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Abstract

This paper outlines the use of a technology toolkit to support emergent literacy curriculum and instruction in early childhood education settings. Components of the toolkit include hardware and software that can facilitate key emergent literacy skills. Implementation of the comprehensive technology toolkit enhances the development of these critical literacy skills in at-risk young learners.

An Emergent Literacy Toolkit for Early Childhood Education Settings

One of the most popular genres found across a variety of television networks over the past few years targets woodworking and home improvement and repairs (e.g., *This Old House*, *New Yankee Workshop* and *Hometime* on PBS; *Extreme Makeover: Home Edition* on ABC; and *Flip This House* on A&E). These and similar shows seek to develop in their viewers enhanced knowledge of tools and tool usage to construct and carry out home improvements and repairs.

In children's shows, the Disney Channel's *Handy Manny* is a popular program featuring the likeable handyman *Handy Manny*. *Handy Manny* operates a home repair shop, using an array of anthropomorphic talking tools to accomplish specific tasks. Each episode of the show features *Handy Manny* and his seven major tool friends taking on repair tasks. When a job comes in, the tools jump into the toolbox, and off they go. The unique qualities of each tool allow the tools as individuals, and especially as a team, to help *Handy Manny* accomplish each task.

As "educational handymen," early childhood professionals seek to construct and repair enhanced emergent literacy skills in young learners, especially those who are at-risk for school failure (e.g., Dickinson & Neuman, 2006; Fields, Groth, & Spangler, 2008; Justice, 2006) and especially in need of emergent literacy skills (Johnston, McDonnell, & Hawken, 2008). The provision of ongoing intensive early literacy interventions promises to minimize the risk of school failure for these young students (Torgesen, Alexander, Wagner, Rashotte, Voeller, & Conway, 2001). These learners may especially benefit from the unique supports accessible through educational and assistive technology (Jewitt, 2006; Loveless & Dore, 2002; McKenna, Labbo, Keiffer, & Reinking, 2006; Siraj-Blatchford, 2004; Valmont, 2003), especially as technology is thoughtfully infused throughout curriculum and instructional practice (Loveless & Dore, 2002; McGee & Richgels, 2006; Van Scoter, Ellis, & Railsback, 2001). Classroom computer usage is consistently associated with increased student motivation (Hitchcock & Noonan, 2000; Kamil, Intrator, & Kim, 2000), and gains in emergent literacy skills (Hutinger, Bell, Daytner, & Johanson, 2006). Unfortunately, to date early childhood education professionals have not integrated educational technology in their work as extensively as they might (Parette, Quesenberry, & Blum, 2009).

One particularly promising approach to implementing classroom technology for young learners is a 'toolkit' approach, in which a collection of appropriate types of technology (both hardware and software) is specifically selected to enhance student performance (Edyburn, 2000; Parette & Wojcik, 2004). Just as *Handy Manny*'s assortment of tools helps him complete his tasks, an emergent literacy technology toolkit is an array of hardware and software tools that support the construction of emergent literacy skills.

Handy Manny always brings along his toolkit when he sets out to do a task. He usually has seven tools in the toolkit, including *Felipe*, the Phillips screwdriver; *Turner*, the flathead screwdriver, and *Stretch*, the tape measure, among others. Much as *Handy Manny* selects each of the tools in his toolkit with specific purposes and outcomes in mind, each of the components in this proposed technology toolkit for emergent literacy instruction was selected for specific functions and contributions.

In the remainder of this article we outline and describe basic hardware and software components of a early childhood field-tested technology toolkit field (Stoner, Parette, Watts, Wojcik, & Fogal, 2008), and where possible provide the evidence base to support its inclusion. However, as is often the case with technology, field practice has often outrun the emerging professional literature. Thus the various uses of technology in early childhood emergent literacy programs, while grounded in thoughtful professional analysis and reflection, may have only incomplete empirical support to date.

Hardware

Handy Manny's tools in his toolkit conceptually would be considered *hardware*; that is, physical objects that can be touched. For many handymen, there are a few tools that are more useful and used more often than others. For example, *Handy Manny* frequently calls on *Felipe*, his Phillips screwdriver. (This is not surprising to *Felipe*, who considers himself to be the most important tool!). Similarly, certain technology *hardware* is especially useful to early childhood educators working on emergent literacy skills, and should be part of any technology toolkit.

Large Computer Video Displays

Handy Manny frequently turns to his tool friend *Flickr* (the flashlight) to help better him see exactly what he is working on. Early childhood educational professionals and students who are using computers and related technologies in early childhood settings similarly require a clear visual display to monitor their work. Liquid crystal display (LCD) panels have become an increasingly popular way to display video information.

Originally found primarily on laptop computers, LCD screens have largely replaced old bulky and heavy cathode ray tube (CRT) displays to become the *defacto* standard for contemporary computer displays (Gowan, 2000). LCD screens typically offer a bright display. Their compact and lightweight nature makes it possible to mount them on walls, maximizing efficient use of limited early childhood classroom space. Most large screen LCD televisions available today also can serve as computer video monitors. The prices of these large screen displays continue to drop, with screen sizes 46" available for under $1000 as of this writing. These large screen sizes are more likely to elicit and maintain the visual interest of young learners (e.g., Buckleitner, 2003).

For even larger displays in early childhood education settings, computer-based instruction can be paired with use of an LCD projection system and large screen which allows easy viewing by larger groups of students.

Audio Output and Input

Contemporary computers are multimedia machines with sophisticated audio capabilities (Jewitt, 2006). Recognizing the contributions of auditory input to learning (Lever-Duffy & McDonald, 2008), most contemporary educational software includes a variety of audio outputs (i.e., sounds, voices). The addition of audio can intensify and/or personalize a young student's learning experiences (Bitter & Pierson, 2005). Most computers today also come equipped with the software necessary to record audio with either built-in or external microphones. (*Handy Manny's* Phillips screwdriver *Felipe* enjoys singing whenever he gets the chance, and so would likely love this feature!)

The capability to easily record a student's voice has a number of educationally significant implications (Skouge, Rao, & Boisvert, 2007). Students can record their own voices for digital storytelling, or teachers can record their voices to include in lessons. Microsoft® Office 2007 also includes a speech recognition feature which allows an early childhood educator to record his/her voice in mp3 (or other digital audio format) for subsequent easy conversion to visual text.

Digital Cameras

It has never been easier for technological novices to generate digital images. The growing availability of hardware and software to manipulate, store, and present images (not to mention the ubiquity of camera phones), makes it easy for early childhood professionals to use *digital cameras* in their work (Blagojevic & Thomes, 2008; Hsu, 2007). Digital cameras are being used to record students' activities over time as portfolio documentation of their growing skill levels (Bitter & Pierson, 2005). In addition very early emergent literacy learners can tell a story in pictures, and write or dictate captions for these images, activities that can be highly motivating.

Software

In the emergent literacy technology toolkit some of the most important tools are *software*, or programs that are run on the computer. A variety of commonly available software programs have been identified to as helping develop emergent literacy skills.

While a research base for educational effectiveness of some software has been well-established, at this relatively early stage of the development of technology-based educational interventions much of the development of the professional literature base is still underway. In the authors' work in early childhood settings, several software programs have shown particular promise in developing and supporting emergent literacy classroom activities. These include:

- Microsoft® *PowerPoint*™
- *Clicker 5* (Crick Software, 2007)
- *Writing with Symbols 2000* (Mayer-Johnson, 2008)

Microsoft® PowerPoint™

Microsoft's® PowerPoint™ facilitates emergent literacy instruction by allowing a variety of visual dimensions of literacy to be manipulated, including (a) types of pictures (both static and animated); (see Fig. 1 and 2); (b) symbol or text; (c) type of voice output (synthesized or digitized); (d) symbol size, shape, and position; and (e) color or black and white display. For example, the animation feature allows letters of a target word to be introduced one at a time, simultaneously teaching the left to right concept as well as words being based on individual letters coming together. The incorporation of individualized graphics enhances young reader interest. The evidence base for using Microsoft® PowerPoint™ in teaching emergent literacy skills to date is growing (Blum, Parette, & Watts, 2009).

Figure 1. Animation features in PowerPoint™ enabling letters to separately to form a word while reinforcing the concept that words are read from left to right.

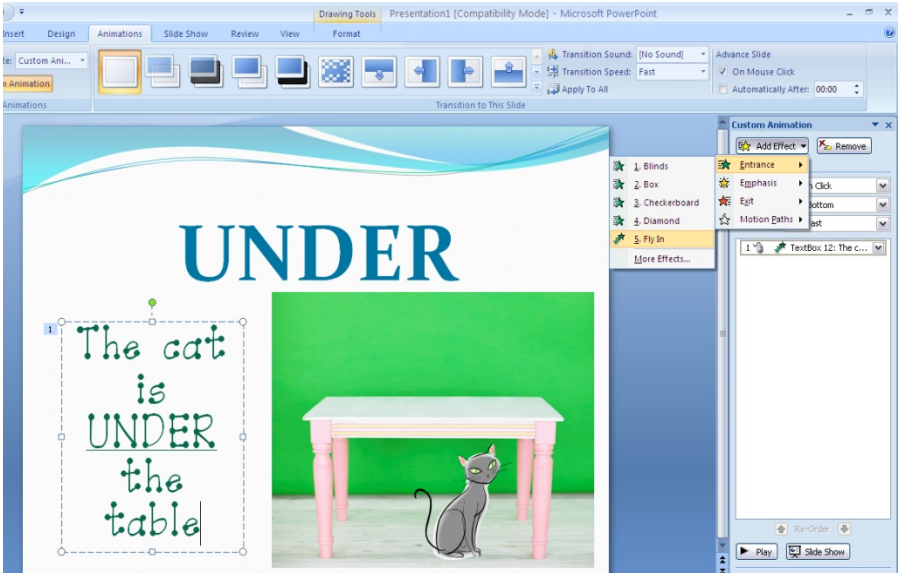

Figure 2. PowerPoint™ allows a graphic (‘cat’) to be inserted along with text to teach a concept.

Clicker 5

Designed to incorporate the major recommendations of the National Reading Panel (2000) findings, *Clicker V* is specifically designed to improve literacy performance and develop emergent literacy skills in young children (Crick Software, 2007). The program is based on a conceptual foundation of ‘grid writing’ in which groups of words or iconic symbols are visually and systematically presented in a sequential manner on a computer screen. Emergent literacy learners then make writing choices from the options listed in the grid (Parette, Hourcade, Dinelli, & Boeckmann, 2009).

Using a grid writing program such as *Clicker V*, words, phrases, sentences, numbers, and pictures can be inserted into grids to allow children to demonstrate rudimentary writing skills through simple mouse clicks (Dell, Newton, & Petroff, 2008). The talking word processor feature in the software allows children to hear words spoken before and after making selections within the grids (Crick Software, 2007; see Fig. 3 and 4). As an English Language Learner, *Handy Manny*'s flashlight *Flickr* would benefit from hearing each word (or even each letter) read out loud in English as it is entered.

Clicker 5 is widely used in schools in the United Kingdom, and increasingly is being used in U.S. education settings (Crick Software, 2009). It has been shown to facilitate word recognition, word naming, rhyme awareness, and grapheme awareness skills among young children (Karemaker, Pitchford, & O'Malley, 2008).

Figure 3. Alphabet board created to instruct alphabetic principle. The student chooses letters in alphabetic order. Sounds can be incorporated so the learner can aurally match the letter with its name.

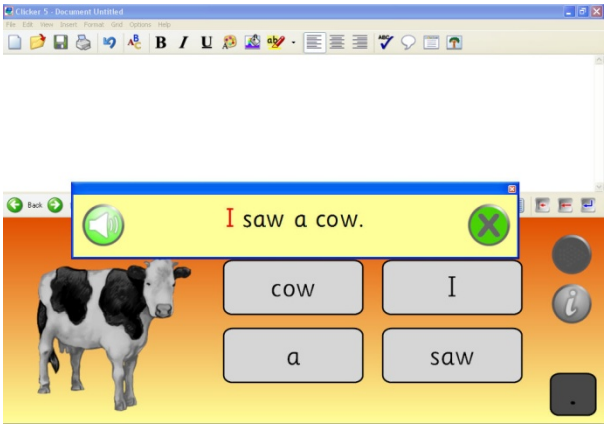

Figure 4. Activity developed to instruct concepts about print. The student clicks on words to create a sentence from a teacher model. Left to right tracking then emphasizes each word as it is spoken, reinforcing left to right directionality.

Writing with Symbols 2000

Squeeze is a pair of pliers usually found in *Handy Manny's* toolbox who is occasionally impatient about getting on with a task. Very early emergent readers similarly are sometimes impatient to begin reading print. Unfortunately the inherent initial difficulties of learning to extract meaning from abstract printed symbols can frustrate these young learners.

In *Writing with Symbols 2000* (Widget Software Ltd., 2005), a program designed to ease the entry into literacy, as a learner types a word, phrase, sentence or story the entered text appears on the screen automatically accompanied by appropriately associated picture symbol(s). This allows emergent readers to begin 'writing' and 'reading' (generating and understanding printed communications) by showing visual representations of the writing (words and pictures) on the screen while providing experience with such fundamental concepts as left to right movement.

The extensive incorporation of pictures in *Writing with Symbols 2000* makes it easily accessible to even the earliest emergent readers. It can be used to create a variety of early literacy tools for the classroom, including worksheets, storybooks, and interactive activities (see Fig. 5 and 6).

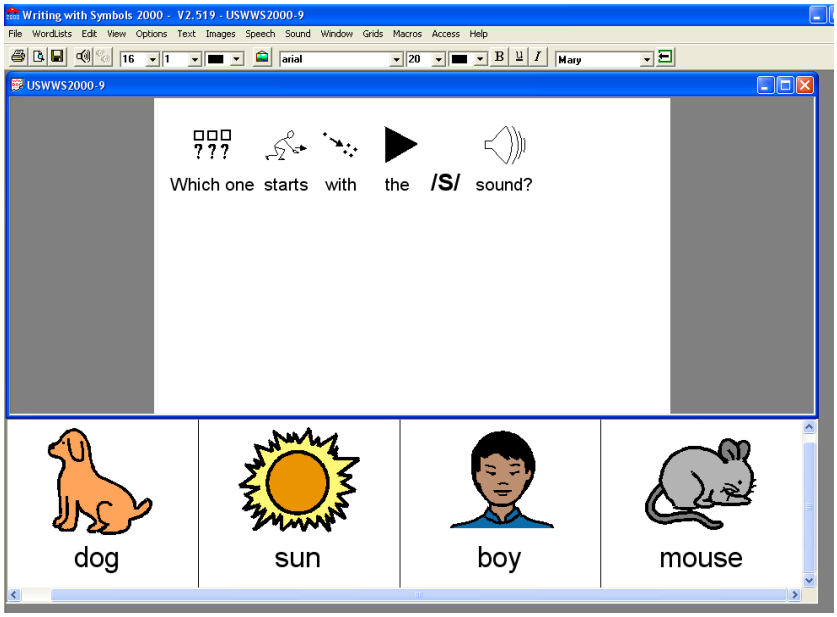

Figure 5. Activity created to instruct phonemic awareness. After asking a question pertaining to beginning sounds, the learner then selects which picture begins with the specific sound.

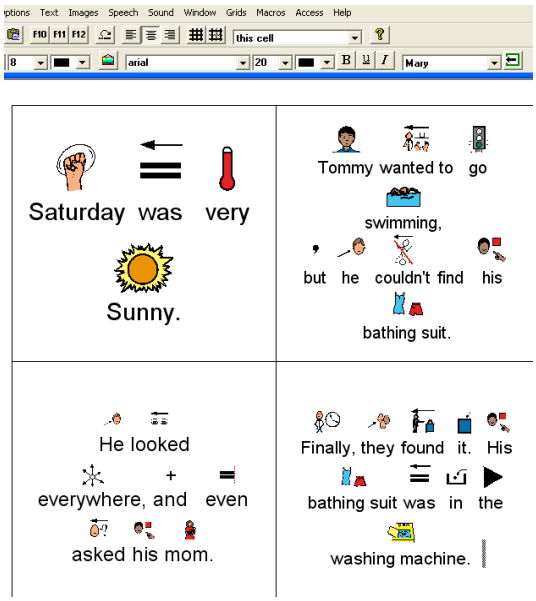

Figure 6. Miniature personal book pages used to instruct concepts about print. This allows the education professional to create personalized stories for each student which can be printed to form a miniature book.

A growing research base for the theoretical foundations of *Writing with Symbols 2000* supports its efficacy in enhancing emergent literacy development (Judge, 2006; Parette, Boeckmann, & Hourcade, in press). For example, Sheehy (2002) investigated the efficacy of teaching word recognition skills using pictures and symbols, concluding that the combination can be effective in helping emergent learners acquire word recognition and related early literacy skills. Similarly, Fossett and Mirenda (2006) reported success using a picture-to-text matching instructional approach to teach sight word recognition skills to young children with disabilities.

Recommendations and Conclusions

One of the qualities that helps *Handy Manny* be so successful is his deep knowledge of each of the tools in his toolkits. He knows their individual characteristics and quirks, and the situations in which each tool is likely to be most useful. With this knowledge, he is able to successfully respond to most of the tasks he encounters.

Similarly, early childhood educators must learn how best to implement the hardware and software tools of the technology toolkit for at-risk young learners (Parette, Peterson-Karlan, Wojcik, Watts, & Stoner, 2007). Just as *Handy Manny* developed skills in using his tools over many years, so might teachers need many opportunities to practice with and learn the capabilities of the technology toolkit.

Based on their field-based success in implementing technology toolkits with at-risk young learners, Blum, Parette, and Watts (2009) proposed a technology toolkit integration process. Importantly, this process included evaluating outcomes of the toolkit integration. While the extant knowledge base in using technology to enhance emergent literacy skills is limited at present, it is rapidly evolving.

Such emphasis on evaluation of theoretical efficacy is especially critical in these times of increased educational accountability. *Stretch* (*Handy Manny*'s tape measure) knows better than most the importance of careful measurement. Much as *Stretch* might measure a board both before and after *Handy Manny* uses *Dusty* to saw it, the early childhood educator who implements the technology toolkit must be able to objectively measure the educational impact of these technology tools (Parette, Peterson-Karlan, Wojcik, & Bardi, 2007).

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