a grouping of social, cognitive, and communicative impairments.

The Diagnostic and Statistical Manual of Mental Disorders IV- Text Revised (DSM IV-TR) provides criteria to determine whether an individual is part of the autism spectrum. Some of the typical characteristics displayed by individuals with autism include: (a) "have trouble processing speech at times; (b) have a hard time making sense of some of the sounds, words, or sentences they hear" (Kluth, 2009, p. 28); (c) may showcase repetitive and unusual behaviors, and a change of normal pattern throughout their day can frustrate or upset them (Perangelo, & Giuliani, 2004); (d) have "good rote memory skills, often relating to unusual subjects, such as shoe sizes, supermarkets, car registration numbers and so on" (Hewitt, 2005, p. 13).

Reading comprehension is an intricate cognitive process that allows readers to comprehend text using a variety of components. Readers need to be able to process and use various strategies, such as (a) inference making, (b) using prior knowledge, or (c) learning the vocabulary of the topic. As mentioned by Randi, Newman, and Grigorenko (2010) "the development of phonological and orthographic knowledge about single word is an important foundation for reading, but word recognition alone is not sufficient for reading comprehension" (p. 891). Individuals with autism have strengths with visual imagery, using rote memory, and a tendency to pay attention to detail, however individuals with autism tend to have "deficits in

social cognition and difficulty interpreting and labeling emotions" (Gately, 2008, p. 40). Children with autism may have developed decoding skills but lack the comprehension aspect of reading. An individual with autism may find it difficult to recognize the various cues needed to comprehend text, such as a characters' social experience or comprehend the value of given stories. Personal narratives are especially more challenging than non-fictional texts (Lanter & Watson, 2008) because individuals with autism interpret language literally and do not necessarily make inferences about the narrative being explored. "Difficulty in separating main ideas from details is not uncommon for people with autism spectrum labels" (Kluth, & Chandler-Olcott, 2008, p. 123), therefore reading fluently may not be an issue, but comprehending text may be.

Reading Comprehension and Hyperlexia

Learning how to read is a difficult task that requires dedication and constant practice. Reading for comprehension is challenging for the typically developing child and even more so for the child on the autism spectrum. "Reading is a skill that is vital to independence, employment and daily living. Without adequate and efficient literacy instruction, students with autism will mature into adults with insufficient skills vital to gainful employment, adaptive daily living, and enjoyable social, recreation, and leisure activities" (Travers, Higgins, Pierce, Boone, Miller, & Tandy, 2011, p. 326). Reading is defined as "the ability to decode words and the ability to comprehend the meaning of those words" (Carnahan, Williamson, & Christman, 2011, p. 54). Students with autism, may be able to decode, but will likely lack comprehension. Students are focusing on how to dissect the words as opposed to understand the meaning of the word (Carnahan, Williamson, & Christman, 2011). Approximately 80% to 90% of students with autism "require literacy instruction to promote decoding and all require instruction to develop reading comprehension skills" (Travers, Higgins, Pierce, Boone, Miller, & Tandy, 2011, p. 327).

Regardless of where the child is found on the autism spectrum, his or her decoding and word recognition skills could be considerably well developed, whereas his or her reading comprehension remains poor (Randi, Newman, & Grigorenko, 2010). The term hyperlexia is associated with students on the autism spectrum and is defined as "patterns of higher word reading skills accompanied by poor reading comprehension" (Gately, 2008, p. 40). However, research has also linked the decoding-comprehension discrepancy with weak readers without an autistic identification. Approximately 10% to 20% of children with autism are considered to be hyperlexic (Travers et al., 2011). Those students with autism and hyperlexia tend to "excel in the traditional phonics instruction because the ability to decode is linked to visual-spatial skills, the application of phonological rules, and the detection of patterns in words--all of which are areas of strength for many individuals with autism" (Mirenda, 2003, p. 272).

Cognitive Processing Theories and Reading Comprehension

The research identifies three various theories that explain the cognitive process in the ASD student (Carnahan, Williamson, & Christman, 2011). First, the Theory of Mind is defined as "the ability to infer the full range of mental state of others and the ability to reflect on one's own and other's actions" (Gately, 2008, p. 41). It is a challenge for those individuals on the autism spectrum to interpret, understand, and recognize sarcasm or jokes in narrative texts and in social settings. Theory of mind skills includes "recognizing and understanding emotions, incorporating pragmatic language skills, determining character goals in stories, and recognizing false beliefs along with trickery" (Gately, 2008, p. 41).

The second theory is Executive Function (EF). This theory incorporates together how an individual organizes, plans and self-monitors a particular activity and how to respond appropriately to a situation (Carnahan, Williamson, & Christman, 2011). This aids the

individual to accomplish a goal by eliminating distractions. In relation to reading comprehension, the EF theory allows the individual to identify a goal for reading a text, as well as self-monitoring their understanding.

Weak Central Coherence (WCC) is the third cognitive theory, which emphasizes the individual focus on details as opposed to the entirety (Carnahan, Williamson, & Christman, 2011). This theory indicates that "an individual has difficulty in using context to derive meaning" (Lanter & Watson, 2008, p. 40). This prevents meaningful learning and distracts individuals from capturing the main idea or purpose of reading a text. One's inability to summarize or identify the main ideas of a story further "limits (his or her) ability to make meaning and integrate that meaning with existing knowledge" (Carnahan, Williamson & Christman, 2011, p. 57, parenthesis added).

Computer Assisted Instruction

Theoretical Benefits Associated with CAI

There are several theoretical reasons why CAI is beneficial for students with autism. Firstly, "abnormalities in sensory perception lead to problems in discriminating and screening out unnecessary information, with difficulties deriving overall meaning" (Williams, Wright, Callaghan, & Coughlan, 2002, p. 72). Students with autism have difficulties interpreting the meaning of words to the main purpose of the text. Computers can easily be adapted to meet the need of the child. Secondly, the responsiveness of a student with autism increases when the environment is predictable. Computers provide autistic students with consistency and predictability within their environment. Students with autism are attentive, and tend to focus on only one cue. Computers can be programmed to limit confusing cues and to control the cues according to the child's learning need. Therefore, this aids students with autism to focus on the

appropriate prompt and build on their learning experience. The third theoretical benefit to using CAI, is to increase the student's active participation in instruction as opposed to being a passive recipient (Williams, Wright, Callaghan, & Coughlan, 2002). The use of the computer allows "visual stimuli in simple and prolonged fashion and can allow the child to actively control learning" (Williams et al., 2002, p. 73).

Computer-Assisted Instruction

Computer-assisted instruction (CAI) has been described as "an intervention in special education that shows promise" (Hitchcock & Noonan, 2000, p. 146). Research done approximately 18 years ago by Heimann, Nelson, Tjus, and Gibberg (1995) reinforces the concept of interactive computers as a positive form of instruction that can facilitate language learning for students with autism and other disabilities. Heimann et al. (1995) provided a basis for research to promote preliminary programs that support the various findings pertaining to technological implementation in schools to assist students with the retention of words, comprehension of text, and social-interactions. The research conducted by Heimann et al. (1995) was a quasi-experimental study that addresses the effects of CAI, which includes the teaching environment that students with autism are in when reading and writing. The study included thirty children assigned to three groups: (a) eleven children diagnosed with autism that had a mental age between 3-9 years of age: (b) nine children with mixed handicaps, and (c) ten normal preschool children. Alpha program used in this study was formulated to facilitate language learning by a variety of technological feedback, such as voice, animation, video, and sign-language. Significant correlations were found between the progresses of children using the Alpha program, specifically geared towards reading comprehension.

Despite the fact that Heimann et al.'s (1995) research was conducted in the late 1990s, the study supports recent research showcasing the benefits of using technology for students with autism. Hutchock's study brings support to previous research indicating that "CAI was more effective than traditional instruction for a wide range of skills in math, science, art, reading, and writing" (Hitchcock, & Noonan, 2000, p. 145). Armstrong (2009) conducted a study on computer assisted reading for students with high functioning autism. This review focuses only on the third research question addressed by Armstrong (2009); that is: "are there any differences in the listening comprehension of children with High Functioning Autism who read at the second grade level, who read along with an adult compared to reading along with a computerized voice on a computer?" (p.16). Five students with high functioning autism were randomly selected for the study based on good decoding skills, poor inferential language, and comprehension capabilities. During the baseline and intervention phase children completed a 20 question oral administered quiz. The computer software provided 35 chosen storybooks that were made by Wynn Wizards, a program that highlights text in color as well as provides a computerized voice, and " the ability to scan printed pages and convert them into an exact replica of electronic text and colored graphics or illustrations" (p. 82). The storybooks contained fictional text to evaluate children inferential and higher level comprehension as opposed to detailed form of understanding. Armstrong's (2009) baseline phase included a read along storybook, in which children read with the researchers once, and then they were asked to retell the story in conjunction with answering questions orally. During the intervention phase, the computer software was introduced in a randomized sequence of storybook and computer software; children read the story with the audio voice following the highlighted text on the computer screen. Results indicated that "all students did poorly on the story comprehension quizzes during the

baseline phase; results at intervention varied. Some participants scored higher than at the baseline while others maintained to the baseline results indicating that the computer software program affects comprehension in a positive way in some kids.

A pilot study completed by William et al. (2002) included eight children between the ages of three and five years old diagnosed with autism. The reading material either a book or a computer-based instruction was taught by a specialist teacher one-on one with the student. The reading books were designed to be as interesting as possible, including bells and horns to press. Flash cards were also included in the daily instruction for book-based instruction.

The books were scanned in order to create a computer-based version of the reading material. The computer version of the books included similar sounds and a voice over. This version allowed the children to turn the pages as with a traditional book. However, extra features such as the clickable sounds, additional games to reinforce important terminology, and a drag-and-drop technology increased interaction. For ten weeks, five days a week for fifteen minutes, the teachers worked with the same children in both conditions; either book or computer based learning. Results of the study indicated that "the children spent more time on task in the computer condition than in the book condition" (Williams et al., 2002, p. 80). It was shown that children spoke twice the number of words in the computer condition and focused for a longer period. The study concluded "children with autism spend more time on reading material when they access it through computer compared with equivalent material in book form" (Williams et al., 2002, p. 88).

A study by Bosseler and Massaro (2003) focused on a computer animated tutor that encourages and supports autistic students' vocabulary acquisition and language learning. The computer animated program Baldi was created to promote effective computer-based language-

training for students with autism in conjunction with Language Wizard which creates vocabulary lessons. The vocabulary lessons used Baldi's synthesized speech, and pictures of the vocabulary words (Bosseler and Massaro, 2003). Researchers expected that Baldi will facilitate language learning for students with autism, given that the "advantages of the program include the unique ability to control and manipulate the visual and auditory components of spoken language automatically, visual images and text in the lessons to provide additional cues for word and concept learning, enough variation in the learning environment to facilitate generalization of what is learned" (p. 655). In addition Baldi program provides a one-on-one method between the child and computer establishing a diverse learning environment that is not necessarily teacher or therapist lead (Bosseler and Massaro, 2003). The program promotes the application of vocabulary, language, and listening skills for students who are having difficulty developing language skills. Bosseler and Massaro (2003) conducted a two-part experiment; the first includes the effectiveness of the Language Wizard and Player. Nine children (one girl and eight boys) diagnosed with autism whose age ranged from 7-12 years old participated in this study. The children were provided with vocabulary lessons created by Language Wizard, and used Baldi's synthesized speech, and pictures associated to the vocabulary words. Images were provided by the experimenter. Students were provided with visual feedback in form of happy or sad facial expressions located at the corner of the screen (Bosseler & Massaro, 2003). The results of the first experiment indicated that "children not only learned new language but retained the material for at least 30 days after training was completed" (p. 658). The second experiment was to monitor the increase in identification during the post-training sessions, and questioned if students would convey what they learned to an environment other than the computer animated program. Six of the nine children participating in the first experiment were included in this

experiment. The students were assessed on the progress through five stages that included standard curriculum and generalizations; different eighteen vocabulary words were selected for each specific child. Results showed that "all of the students identified significantly more words during post training" (p. 665) indicating a correlation between word retention and Baldi. This study provided supportive evidence that learning is present based on the computer program, "vocabulary knowledge can generalize to novel images, and that it can transfer outside of the computer program" (p. 666). The program also supported the notion that children are capable to transfer their learning to their natural environment. The advantages of Baldi for students diagnosed with autism is that the program provides students with a multi-display with alternating depictions of skin or face (frontal and side view of the automated tutor) and the same alterations may be done for the voice (Bosseler and Massaro, 2003).

Moore and Calverti (2000) conducted a study that included fourteen students (twelve boys and two girls) with autism between the ages of three to six. The purpose of the study was to establish a computer software program that enhances behavioural learning in conjunction with improved vocabulary skills for children with autism. The participants were grouped according to skill level, students who showcased receptive verbal skills and students who could generate simple sentences and students who were able to produce and utilize intricate sentences but not constantly. The study presented the students with multiple steps. Students were taught the names of objects; they were taught verbal instruction through drills and were given verbal praise or positive reinforcement such as playing with a preferred object. The computer software program worked hand in hand with the latter drills, but added a sensory reinforcement component, such as color, animation, music and fascinating sounds. Students " learned 74% of the targeted nouns in the computer condition and only 41% of the nouns in the teacher condition;

and 57% of the children in the computer condition wanted to continue treatment compared to none of the children in the teacher condition" (p. 361). Therefore, there is a significant correlation between word processing and CAI - children respond positively to computer software and a sensory component provided. Students who have autism learn through rote memory, therefore their inference strategies are not as developed. The computer program allows the children to establish connections between words and sensory components that will benefit their learning. The integration of "computers in classrooms could provide a cost-effective teaching method to supplement current behavioural pedagogical practices" (Moore & Calverti, 2000, p. 361).

Limitations of Computer-Assisted Instruction

Although the research has shown the benefits and positive effects of CAI, several negative aspects are also associated with CAI. Individuals may fear that the use of CAI may "increase social withdrawal, the computer as a focus for obsession or the encouragement of other obsessive technologies may also be a factor" (Williams, Wright, Callaghan, & Coughlan, 2002, p. 72). Social withdrawal can be increased between the teacher and the student with ASD depending on the use of the computer. The use of the computer may as well limit verbal communication, social skill and eye contact between the teacher and student with ASD. These are already difficulties for the student with ASD (Ramdoss, et al., 2011).

Effective Teaching Techniques

E-Word Wall

The use of technology in an elementary school classroom not only motivates a student's learning, but can also enhance a teacher's learning style. Generally, students with ASD respond relatively well to "visual images including visual representation and written words" (Narkon,

Wells & Segal, 2011, p 39). Word walls are typically found in the general or special educational elementary school classroom. A word wall is an instructional tool that provides students with an ongoing visual reference intended for vocabulary acquisition. A word wall is a useful tool for students and teachers to provide "an interactive, ongoing display of words and/or parts of words, used to teach spelling, reading and writing strategies, letter-sound correspondence, and more" (Narkon, Wells, Segal, 2011, p. 40).

However, the E-Word Wall (EWW) can be described as an interactive version of the traditional word wall. The EWW is a "digital-based instructional tool that provides the option of creating individualized, portable, engaging, manageable, and multisensory word study for stuents" (Narkon, Wells, & Segal, 2011, p. 40). EWW can easily be designed using PowerPoint completed by the teacher or the student.

Wells & Narkon conducted a study analyzing "the use of a word wall strategy and whether there were differences in effectiveness on children's word identification and on the teacher's sense of efficacy when using small-group traditional word wall instruction versus an individualized electronic word wall instructional format" (2012, p. 6). The participants in the study were three kindergarten students with developmental disabilities. For math and language arts the kindergarten students attended a special education setting, but they participated with the general class for other school subjects. For the EWW, the participants were sent individually to the computer station to practice their vocabulary words. For the traditional word wall group-instruction, the students gathered around a kidney-shaped table with a teacher (Wells & Narkon, 2012).

The vocabulary words consisted of six words; three words were used for the EWW only and the other three were only used for the traditional word wall. During the traditional word wall

instruction, the teacher pointed to the word and "modeled the pronunciation followed by pointing to each letter as she spelled the word" (Wells & Narkon, 2012, p. 10). The students were instructed to read and spell each word together as the teacher pointed to each word. During the EWW instruction, each word included audio, a sentence and an associated picture. The first day of intervention was focused on the teacher explaining how to navigate the EWW and the second intervention day focused on the teacher encouraging the student to navigate EWW independently. In the remaining sessions, the student worked independently with the teacher close by to provide assistance.

The results of the study have shown that the three kindergarten children were able to navigate EWW independently. With the traditional word wall, the teacher reported a frequent need to redirect student engagement. Although the teacher was previously familiar with EWW, it was indicated from a professional perspective that EWW is an effective strategy to teach word identification. The overall results concluded that either "word wall strategy can be an effective instructional strategy for children with developmental disabilities in kindergarten in special education resource setting" (Wells & Narkon, 2012, p. 14).

There are several differences between the traditional word wall and the interactive EWW. The traditional word wall includes words that are alphabetical and visual representation that can be kinesthetic. Word walls have limitations in regards to wall space and word walls do not include an auditory component and lack an independent interactive feature. Word walls can eventually become problematic for teachers who share or change classrooms during the day.

The EWW "links an alphabet chart to alphabet word pages through user-friendly navigation buttons on the presentation slides" (Narkon, Wells, & Segal, 2011, p. 41). An auditory component is available which enables students to hear the letter names and sounds. The

EWW can easily incorporate pictures for each vocabulary word that creates meaningful visual and auditory prompts. Visual representation that is meaningful for the student increases the likelihood of retention.

There are several advantages for using an EWW. Firstly, EWW are personalized and individual for the student. Such differentiation allows students to use their own personal visual cues for each word and matching sentence. With EWW, students can share their words with others in partners or in small groups. Interactive word walls created with computer programs provided the opportunity to access them at school and at home. EWW can provide the students with a sense of responsibility that they are independent of their own word wall.

PowerPoint Software

A study conducted by Coleman-Martin, Heller, Cihak, and Irvine (2005) provides insight on CAI promotion of word recognition through PowerPoint Software. The participants included students with speech impairments that have letter to sound recognition, reading recognition at approximately the grade two levels, and have not used a non verbal reading approach (NRA). The process included the use of PowerPoint software from Microsoft that is accessible for all computers--teachers and parents have access to the program and can create a slide show appropriate for the student. Throughout the study a series of PowerPoint slides were created with target words displayed on each slide with a corresponding visual and auditory component. The procedure is one that can easily be implemented and used by teachers in the classroom. The first slide showcased the entire word and encouraged the student through auditory instruction to slowly pronounce the word. The following each word various slides showed the breakdown of the word's phonemes with accompanied auditory assistance, so the student would follow and pronounce the phonemes accordingly. Once all the phonemes were introduced the last slide

would show the entire word, and included a reinforce screen that included picture and encouraging phrase "Excellent" (Coleman-Martin et al., 2005).

Students participants have partaken in three steps during the guided practice of NRA: (a) that provided students with directions about what they were going to be participating in, (b) that encouraged students to participate through teacher modeling, (c) that encouraged the use of metacognitive strategy to decode words using internal speech in conjunction to the PowerPoint software (Coleman-Martin et al., 2005). Students were able to obtain objective words during each of the conditions using NRA and the Use of PowerPoint slides facilitated their decoding of new words without teacher instruction. The latter was found to be an effective method of teaching new words (Coleman-Martin et al., 2005). PowerPoint can be beneficial for both teachers and students on the autism spectrum with respect to the introduction of word recognition and comprehension.

TeachTown

Whalen, Moss, Ilan, Vaupel, Fielding, Macdonald, Cernich & Symon (2010) conducted a study based on the TeachTown intervention, which is a CAI program that provides computer lessons and natural environment activities for students with autism between the ages two to seven years old. The computer lessons were designed on the principles of apply behaviour analysis (ABA) therapy. The program incorporates a variety of images to assisted generalizations, and provides "verbal instruction . . . and the student clicks on the correct response from a field of 3 to 8 choices" (Whalen et al., 2010, p. 183). Forty-seven students between ages three to six with an eligibility of autism participated in this study who were assigned to a treatment group (22 students) and a control group (25 students).

The program is individualized to allow the student to progress through the curriculum at his or her own pace. The program allows for teachers to "share information with the families and other educational team members and for the child to be able to use the program at home and in numerous additional learning environments (e.g., the speech language pathologist's clinic, daycare, home, et cetera)" (Whalen et al., 2010, p. 185). Students who did not participate in the TeachTown program followed a classroom structure associated with the TEACCH and ABA approach, programs generated to facilitate learning for students with learning disabilities. The results of the study "support the idea that CAI may be an effective and practical tool for teaching several types of skills to children with ASD in a classroom environment" (Whalen et al., 2010, p. 190).

The advantages of CAI in the school environment are that the treatment delivery of the programs can meet the needs of each student, and data can be collected quickly based on the student's progress. In addition, the instruction can be met with minimal training and is effective, and provide detail data to help teachers' analyze students' development, through positive computer based reinforcement. Lastly, "computers can be highly motivating for children, resulting in increased attention to task, increased positive social behaviours, and decreased problem behaviors" (Whalen et al., 2010, p. 193).

Emergent Literacy Skills Teacher Led Instruction and Computer Assisted Instruction

Travers et al (2011) compared the effectiveness of a traditional, teacher-led instruction (TLI) model with computer-assisted instruction by focusing on teaching alphabetical skills to a group of seventeen preschool students between the ages of three and six years old with autism. The study was conducted in nine preschool classrooms across districts in Southwestern United States. A special education teacher along with two paraprofessionals taught each class and each

classroom included at least one computer. A variety of instruments were used, including a Brigance Diagnostic Inventory of Early Development-2 to measure student's knowledge of the letters and recording systems were used to track student attention and engagement. Teachers used checklists to measure "teacher adherence to the treatment in both instructional conditions" (Travers et al, 2011, p. 329).

For the teacher-led lessons, the teachers used alphabet books where each book focused on a specific letter. The teacher read each book to the students for 10 minutes daily, four days per week for a period of four weeks. The TLI lesson was taught as whole group. Alphabet book lessons were created randomly using 80% of the letters that the students had difficulty identifying at the pretest. Teachers asked each child to point to a specific letter and the child was give a few seconds to response. The teacher would provide immediate feedback. Teachers were given specific instructions including, how to respond to a question and when to move onto the following page.

For the CAI condition, a software program called *Runtime Revolution: Media Version* was designed especially for the study. When the program was designed, positive qualities of educational software found in other studies were taken into consideration, such as "promotes, small teaching sets, correction strategies, and repetition" (Travers et al, 2011, p. 331). These features appeal to students with autism. The program included games to use as reinforcements when a student properly identified a letter. Each student received individual training on how to use the program. Once the student knew how to navigate the software, the teacher would set up the student on the computer and the student was left independently to complete their assigned task. Significant main effect for CAI were indicated over time. CAI was successful to increase student recognition of each letter, as did TLI. However, the qualities used to design the

computer program were incorporated into the alphabet book during TLI. It may appear that these qualities are difficult for all teachers to consistently incorporate into their daily teaching (Travers et al, 2011). During the TLI, the teachers were instructed of what exactly to say and how to say it and this may have impacted the effectiveness of TLI. The TLI and CAI lessons were effective, easily incorporated into the daily routine and required little teaching resources. Each teaching instruction provides the teacher with the opportunity to choose which method would better suit the classroom need. A student with autism can easily be left independent on the computer, while the classroom teacher can perform other duties.

Research Limitations

A common limitation identified among most of the studies conducted was the sample size, relatively small and male dominated, with very few female groups of participants. Secondly, there was a generalization made throughout the research based on the level of comprehension for the population of students with autism. For instance not all students learn at the same level, some students with autism may be more visual learner, whereas others may be more auditory. There was also an inconsistency in stating the various levels of learning which each of the participants were able to achieve. The studies on reading comprehension for students with autism are few and limited, therefore providing minimal form of comparison among reading comprehension and technological support, specifically for students at the elementary level. Due to the lack of empirical research available, teachers may not have sufficient resources to support reading comprehension for students with ASD, which is wearisome since the IDEA and No Child Left Behind Act encourage educators to use research supported methods. The studies also were limited by the possible discrepancies of responses that the children with autism provided.

Conclusion

Computer assisted instruction is a practical approach for teaching literacy skills to students with ASD. In addition to benefits discussed above, CAI also indicates "an increase in the learning rate, an increase in students working independently on the computer, and an increase in curiosity, improved attention and social behavior" (Williams et al., 2002, p. 74). Students with ASD are responsive to visual teaching techniques and CAI provides several opportunities to adjust visuals according to individuals' needs. CAI can be used to "individualize instruction by selecting difficulty settings appropriate for a particular student's ability level" (Ramdoss, Mulloy, Lang, O'Reilly, Sigafoos, Lancioni, Didden, & Zein, 2011, p. 1307). Research argued the social deficits are minimized due to less interaction between student and teacher and those students with ASD "might benefit more from literacy instruction if they do not have to simultaneously engage in social interactions with the teacher" (Ramdoss et al., 2011, p. 1307). The benefits of CAI have also shown that students with ASD are responsive to computers, which could make academic learning more pleasant for the student with autism through the use of computers. CAI also increases student motivation by "providing a context for the learner that is challenging and stimulating" (Traynor, 2003, p. 137).

In order for students with autism to develop literacy skills, it is best for the student to be placed in an inclusive classroom with pupils in the same age group (Chandler-Olcott & Kluth, 2009). Students with autism can be integrated into the regular education classroom without "changing the culture of those classrooms" (Chandler-Olcott & Kluth, 2009, p. 556). There are several benefits for the teachers and the non-labeled students in the inclusive literacy classroom. Benefits include expanding one's definition of the concept of literacy, "multiple ways of participating in classroom life are valued, and instructional planning focuses on outcomes and

not activities" (Chandler-Olcott & Kluth, 2009, p. 548).

The notion that individuals communicate differently is emphasized depending on the individual with autism. The instruction of the classroom has shifted from formal, explicit teaching to active participation and socialization (Chandler-Olcott & Kluth, 2009). Whole class read aloud have been found to be powerful tools in the classroom because they model fluent oral reading. Role-playing and storytelling are examples of multiple modes of representation in literacy and aid an individual with ASD to construct narratives. The inclusive classroom has taught individuals that "every child strengths the literate community" (Chandler-Olcott & Kluth, 2009, p. 555). Research has identified that the presence of individuals with ASD in the generalized classroom, has improved literacy learning for all students (Chandler-Olcott & Kluth, 2009, p. 548).

In order to finalize our research review, a teacher's manual has been developed to provide the elementary school teacher with guidelines of how to use technology to promote reading comprehension. The teaching manual is intended to guide the teacher how to use and integrate some of the research based computer assisted instruction, such as Baldi, EWW, TeachTown and PowerPoint. An additional computer program, K5 Learning has also been included because it reinforces the strategies implemented in the programs discussed in the literature review.

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Teacher's Manual

Rationale

The main goal of this teacher's manual is to provide elementary school teachers with a basic foundation of how to use technology in the classroom in order to promote literacy skills, specifically reading comprehension. Technology has become such a predominant part of our students' lives; students are growing and developing alongside technology. Students are drawn to technology and research has shown to have positive affect towards the use of technology and academic motivation. However, technology can be a scary concept, all that it encompasses. Some teachers may feel uncomfortable or hesitate to integrate technology into their teaching practices. The feeling of being overwhelm is one that can often be associate when creating lessons to promote learning and incorporate technology. Some teachers may feel the opposite, the processing of including technology into their lessons may be easy and stress free. There is no need to fear technology we should all as teachers embrace it! A method that truly has produced positive results for teachers and students, so why not incorporate something that actually works!

Like our students, sometimes teachers often need a toolbox or a helping hand in order to guide them on the right track. The purpose of this teaching manual is to provide teachers like you and I, with a manual of strategies in addition to simple, effective, and easy to use computer programs in order to increase reading skills. Although, the manual was developed from a body of research focusing on high functioning students with autism, the programs and teaching suggestions can certainly be applied for all students.

We hope this teaching manual will encourage you, as it did for us to open the possibility of incorporating new methods to teach literacy with technological resources.

Teach to put a smile, encourage a thought and support inquiry,

Maria Vaccaro and Lisa Morello

"If we teach today as we taught yesterday, we rob our children of tomorrow"—John Dewey

Computer-Assisted Instruction Programs

Baldi

iBaldi

Compatibility: iPhone, iPod touch, and iPad. Requires iOS 5.1 or later

Purchase:

The application can be accessed and purchased through iTunes stores from anyone of the devices mentioned above.

Direct link: https://itunes.apple.com/us/app/ibaldi/id504464546?mt=8

Price: $1. 99

Description:

The application is to help students listen and develop comprehension skills and emotion associated to a computer animated tutor called Baldi or Baldette. The animated characters are a 3D depiction of real life and accurate mouth and facial movements to show believable and

human accurate emotions for students who have difficulty comprehending and speaking; Baldi and Baldette provide students with accurate facial movements in accompany with the text being read. The application is a great tool for students on the autism spectrum, Baldi and Baldette are language teachers for students who need extra guidance; the tutors help students learn, comprehend and encourage speech output through this interactive application.

iBaldi provides users with the feature to import text and have the animated tutors voice the text that was imported. The texts can be saved to be accessible at any time, and Baldi's facial and emotional output can be control within the settings of the application. The application provides a great tool for teachers, parents and children to access Baldi anywhere and at any given time through the programs easy accessibility.

These are images of what the application looks like for the iPhone or iPod Touch version:

Image 1:

The pictures showcase how the animated characters would look and be shown to individuals that use the application. Your student has the option to use and set up Baldi or Baldette through full facial and mouth recognition or an intricate and detail version demonstrating the exact movement an individual's mouth makes when using speech. This intricate and detail depiction is an amazing tool to allow your students to make a connection of the mechanics speech output.

Image 2:

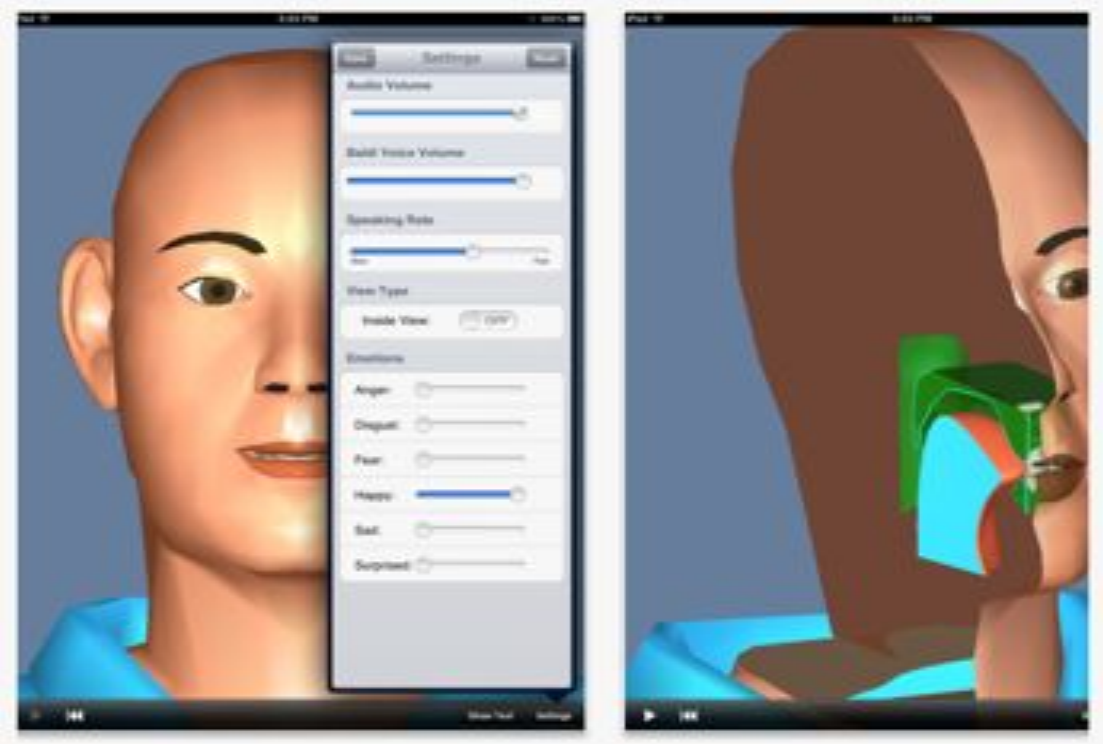
The following screenshots provide an example of how you can change the setting to best suit the needs of the student using Baldi. The application provides a clear explanation of the purpose and use of the program. As seen the settings can be adjusted to show a variety of emotions and can be adjusted to provide your student with the intensity of emotions. Baldi's speaking rate can be altered to fit the student's needs, adjustments can be made by simply moving the horizontal scroll towards slow or fast. The inside view can be easily accessed by sliding the icon on or off.

These are images of what the application looks like for the iPad version of iBaldi:

Image 3:

The iPad version of iBaldi provides users with the same accessibility to facial and emotional recognition as the iPhone and iPod Touch application. The iPad application allows for your students to have access to a bigger version of iBaldi, for some individuals this enhancement is beneficial and allows the student to concentrate.

Image 4:



The iPad can be an incredible interactive tool to use within the classroom for teachers. The iPad can be connected to the classroom SmartBoard, so students can have an interactive session with Baldi. Tthe program may be presented individually or within a small group session of students at the same level. Baldi is helpful within a one on one setting, and can provide teachers with a reinforcement tool for students within the classroom.

Baldi Match: 99 Nouns for Kids

Compatibility: iPhone 3GS, iPhone 4, iPhone 4S, iPhone 5, iPod touch (3rd generation), iPod touch (4th generation), iPod touch (5th generation) and iPad. Requires iOS 5.1 or later.

Purchase:

The application can be accessed and purchased through iTunes stores from anyone of the devices mentioned above.

Direct link: https://itunes.apple.com/us/app/phonics-with-baldi/id543100694?mt=8

Price: $1. 99

Description:

The application is produced in a form of a game to encourage learners to engage in a matching game developed to reinforce phonetic awareness and make reading interactive an enjoyable. The computer animated characters Baldi and Baldette show children accurate speech movements, and encourage retention of phonemes associated with the words shown. The computer animated tutors are available to help guide students and facilitate their learning process

through an interactive matching game. The difficulty of the game and features associated with the computer animated tutor can be adjusted within the setting of the application. The tiles for matching can range between easy, medium and hard.

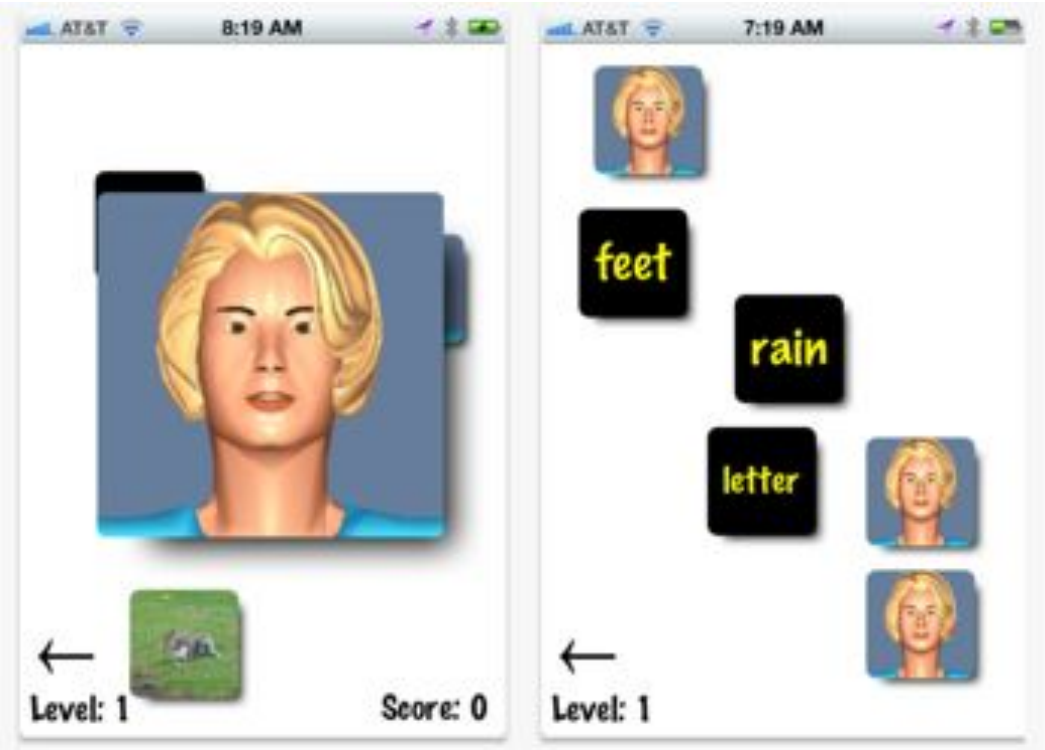
The game provides users with the ability to select the number of paired tiles that are shown, this is really helpful for teachers to adapt the matching game to their student's needs versus a generic, and concrete number of matching tiles. As well as when the user continues on to the various levels, the tiles can also be adjusted, and if teacher or student wants to make additional changes they can simply select the main menu and will be redirected to the home screen of the program.

The application allows for the user to control the settings as follows: voice aspect of the program allows for control of the tiles auditory feature. |When the user selects the tile voice feature that can be activated by touch, and voice can be turned off if student wants to practice pronouncing the words on his or her own.

Teachers and students can benefit from the amazing feature that the program's animated characters can display, which is the inside of the tutor's mouth. This helps students with pronunciation and providing an accurate depiction of one's movements associated with pronouncing words, the settings of the application also allows for the characters movements to be adjusted (slow to fast).

These are images of what the application looks like for the iPhone or iPod Touch version:

Image 5:



The tiles show the animated tutor's facial expression when the student selects a tile. The tutor can voice the words or simply allow the student to voice the words on his or her own. Levels can be adjusted throughout the game, if the teacher would like to add more tiles, or voice associated to the tile the adjustments can be made.

Image 6:

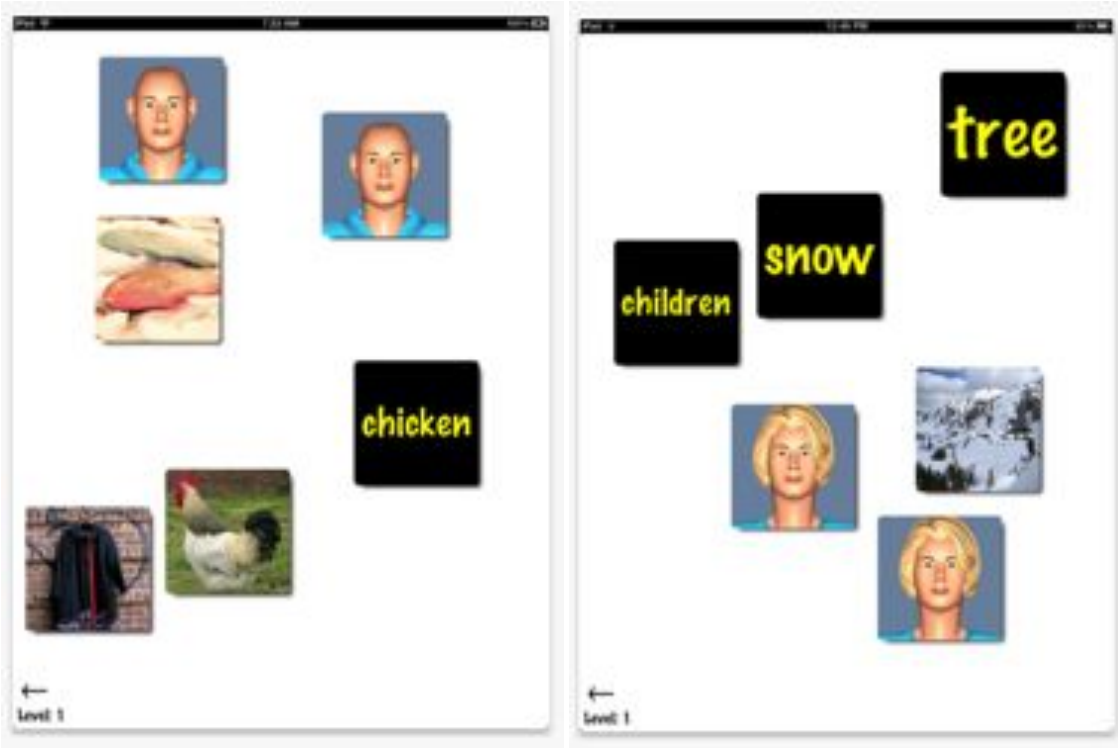
Adjustments for the tiles, voice, and tutor can be made in the settings, as well as a reset button if you would like your student to be working with the original setting of the application. The alterations are similar to the previous Baldi application; they are straight forward, and user friendly.

Image 7:

Real images of the words are shown to help students make a visual connection, and the students may be given rewards throughout the game; this option is also in the settings and is easily accessible.

These are images of what the application looks like for the iPad version:

Image 8:



Same as the iPhone or iPod Touch application the iPad version allows for users or administrators to adjust the setting accordingly to the needs of the user. Students and teachers can adjust the settings accordingly and easily.

Image 9:

The iPad can be integrated into your classroom and allows for a more hands on experience with nouns. Students can use this application to encourage word recognition and gain strategies of how the words are pronounced as well as written. The progress can be monitor by the teacher.

Phonics With Baldi

Compatibility: iPhone 3GS, iPhone 4, iPhone 4S, iPhone 5, iPod touch (3rd generation), iPod touch (4th generation), iPod touch (5th generation) and iPad.Needs iOS 5.1 or later.

Purchase:

The application can be accessed and purchased through iTunes stores from anyone of the devices mentioned above.

Direct link: https://itunes.apple.com/us/app/phonics-with-baldi/id543100694?mt=8

Price: $1. 99

Description:

The following application is set to provide learners with an engaging and entertaining matching game to help students read. The computer tutors Baldi and Baldette provide accurate

speech movements, and showcase the speech maps into letters. The program allows for speech and written letter recognition.

Allowing the students to visually and physically participate in the breakdown on phonemes provides a great tactic in increasing phonetic awareness for students with learning difficulties. The matching game has features that can be controlled as the previous applications, for instance selecting between the two different animated tutors, allowing for the speed of speech, and encourages students to partake in this wonderful learning experiences with rewards for accomplishing the game. The rewards can be removed to be used at a later time, not to discourage learners from playing.

Like the Baldi's Match: 99 nouns for kids application administrators of the application can adjusted the matching cards, the option of selecting Baldi or text, as well as the level (easy, medium, difficult). Through the settings the volume of speech can be controlled and each specific word card can emit speech or can be turned off.

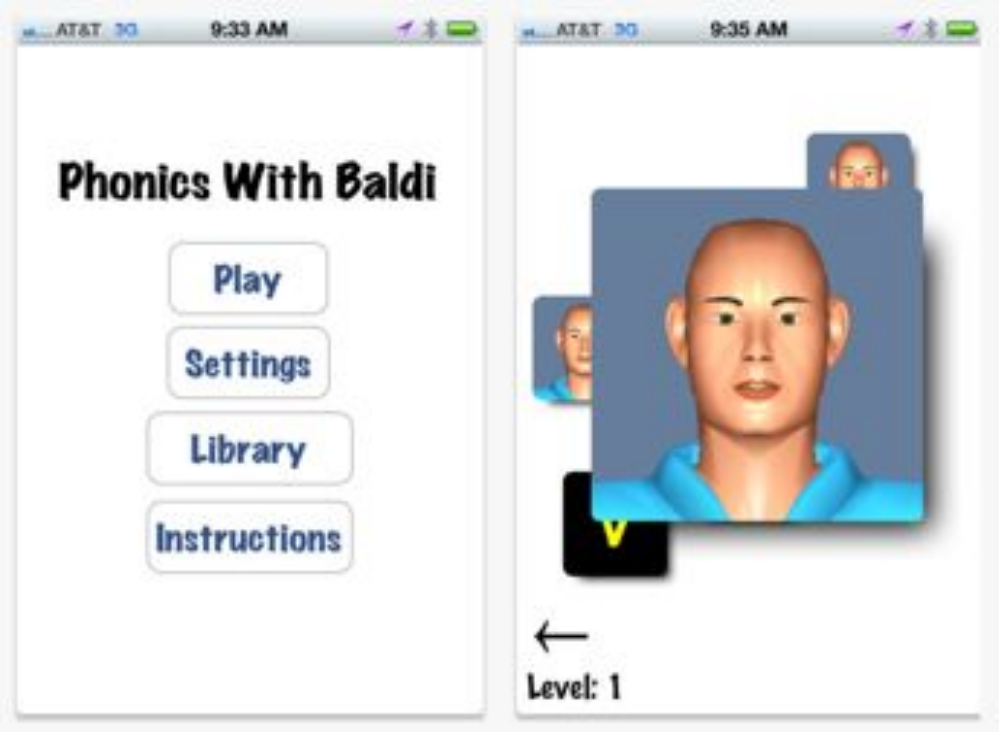
An additional option presented in this application is control of the animated tutors speaking rate, and displaying the mouth of the computer animated character. By displaying the mouth this allows for students to gain a visual representation of pronunciation of words. The tutor also depicts several emotions associated with the game; this is specifically beneficial for students who are on the Autism Spectrum who may have difficulty making the connection between facial or auditory representations of emotions.

A specific feature that provides excellent reinforcements of phonetics is the library section. The library provides administrators and users with the ability to search and discovery the different letter combinations for pronunciation through a dictionary. Students are able to

visually and hear the various letter combination for phonemes within a word. This is an amazing opportunity to encourage participation of letter and reading comprehension.

These are images of what the application looks like for the iPhone or iPod Touch version:

Image 10:

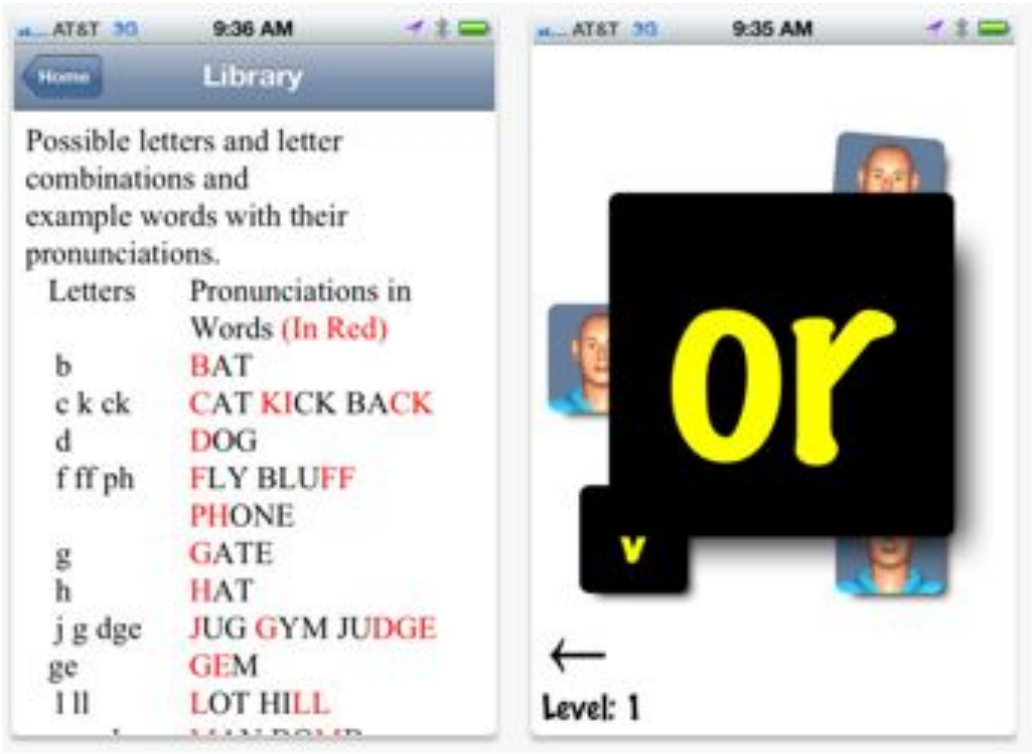


The iPhone and iPod Touch application is shown as follows; when the program is opened the teacher or student can select from four tools (Play the game, adjust the setting, library and instructions. The application is straight forward and allows for students to be actively involved in the words phonemic breakdown, with the adjustments appropriate for the learner.

Image 11:

The adjustments to the computer animated tutor as mentioned for the prevision applications can be altered with the settings. The application is easy and simple to readjust according to your student's needs.

Image 12:



The library feature encourages students to look up the letter combinations that exist and the program allows for examples of how the words can be pronounced. This tool allows for phonemic breakdown of words that your student can relate to, as well as make connections with.

These are images of what the application looks like for the iPad version:

Image 13:

The following iPad screen shot shows an example of the instructions associated with the program. Teacher have access to a detailed text of instruction, library feature, and the various emotions that can be shown through the animated tutors Baldi or Baldette.

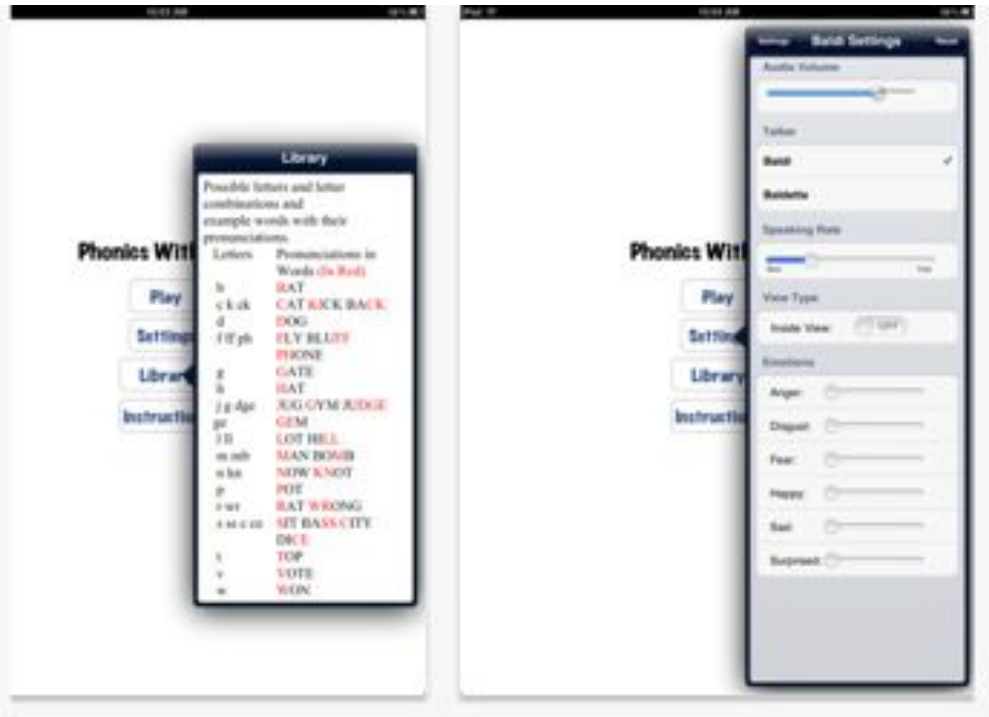


Image 14:

Examples of how the animated tutor will be presented throughout the application.

Teachers can decide if the tutor is shown or has speech output with the letters shown.

TeachTown

Welcome to TeachTown, within this program your students will be greeted at the beginning of the session with a Town map. The map provides students with five buildings to choose from. Each building has a specific lesson and subject that was preselected by you. Student selects one of the 5 building to start their lesson. When the student has selected the lesson he or she can start to focus on the subject presented. TeachTown allows you to monitor student's results and curriculum by the data presented from pre-test, training exercises, and post-test of the program.

Image 15:

The Student Experience

Image 16

: **The Student Experience**

The sessions themselves allow for a beginning, middle, and end. When the student has selected the correct answers the program provides the learner with positive feedback, but if the student selects the incorrect answer no auditory feedback is provided.

Image 17:

If your student continues to answer incorrectly TeachTown automatically starts to fade out the incorrect images to help your student select the right answer. This is an amazing strategy without instilling pressure on your student!

Image 18:

As the student begins to answer correctly, the answers begin to fade back. This is a fantastic way to slowly ease the student back into making choices. This option of the fade back only happens during training exercise. When your student provides 3-5 correct choices a reward is provide to encourage and motivate his or her learning. Animated computer games or cartoons provide your student with 15-40 second reward session. This allows for students to have a well deserved interlude.

Image 19:

Once the reward session has been completed the student automatic goes back to the session he or she was working on. When your student has completed the lesson he or she will be navigated to the TeachTown map and may proceed to select another building. The amount of lessons the student completes depends on you! You control the lessons and time associated to those the lessons allotted to your student.

Image 20:

You do not have to worry about closing the session or boring the young learner, once the sessions that you have allotted are completed TeachTown ends automatically. TeachTown map appears and the town gets dark, and an animated voice declares “Goodnight TeachTown”, indicating the end.

What does the program offer you as a teacher if purchased?

TeachTown: Basic Classroom combines computer lessons with offline activities for students who are developmentally 2 to 7 years old. Automatic data tracking and reporting system allows teachers more time for individuals attention with heir students, and addresses early learning standards and IEP goals

Cost: $300.00 a year per student

Includes: Basic software disc, 300 downloadable generalization lessons, online video tutorials, and administrator quick start guide, online access to TeachTown stuff.

Option 2: TeachTown: Basics Home Edition

Includes: 500 computer lessons, over 300 downloadable off computer activities, dozens of animated games and awards, download reference guide, automatic data collection.

Cost: $29.95 monthly a year per student

WAIT!!! There is an Alternative TeachTown provides administrators, teachers, and parents with the opportunity for a 30 day free trial. This allows you as the teacher to distinguish if the program is suitable for your student.

If the cost is still too pricey and your school does not have funds to purchase TeachTown, the program offers funding and grant options at the following links**:**

Websites:

- http://web.teachtown.com/products/teachtown-basics-classroom
- http://web.teachtown.com/products

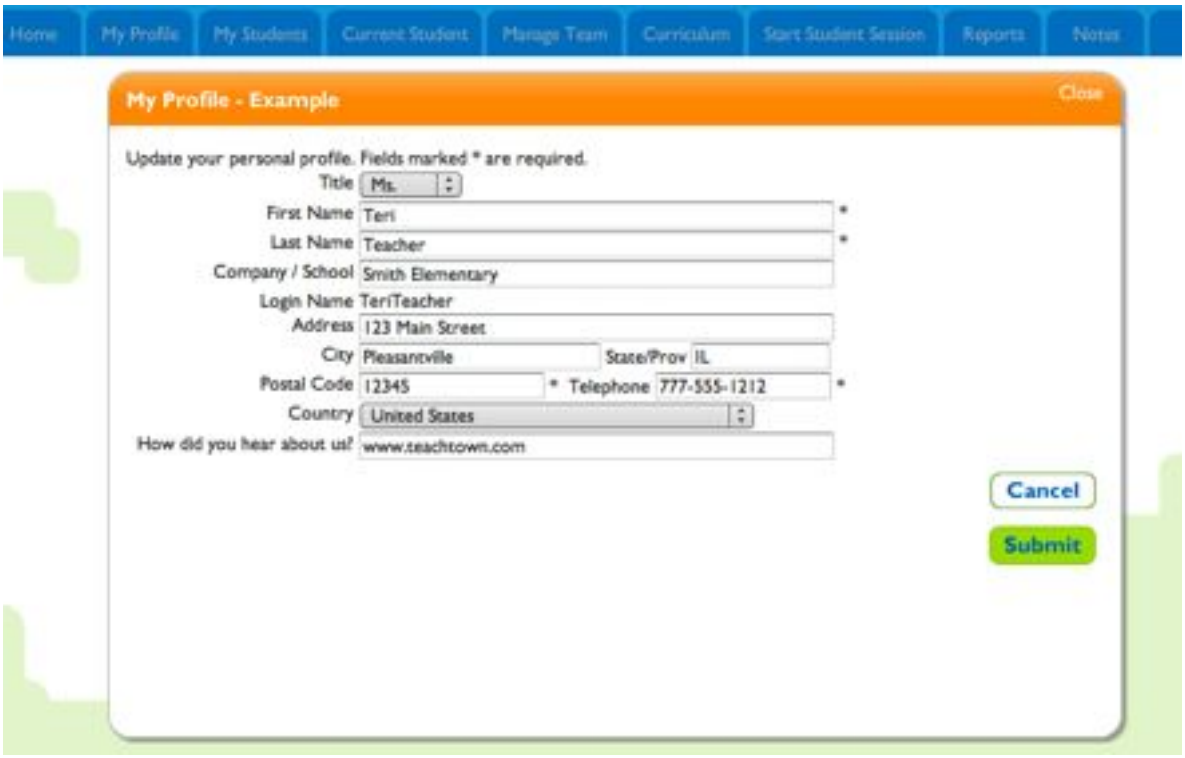
How does the teacher have access to teach town?

The manual provides you with a Step by step Demo view of the TeachTown program:

The program requires that you enter information about your student, and as an administrator you have access to all the students you register onto TeachTown.

What can be seen by the Demo view:

Profile



The teacher information is available for editing and TeachTown allows for billing information to be edited as well, for instance if the parents of your student feel like the program would benefit their child at home, they can provide their child with a monthly subscription.

My Student

:

You have access through the dropdown menu My Students for TeachTown to showcase all students, active students, in active students or add students. Throughout the program on the right hand side an “i” will appear, this provides you with information based on the task bar that you have selected.

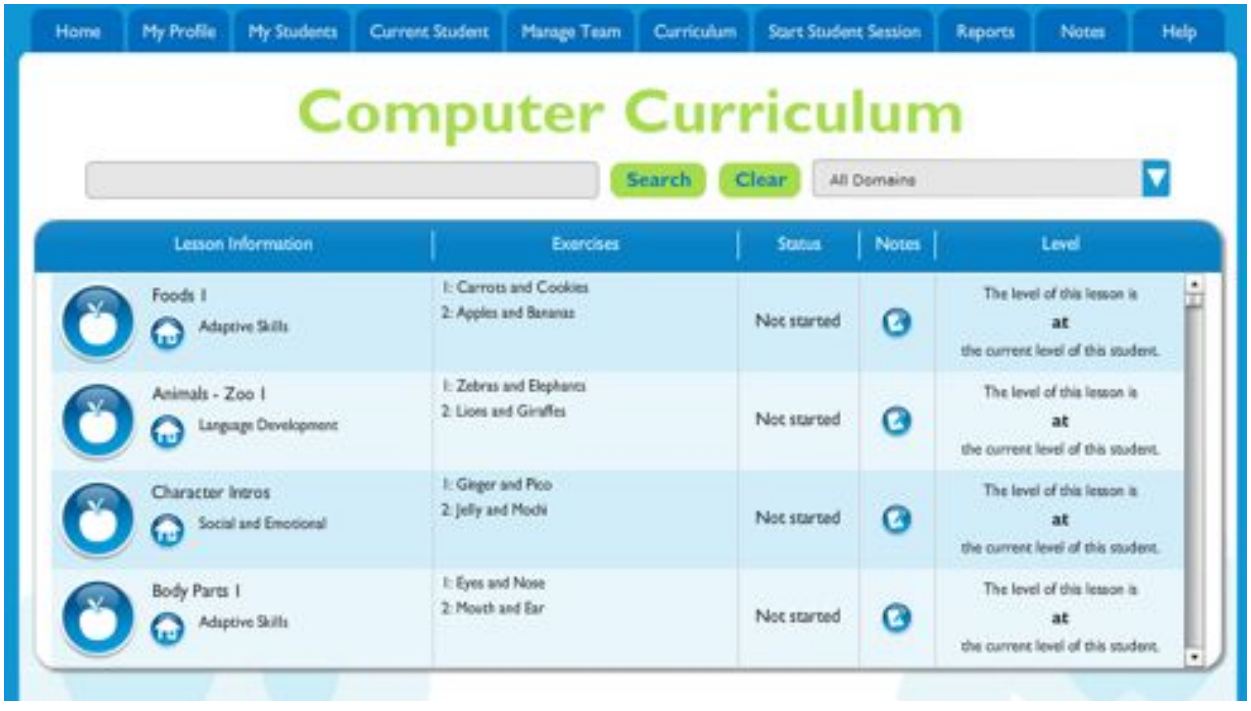
Manage Team:

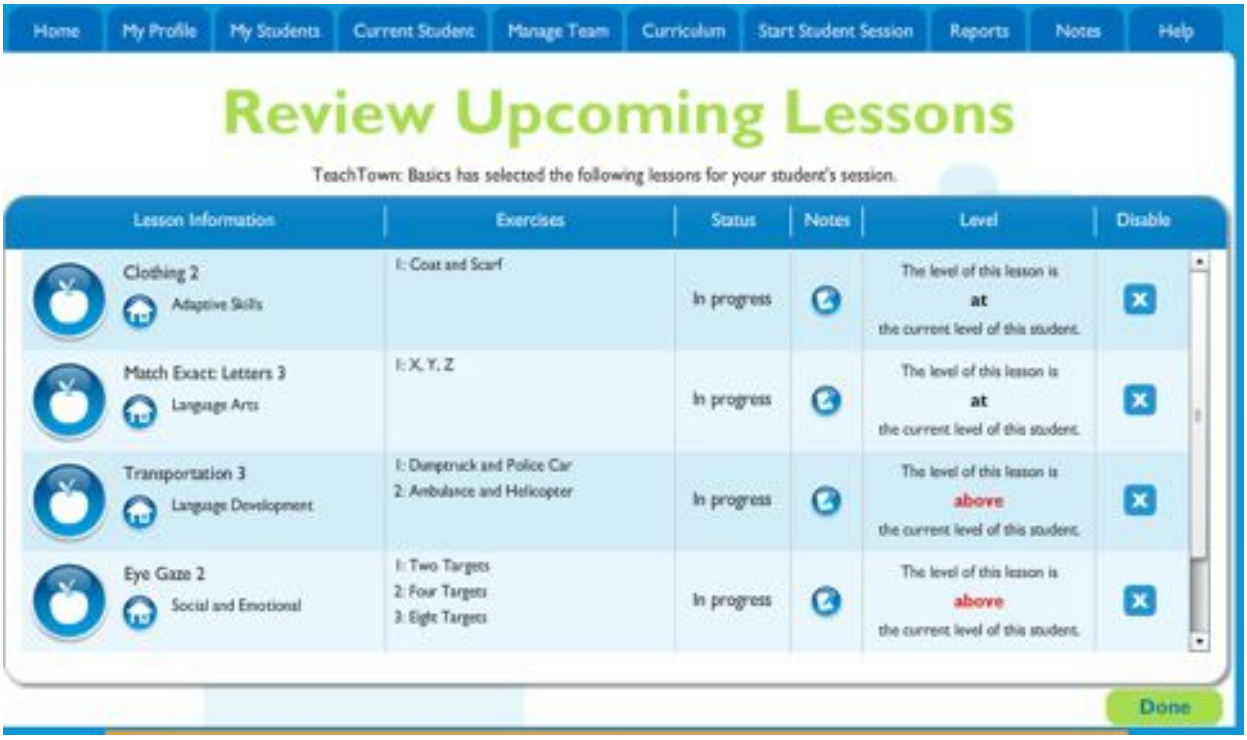
The students team can be managed as well, this may include as many facilitators that you want, child care worker, partner teacher or parent. The team management section allows for students to be transferred as well. This means that once you no longer work with the student you may transfer the student to another facilitator, an amazing tool to ensure the student's progress is being monitored and maintained.

The curriculum can be adjusted to your student's learning abilities as well. The taskbar includes curruiculm dropdown menu that indicates view computer lessons, choose facilitator selected lessons, and view of computer activities.

Curriculum:

The following screen shots show you how each section of curriculum would be shown.



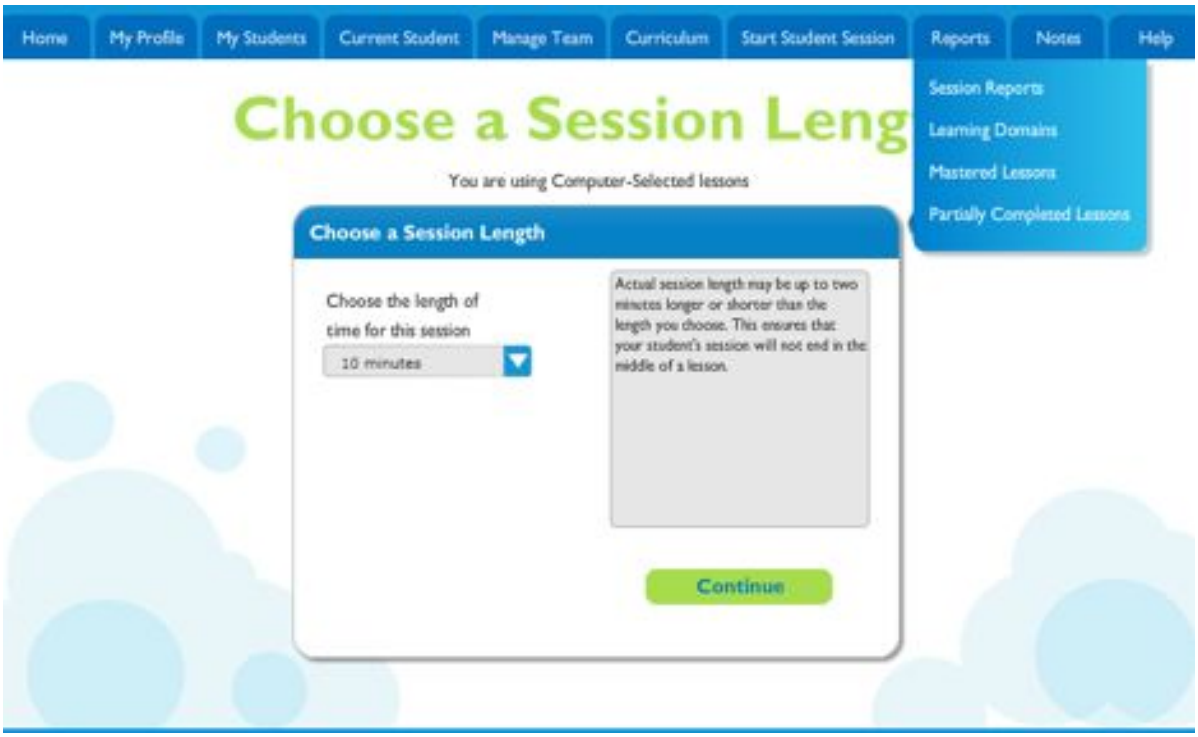


The following partially completed lessons shows you the progress of your student, and what he or she has completed.

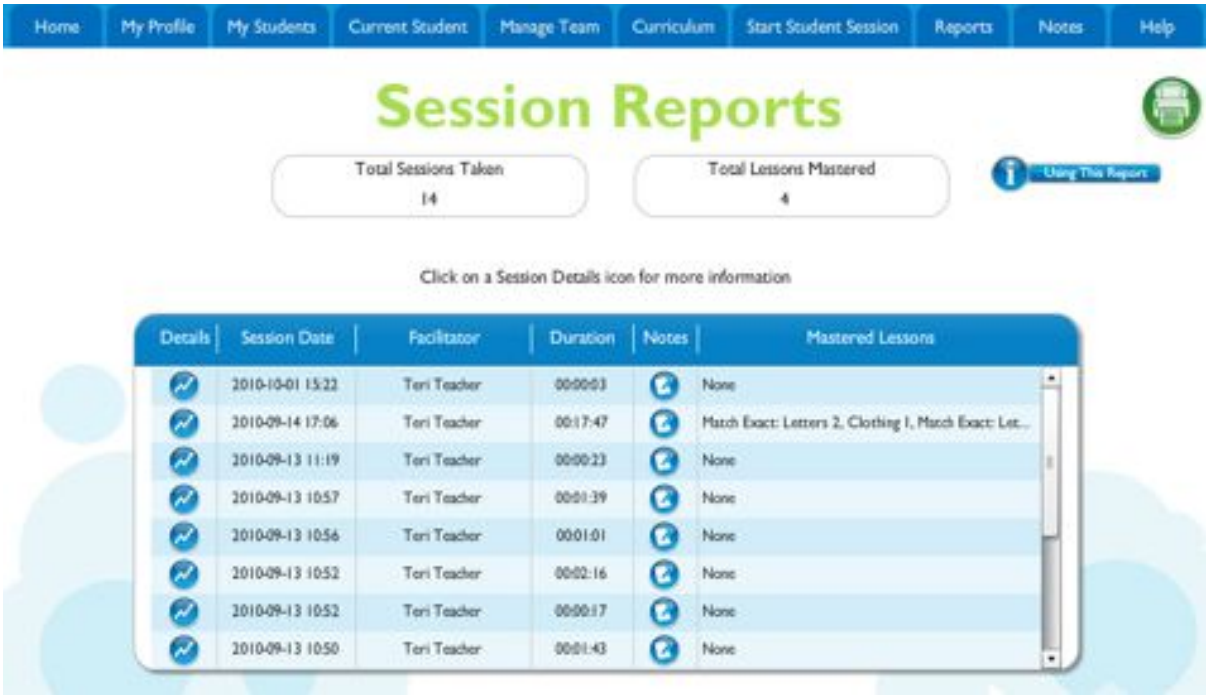
Student Session:

As mentioned within the student section of how the program works, you the teacher have the ability to manage the length of time given for each session. Students can work on sessions based on their own capabilities and not have to be anxious of completing a task quickly and with overwhelment.

Reports:



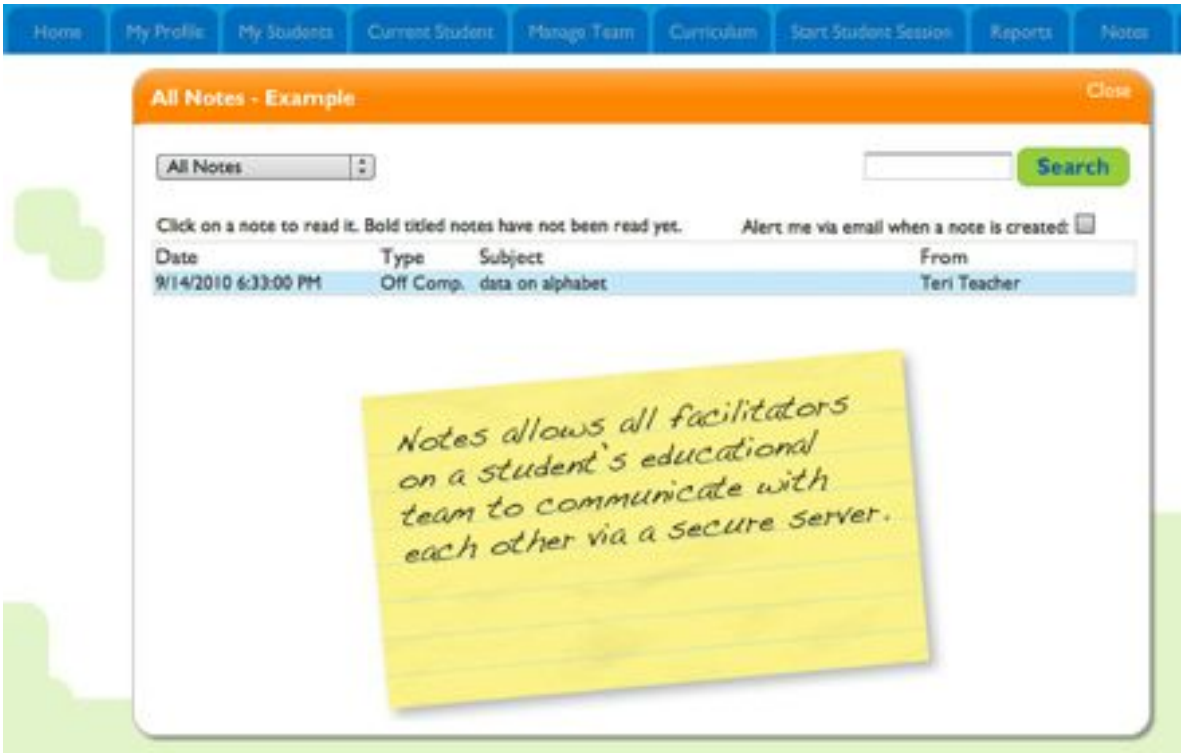
The reports sections allows you to keep track of your student's progression within the lessons suggested for his or her learning. The student's reports are detailed by the date, who was the facilitator, how long the session took and the material covered within the lesson.



Learning Domains

Learning domains are also shown and provide you with the level at which your student stands for each of the following domains: Adaptive Skills, Cognitive Skills, Language Arts, Language Development, Mathematics, and Social and Emotional.

Notes:



You can also leave notes throughout the lessons for your fellow facilitators in your team to communicate.

Getting Started:

Lastly, you will prepare your student to start his or her session. If you need to go back to the main menu do not forget that you can always click on the home button on your taskbar.

Enjoy your TeachTown sessions!

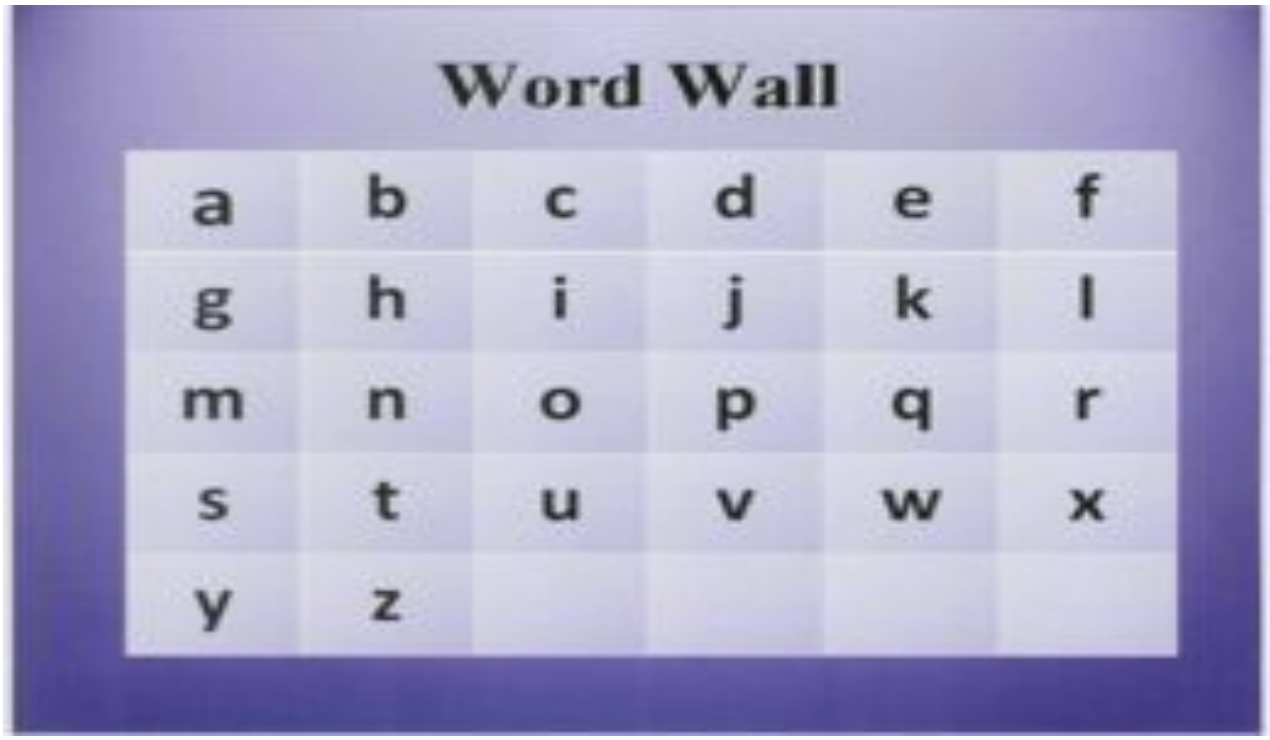
The E-Word Wall

An individual can walk into almost any elementary school classroom and find a word wall displayed somewhere in the classroom. Whether the word wall includes bright colors, black and white writing, or large fonts, the word wall is usually displayed for every student in the class to use. A word wall can be a useful tool for students to provide "an interactive, ongoing display of words and/or parts of words, used to teach spelling, reading and writing strategies, letter-sound correspondence, and more" (Narkon, Wells, Segal, 2011, p. 40). However, how the teacher uses and integrates the word wall into the classroom's learning experience depends on the individual's teaching style.

E-Word Wall (EWW) can be described as an interactive version of the traditional word wall. The EWW is a "digital-based instructional tool that provides the option of creating individualized, portable, engaging, manageable, and multisensory word study for students" (Narkon, Wells, & Segal, 2011, p. 40). The overall purpose of an EWW is for each student to access their own individual word wall that was designed especially for their own individual learning needs.

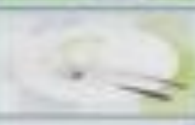
The EWW can easily be designed using Microsoft's PowerPoint program. The first page of the interactive word wall includes the 24 letters of the alphabet in either upper or lower case letters. The student can select and change the background color, font size, and writing style according to their individual preference.

Image 21:



The student selects a letter of the alphabet, for example the letter “D” and a new slide appears with the list of words alphabetized accordingly. The image 22 is an example of what a child may be presented with. The table can be organized accordingly; including the letter of the alphabet selected the word, a picture of the word and the word used in a sentence. An audio component can easily be used to hear the pronunciation of the word and the word being used in a sentence. The sentences can be changed and adjusted according to the student’s learning needs and style. Words, pictures and sentences can be removed and added whenever necessary.

Image 22:

d	dog		The dog is sleeping.
d	duck		The duck is dancing.
d	deer		The deer likes to eat grass.
d	dish		The dish is empty.
d	dollar		Do you see the one dollar bill?
d	dig		You need a shovel to dig.

Creating Your Own E-Word Wall

Creating your own EWW is simple and eventually, the learner will be able to create and manage their very own personalized EWW. The step-by step procedures that are provided are generalized and may slightly change depending on program being used. Narkon, Wells and Segal (2011) have identified and explained the five steps of how to create an EWW.

Step 1: Creating the Alphabet Chart

1. Once the PowerPoint program has been opened, your first slide will become your E-Word Wall Alphabet Chart.
2. You will need to select a different slide layout for your first slide. Using the slide layout menu, left click on the Title Only layout option. Type

"Word Wall" in the title box. Select a font color and a size of your choice.

3. To create the Alphabet Chart beneth your title, left click on the Table icon and select a 6 column by 5 row grid. Insert this title table into the body of the slide, sizing the table to fit the page.
4. Now center the letters of each cell by highlighting the entire chart and left clicking on Align: Center on the tool bar.
5. Type in the letters of the alphabet on the chart with one letter in each cell.
6. Now you can add the letters name and sound for each letter, if you like. Select Insert from the tool bar with a left click. On the drop down menu, point to Movies and Sounds and left click on Record Sound. Type the letter in the Name box and then click Record. When you are finished recording, click Stop and then click OK. A second icon appears on the slide. Place your cursor over the sound icon. Hold down in the left mouse button and drag the icon to the cell with that letter.

Step 2: Creating a Template for the Individual Alphabet Pages

1. Create a New Slide.
2. Using the slide layout menu, left click on the Blank layout option.
3. To create the grid for the alphabet pages, left click on the Table icon and select a 4 column by 6 row grid. Insert this table into the body of the slide, sizing the table to fit the page. Leave approximately 1 inch of space beneath the table.
4. You will need to change the size of the columns on your table. Realign the column

spacing by placing the cursor on the first column line and dragging it so that the first column is just large enough for the letter of the alphabet.

5. In the same manner, resize the remaining columns so that the second column is large enough to hold the vocabulary word, the third column is large enough for a relevant picture, and the last column is large enough for a sentence describing the picture.
6. To center the content in the first three columns, highlight them on the chart and left click Align: Center on the tool bar.
7. The sentence column (fourth column) will need to be left justified. Highlight that column and leftclick Align Text; Left Justify on the tool bar.
8. You will now place action buttons on the bottom of the individual alphabet pages in the E-Word Wall to navigate between them and the Alphabet Chart. To place a button on the bottom of the slide, first select Autoshapes from the drawing tool bar. Then from the options menu, select the Action Button: Home (shaped like a house) from the grid with a left click. Move your cursor, now appearing as a crosshair locator, to the center bottom of the slide and left click. From the menu that appears, be sure that Hyperlink To First Slide is selected and left click on OK at the bottom of the menu. Size the action button to fit on the center bottom of the slide.
9. You will now place an action arrow on the bottom right corner of the alphabet page to move forward to the next page. To create the forward arrow, select Auto shapes again from the drawing tool bar. From the options menu, highlight Action Buttons and select the Action Button: Forward or Next with a left click. Move your cursor, now appearing as a cross hair locator, to the bottom right side of the slide and left click. From the menu that appears be sure that Hyperlink To Next Slide is selected

and left click on OK at the bottom of the menu. Size the action button to fit on the bottom right corner on the slide.

10. Repeat the same process to select the Action Buttons: Back or Previous arrow to allow navigation to previously viewed pages. Place this button on the bottom left corner.

Step 3: A Template to Make The Entire Alphabet Pages for the E-Word Wall

1. To create each individual alphabet page from the template you've just created, place the cursor on the template slide in the slide sorter on the left side of your screen. Right click on the second slide to reveal the drop down menu. Select Copy.
2. Place the cursor in the slide sorter directly below the previous slide and right click for the drop down menu, left click on Paste.
3. Continue to follow this process until you have 17 template pages. Now you need to label each slide with a letter of the alphabet. Go back to the second slide and type in "a" in the top left corner cell. On the third slide, type in "b" in the top left corner cell. Continue through your slides until you have labeled one page for each letter of the alphabet. You should have a blank template page for your final slide which you can use to insert new pages when needed.

Step 4: Creating the Links in the E-Word Wall Alphabet Chart

1. Go back to the initial Alphabet Chart and highlight the first letter of the alphabet.
2. On the tool bar, select Insert then Hyperlink. Left click Place In This Document and click on the slide you want to link to.
3. When you are back on the alphabet chart, your letter should be underlined, and it may have changed color.

4. Follow this process for each letter of the alphabet on the chart, linking each letter to the appropriately labeled individual alphabet page.

Step 5: Filling in Your Chosen Vocabulary on The Alphabet Chart

1. In the second column, type in the vocabulary word.
2. To add the sound of the word, select Insert from the tool bar with a left click. On the drop down menu, point to Movies and Sounds and left click on Record Sound. Type in the word in the Name box and then click Record. When you are finished recording, click Stop and then click OK. A sound icon appears on the slide. Place your cursor over the sound icon. Hold down the left mouse button and drag the icon to the cell with the word.
3. To add an appropriate picture that can be used as a visual cue for the vocabulary word, select Insert from the tool bar. On the drop down menu, point to Picture and then select Clip Art or From File if you have a photo you would like to use. Paste the pictures in the third column and size to fit the cell.
4. In the fourth column, type a sentence that describes the picture that includes the vocabulary word.
5. To add the narration of the sentence, select Insert from the tool bar with a left click. On the drop down menu, point to Movies and Sounds and left click on Record Sound. Label the sentence in the Name box and then click Record. When you are finished recording, click Stop and then click OK. Place your cursor over the sound icon. Hold down the left mouse button and drag the icon to the cell with the word.
6. If you would like the students to have the opportunity to practice typing the word and adding another sentence for additional multisensory practice, leave a blank row

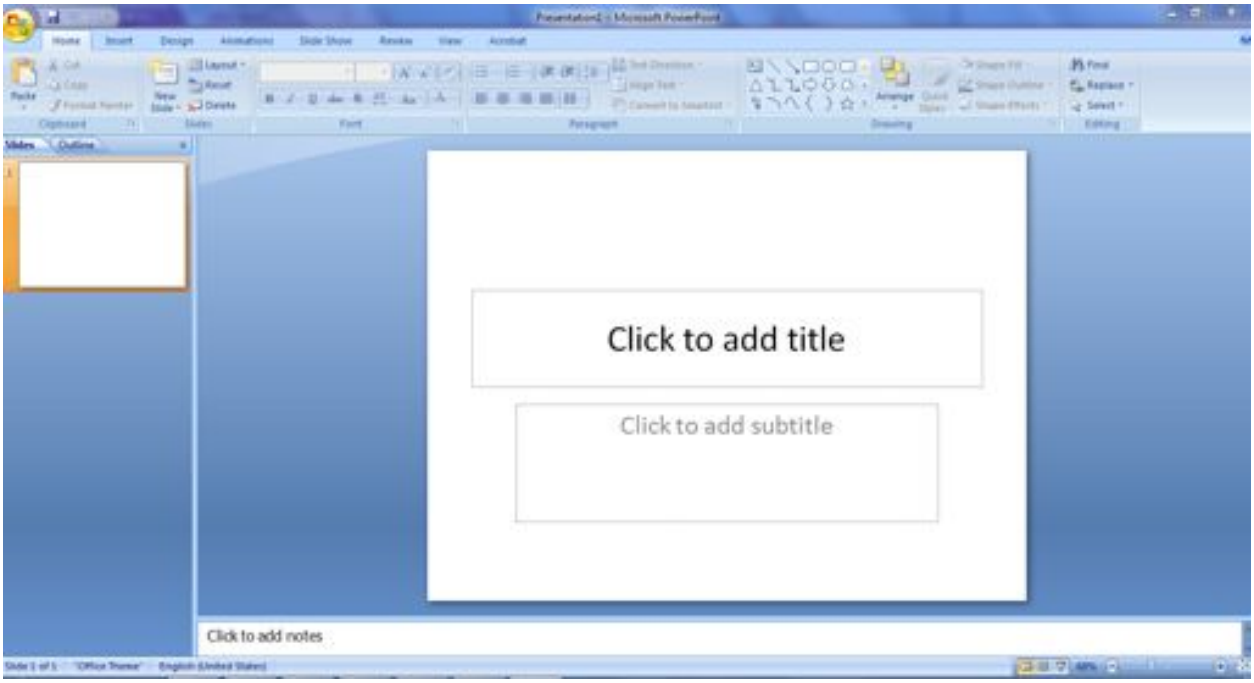
between vocabulary words.

7. Follow the previous steps to add additional words to a page.

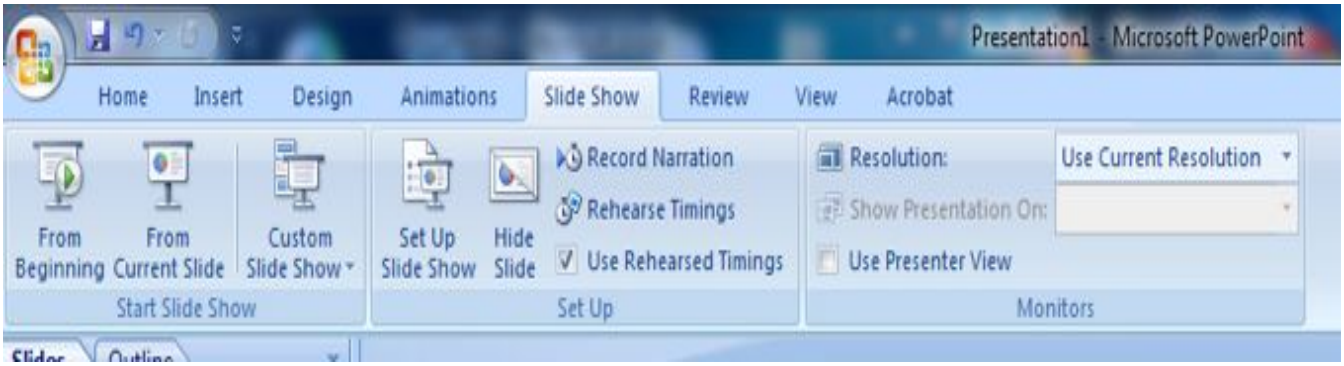
PowerPoint Software

A simple, easy and cost efficient program to encourage your students to learn is PowerPoint from Microsoft. You can select the words that you want your student to learn and with the voice output option you can easily provide your learner with the phonetic breakdown of the word. There will be an easy step by step depiction of how your PowerPoint may look like.

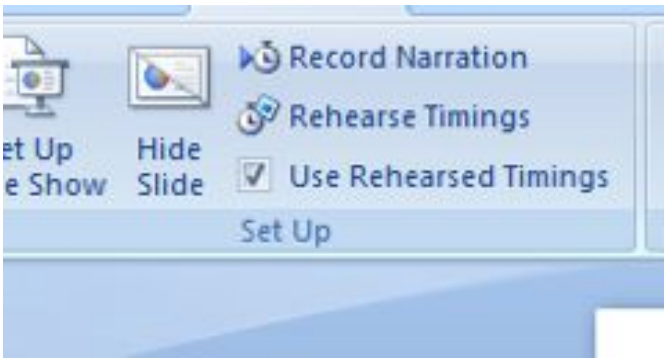
Step 1: Active participation from your student.



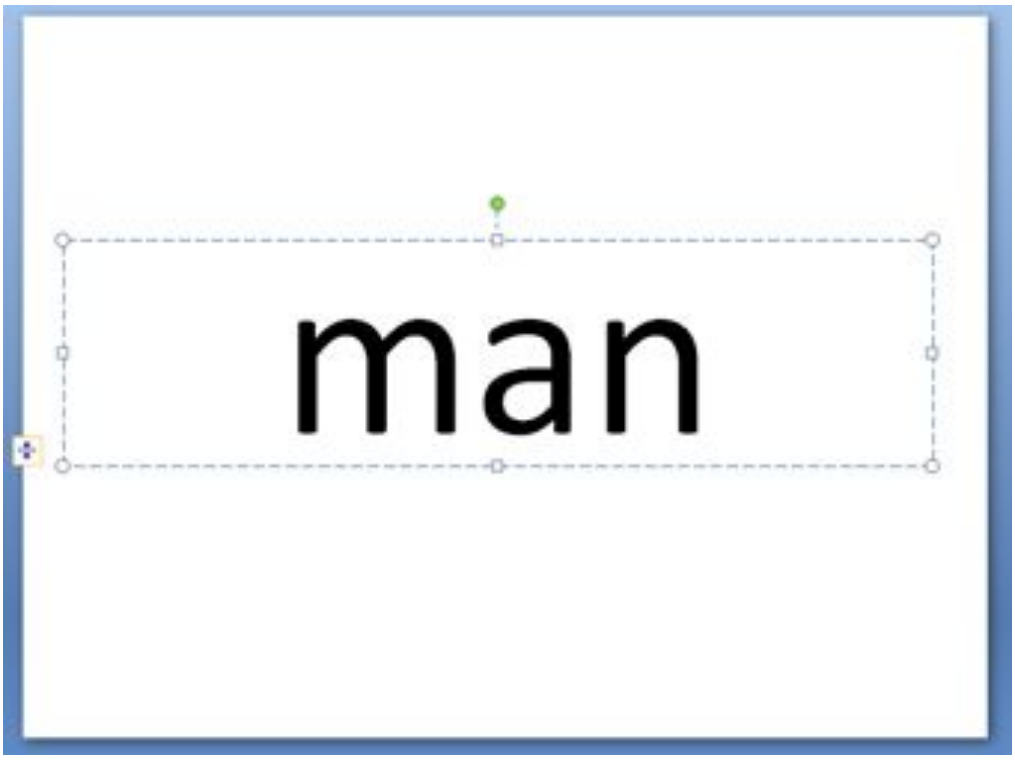
The word that you have selected can be written on the PowerPoint slide. Once the word has been written you can add your own voice for your students to follow. There is an option to have the sound play automatically or with a click; this all depends on how and what best suits your learner's needs. On the top of your toolbar you can select Slide Show, record narration on each slide with time management.



The following image will be shown. By clicking on record narration, rehearse timings all can be adjusted for your slide show.



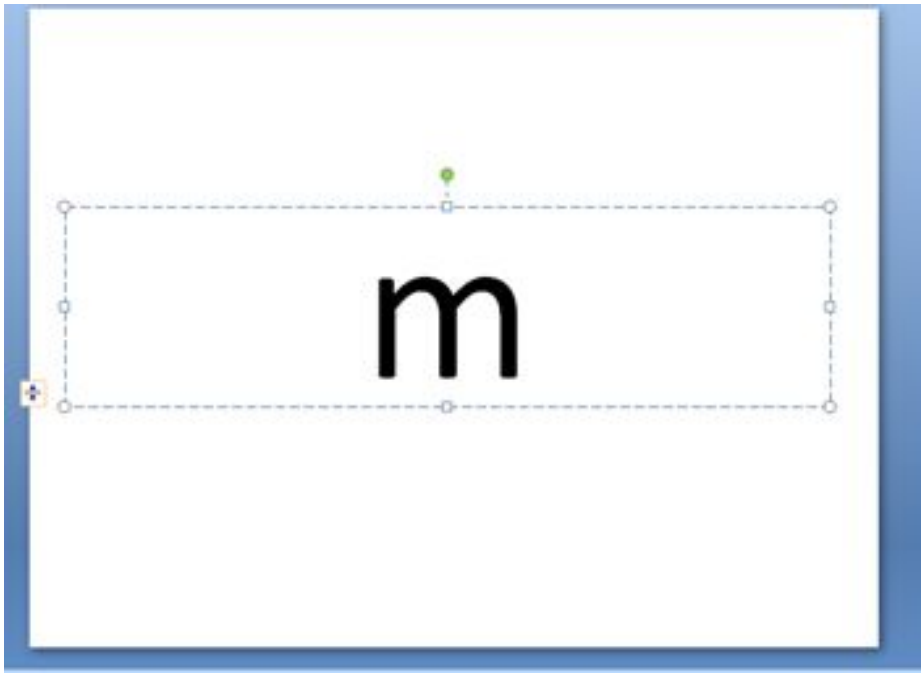
Your first slide should look and include a voice output that says “Let’s look at this word together. Say this word with me slowly. mmaann.”



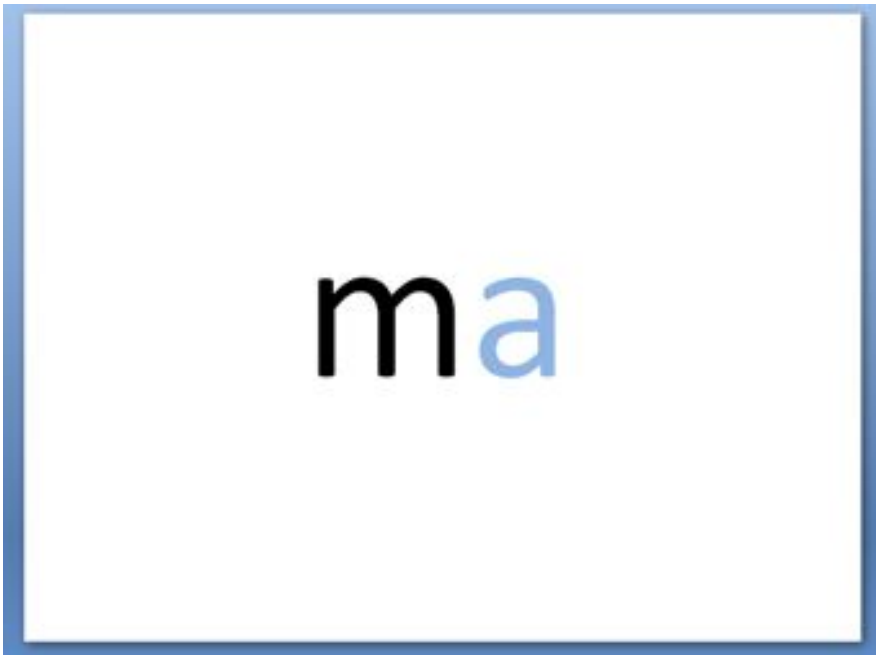
Step 2: Internal Speech

Throughout this step your student uses his or her internal speech and practices each sound individual with the help of your voice recording. The slides are timed to be activated one after the other without a break. As mentioned above this option is available in PowerPoint, and allows for your student to have a clear breakdown of the word they are learning to pronounce and understand.

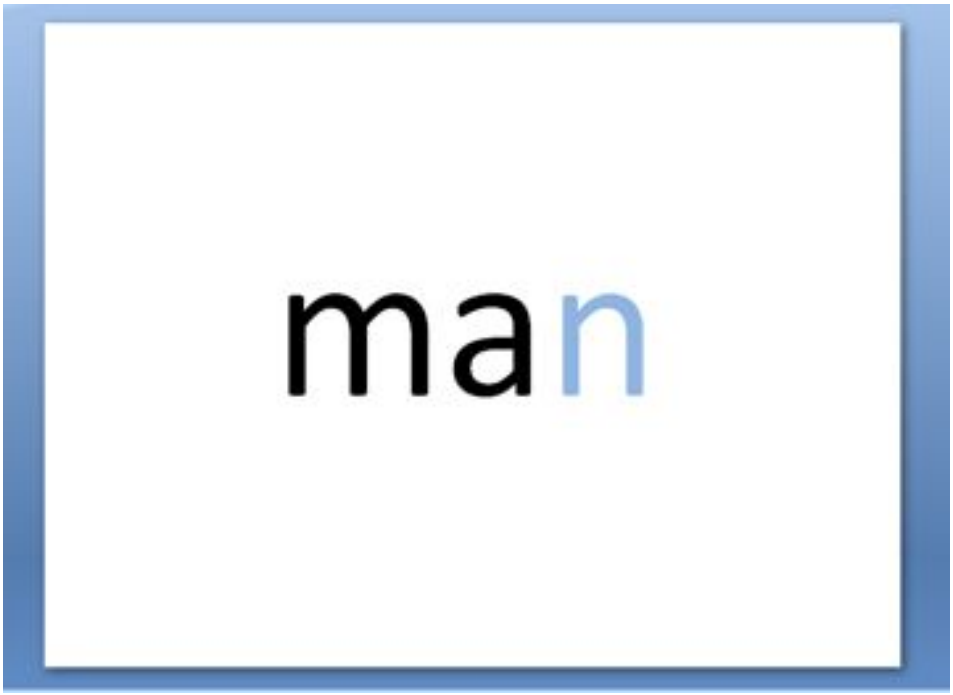
The audio for this slide will include your voice indicating “Now, say this sound in your head, mmm”



The audio will continue automatically with your voice to include the following sound "…aaa…"



The same will be done for the next sound "…nnn…"



Step 3: Pronunciation of the word slowly using internal speech.

Your student will be guided by your voice output to slowly say the word internally. The audio you can input state the following, “In your head, say this word slowly. Do not stop between the sounds. mmmaaannn”.

Step 4: Pronunciation of the word quickly using internal speech

Your student will continue on to the next slide and hear a prompt (your voice) saying "Now, in your head, say this word fast. Man." This allows the student to get a clear view of the composition of the word he or she is learning.

Step 5: Reinforcement

The last slide you can copy paste a picture that encourages your student to participate in more PowerPoint word slides. The pictures may vary according to your student (favorite character or favorite toy etc.). The final slides allow you to provide a visual and auditory reinforcement to your student "Good work", "Excellent" and "Great".

You got it! There you have it, you can produce your own PowerPoint for each word that you want your student to learn and comprehend. The PowerPoint slides are amazing tools that can be tailored to meet the needs of your learner. Here is a simple and inexpensive tool that can help any student in your classroom; especially those with learning difficulty become aware of a

words phoneme. Phonetic awareness is extremely important for students reading fluency and reading comprehension.

K5 Learning

What is K5 Learning?

K5 Learning is an online interactive program that is intended to enrich reading skills and mathematical concepts especially for students in kindergarten to grade 5. K5 Learning is ideal because students work at their skill level, as opposed to their grade level. K5 learning is beneficially for slow learners, high functioning autism, dyslexic, students with ADD/ADHD and those students who are learning English as second language.

Basic Overview of Curriculum

Reading. The "reading curriculum is based on the instructional guidelines laid out by the National Reading Panel" focuses on the 5 key reading skills (K5 Learning, 2010).

1. Phonemic Awareness
2. Phonics
3. Sight Words
4. Vocabulary
5. Reading Comprehension

Each lesson begins with an interactive tutorial appropriate for each student's level. The program is designed to continually generate a positive response from the learner. The learner is encouraged to work independently.

Spelling

Students are provided with word lists based on their grade level, skill level, past quizzes and specific goals. Visual images and large print fonts are used to increase visual representation of a word. Misspelled words are correct with cues, hints in comparison to low scores.

Mathematics

The overall goal for the math curriculum is to increase mathematical fluency, reach a level of mastery for basic operational skills and above all develop student confidence in math. The math curriculum focuses on:

- Numbers and Operations,
- Measurement,
- Geometry,
- Algebra
- Data Analysis.

Free Trail and or Subscription and Associated Costs

The full entire K5 Learning is offered for a free 14-day trail. However, if a parent decides to purchase the program for one child it either costs $25.00 per month or $199.00 for the year. To register additional students costs $15.00 per month or $129.00 for the year.

A Guide Through K5 Learning

A teacher or parent can sign up and create a separate username and password, one for the learner and the other for parent. K5 learning allows the parent to have access to monitor, receive progress updates and assessment results based on the performance of the learner.

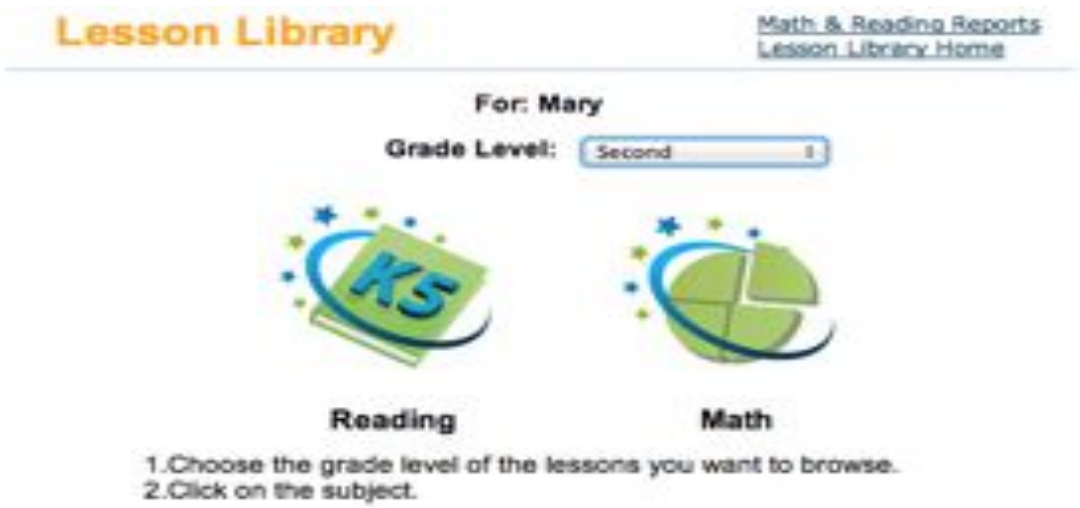
The login-in page is free from distracting advertisements and the user-friendly log in screen provides simple navigation from the parent log in, to the student log in to the K5 Learning home page.

In the parent section of K5 Learning, one can access and view the learner's information with access to:

- Viewing reports
- Assign reading and math lessons

- Add spelling words
- Change spelling sections

In this section, parents can change a student's grade level, assign lessons and view the learner's progress.



Once the parent selects the icon Reading, a table is provided with the lesson group, time and number of lessons. The lessons are divided according to the 5 key reading skills and then broken down accordingly. The parent has the option of selecting the lesson that best matches the learner's needs. Lessons do not need to be completed in a particular order. The lessons listed below are specific to the reading curriculum designed by K5 Learning for a grade 2 student. Please note that not all lessons are listed.

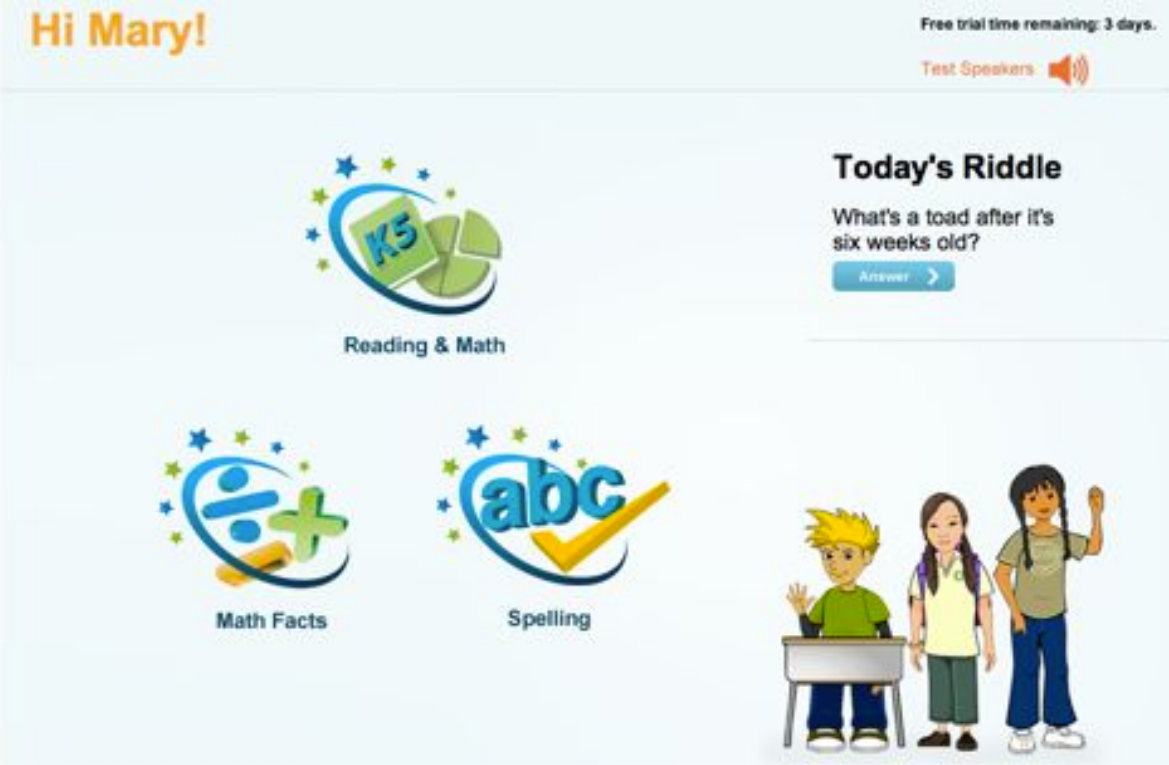
Mary Second Reading

Ready to customize your child's instruction? Select lessons and then click on this button. ASSIGN LESSONS View Assignments

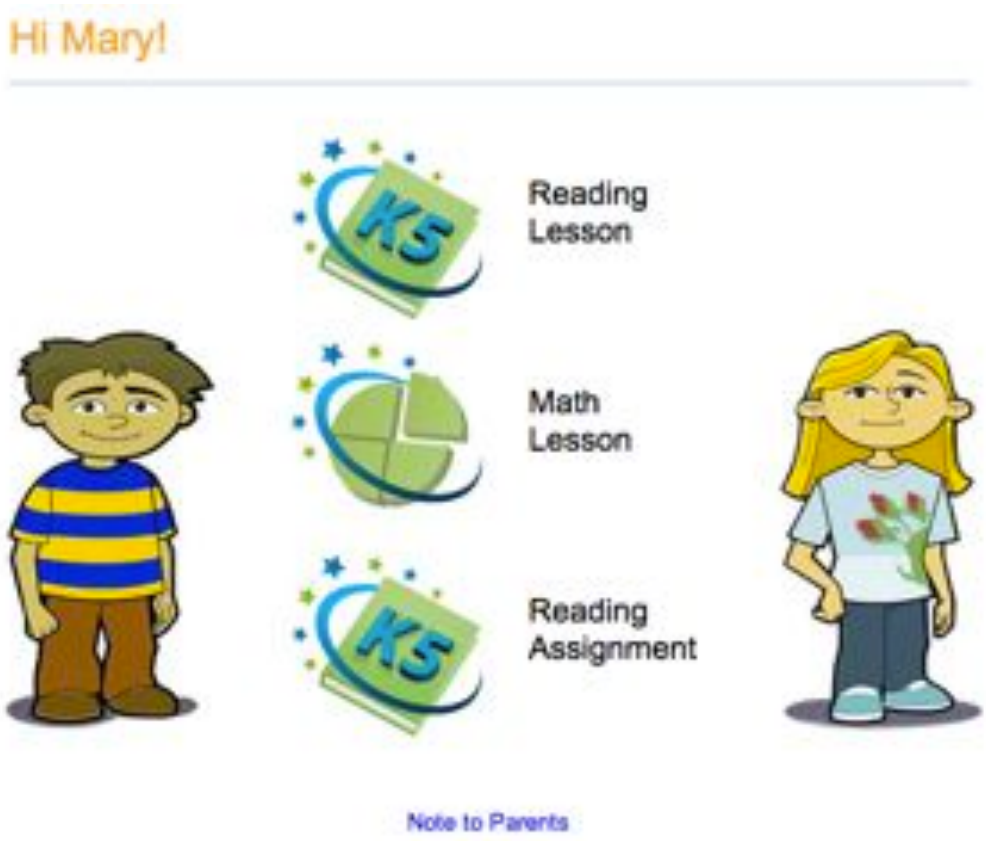
Reading - Second Grade

Select	Lesson Group	Time	# of Lessons
☐	Basic Sight Words - Set 1 - Volumes 1 - 4	1 hr 6 min 12 sec	4
☐	Basic Sight Words - Set 2 - Volumes 5 - 8	1 hr 13 min 35 sec	4
☐	Grammar: Sentence Identification	8 min 55 sec	1
☐	Phonemic Awareness - Addition	28 min 45 sec	1
☐	Phonemic Awareness - Blending	26 min 30 sec	1
☐	Phonemic Awareness - Categorization	27 min 50 sec	1
☐	Phonemic Awareness - Deletion	24 min 35 sec	1
☐	Phonemic Awareness - Identity	33 min 15 sec	1
☐	Phonemic Awareness - Isolation	26 min 5 sec	1
☐	Phonemic Awareness - Rhyming	22 min 20 sec	1
☐	Phonemic Awareness - Segmentation	31 min 30 sec	1
☐	Phonemic Awareness - Substitution	29 min 15 sec	1
☐	Phonics - Consonant Digraphs	19 min 45 sec	1
☐	Phonics - Diphthongs - Volumes 1 - 3	1 hr 20 min 59 sec	3
☐	Phonics - R-Controlled Vowels - Volumes 1 - 4	1 hr 30 min 45 sec	4
☐	Phonics - The Tricky Word Strategy - Volume 1	32 min 15 sec	1
☐	Phonics - Vowel Digraphs - Volume 1	36 min 30 sec	1
☐	Reading Comprehension - Author's Purpose	37 min	1
☐	Reading Comprehension - Cause & Effect	34 min 43 sec	2
☐	Reading Comprehension - Compare & Contrast	30 min 37 sec	2
☐	Reading Comprehension - Drawing Conclusions	9 min 32 sec	1
☐	Reading Comprehension - Fact and Opinion	11 min	1
☐	Reading Comprehension - Main Idea	6 min 15 sec	1

Once the student logins into their account, the learner is shown the main page with three separate icons: Reading and Math, Math Facts, Spelling. The learner clicks on the appropriate icon. For the purpose of this manual, only one icon "Reading & Math" will be explained.



Once Reading & Math is selected, the student is brought to the secondary page. The secondary page contains three icons: Reading Lesson, Math Lesson and Reading Assignment. The student will select Reading Lesson and a new window opens.



In the Reading Lesson section, the parent has selected the option for the learner to focus on phonetic awareness. Through an audiotory explanation, the learner is first provided with an explanation of the lessson and then is able to practice. As the learner is listening to the explanation, the words spoken are highlighted and a curser is used to point to the words as well. In the activity shown below, the student must fill in the blank using the correct word. The focus of this lesson is to recognize and listen for the R controlled vowels - er/ir/ur.

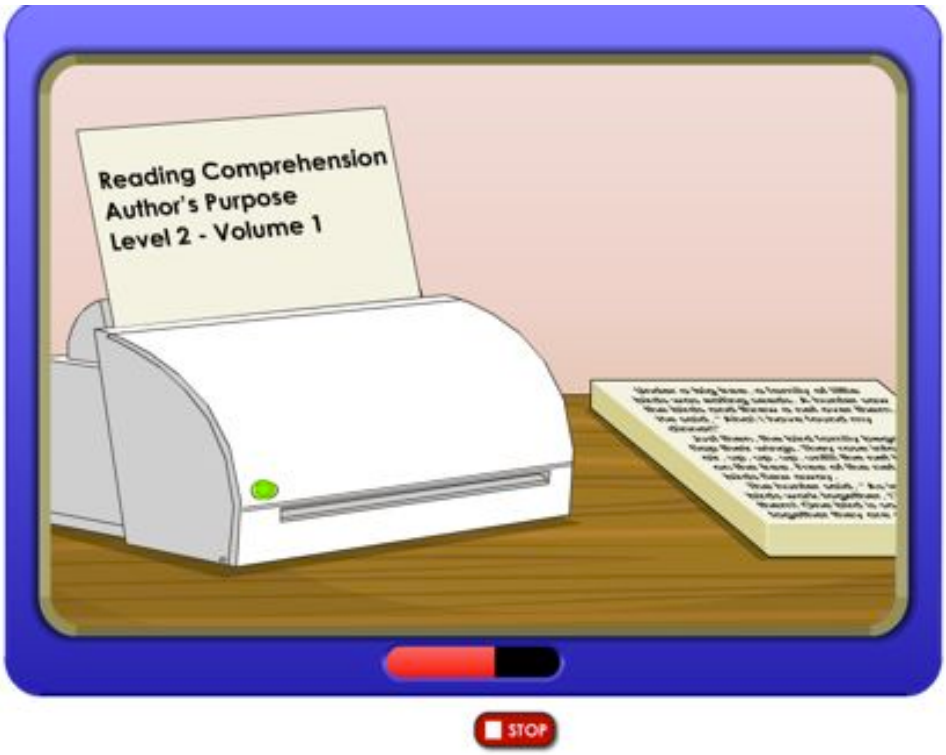
Image 23:

When the learner has completed the series of activities for the particular lesson, the learner can play a short game as a reward for completeing the activities. Once the game has ended, the student is given the option to either continue or stop the lesson. If the student decides to end the lesson, the window automatically closes and the secondary window remains opened.

Image 24:

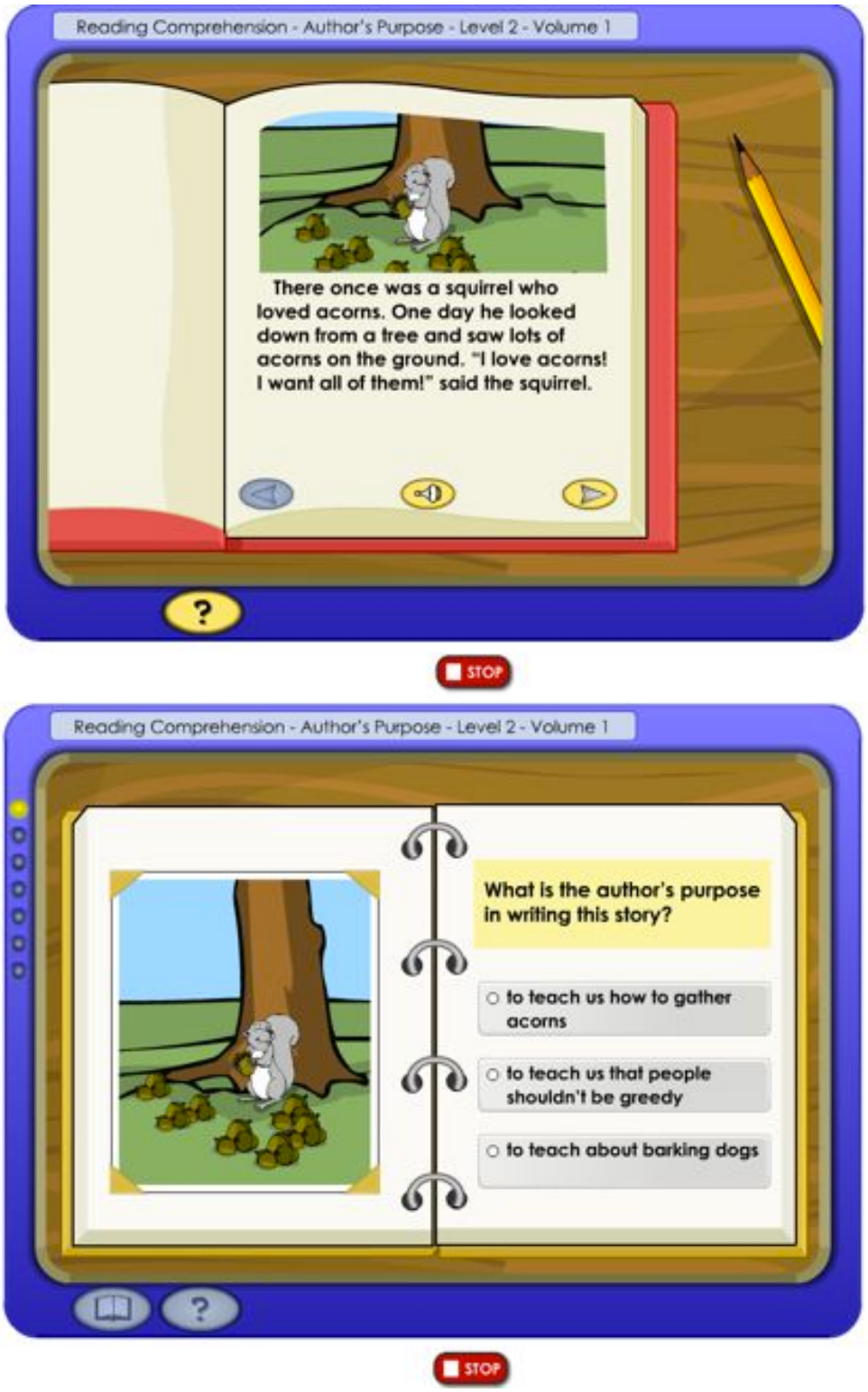
The second icon on the secondary page is reading assignment. The student will select reading assignment and a new window opens. For this section, the parent has selected what the learner will focus on. For this activity, the learner is to focus on the author's purpose of the story.

Image 25:



The learner is provided with a short explanation of the purpose for reading the story. The student can select the option to either have the story read to them as the words are highlighted or the student can read the story on their own. The student can turn the pages forward or backwards by simply clicking on the bottom arrows. If the student needs help or a replantation of the instructions, they can click on the question mark button.

Image 26:


Reading Comprehension - Author's Purpose - Level 2 - Volume 1
There once was a squirrel who loved acorns. One day he looked down from a tree and saw lots of acorns on the ground. "I love acorns! I want all of them!" said the squirrel.
STOP
Reading Comprehension - Author's Purpose - Level 2 - Volume 1
What is the author's purpose in writing this story?
to teach us how to gather acorns
to teach us that people shouldn't be greedy
to teach about barking dogs
STOP

Once the story is finished, the student is given reading comprehension questions based on the goal of the lesson. The question and answer are read to the learner. If the student selects the wrong answer, they are encouraged to try again. If the learner selects the wrong answer for the second time, they are provided with the correct response. Once the learner has answered the series of comprehension questions pertaining to the goal of the lesson, the learner can play a short game as a reward for completeing the questions. At the end of each completed lesson, a percentage of accurary and the total amount of time to complete the lesson is provided for the student.

Integrating Computer-Assisted Instruction into the Classroom

Considerations	Guidelines
Training the student.	Train the students in the use of the hardware and input device (e.g., joystick, mouse, etc.).
Computer buddies.	Use "computer buddies" as a peer-mediated intervention while the students are learning the software.
Be the expert of the program.	Familiarize yourself thoroughly with the personally authored or commercial software so you will be better prepared to solve problems that arise.
Minimize classroom environment noise level.	Have students wear earphones when using the software to personalize the interaction and minimize distracting/competing environmental sounds.
Minimize class distractions.	Place the computer facing a wall or in a cubicle to minimize distractions.

Location of computer.	Position the computer so that the educator can observe the student's interactions with the software and the hardware.
Minimize keyboard use.	If possible, design the software so that no keyboard is necessary to minimize the complexity of interacting with the computer.
Minimize the possibility of any distraction	If the students are highly distractible or tend to focus on irrelevant stimuli (e.g., the Apple logo on the front of the computer), mask off all of the computer with cardboard except for the screen.

(Higgins & Boone 1996, p. 77)

In today's modern classroom, each class contains at least one computer. From our research review, the use of technology for students with autism identified the following:

- Increase in focused attention
- Increase in overall attention span
- Increase in fine motor skills

- Increase in motivation
- Decrease in agitation
- Decrease in self-stimulatory behaviors

Computer assisted instruction can help students with autism to improve or increase their:

- Consistency and predictability of their environment
- Express communication skills
- Social interaction skills
- Attention skills
- Motivational skills
- Organizational skills
- Academic skills
- Self-help skills
- Overall independence

Students with autism have a better understanding when visual representation is included in your teaching style. Computer assisted programs provide visual representation such as:

- Photographs
- objects
- Realistic drawings
- Line drawings
- Written words

Here are some factors and questions to consider when searching for a computer software program when integrating CAI into the classroom envirnoment:

- What is the target of instruction (i.e., reading comprehension, sight word recognizition)
- Become familiar with software options available. Remember the CAI chosen, must be a good fit for the student's individual needs.
- Ensure the program will be supported by the school computers or any other technology being used (ie: ipads, laptops, smartboards).
- Devise a plan how to introduce and support your students when using teachnological programs.
- How will you collect and monitor data regarding the student's use of the program and their progress?

Online Resources

Looking for some new and fresh online resources? Here is list of useful resources organized according to topic.

Electronic Books

- Tar Heel Reader: http://tarheelreader.org/
- TumbleBooks/Readables: http://www.tumblebooks.com/library/asp/home_tumblebooks.asp or http://www.tumblebooks.com/tumblereadable/ (elementary and above)
- Stories by Public Broadcasting Service (PBS): http://pbskids.org/lions/stories/
- Children's digital library: http://www.storyplace.org/
- Read alouds: http://www.storylineonline.net/

Demo Software program

- Welcome to Blooming Kids: http://www.bloomingkids.com
- Fast ForWord for Autism: www.gemmlearning.com/autism_help.php?1=on
- Zac Browser: The Virtual Playground for Students with Autism: zacbrowser.com
- Autism curriculum encyclopedia: www.acenecc.org
- Social Skill Builder: Autism and Special Need Software: www.socialskillbuilder.com/products.htm
- Launch into Learning: Edutainment for Children with Autism: www.launchintolearning.org
- Grammar Trainer demo: Autism Language Therapies: www.autism-language-therapies.com/theory.html

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