

Literacy Explorer: A Performance Support Tool for Novice Reading Facilitators

Brenda Bannan-Ritland

Emily Egerton

Jen Page

Michael Behrmann

Abstract

This article describes *Literary Explorer*, a Web-based electronic performance support system designed to enable and enhance reading facilitation skills among parents, teachers and tutors of elementary and middle school children with disabilities. Supported through a U.S. Department of Education Steppingstones to Technology grant, the Literacy Access Online (LAO) project is a unique partnership between George Mason University's Instructional Technology Immersion program and the Parent Educational Advocacy Training Center.

Designed primarily by graduate students implementing a systematic design process, the performance support system is specifically targeted to assist one-on-one reading sessions, providing a simultaneous supportive environment for both the novice reading facilitator and the child with whom he or she is currently working. Incorporating findings from reading experts, Literacy Explorer provides guidance, resources and information on how literacy facilitators can integrate best practices in literacy skill acquisition into their reading sessions. This article provides a case study of the analysis of the performance problem and specifically detail the design processes and documentation involved in the creation of the Web-based performance support (PS) system – EPSS - as well as future phases of the project¹.

Introduction

During the last decade, electronic performance support systems (EPSSs) have provided valuable solutions to many human performance problems (Gery, 1995; Laffey, 1995). While this specific performance technology has been successful in corporate and other work contexts, it has great potential to support national educational initiatives that have a performance focus. Through creative partnerships and vision, an Instructional Technology graduate program, the Helen A. Kellar Institute at George Mason University (GMU), and the Parent Educational Advocacy Training Center (PEATC) are currently employing PS technology to address one of the most important educational goals for all children – literacy, with particular focus on those with disabilities. Literacy Access Online incorporates a Web-based electronic performance support system called the Literacy Explorer. This software tool, designed by graduate students as part of their Masters and Doctoral coursework in Instructional Technology, is targeted to address the unique needs of struggling readers and their often novice literacy facilitators. Literacy or reading facilitators (defined as parents, siblings, guardians, peer or adult volunteers,

¹ PS (performance support) and EPSS (electronic performance support system) refer, respectively, to the techniques and practices of creating performance-centered systems and the resulting electronic systems.

teacher assistants, or any additional lay or professional persons involved with helping a child learn how to read) can use this tool to support elementary and middle school students with disabilities (grades 4-8) in the reading process².

This article will detail the performance problem of literacy and children with disabilities as well as the systematic design process of the GMU team from needs analysis through design of a prototype. It will discuss the relevant details of the grant, various facets of the needs analysis, selection of reading strategy content, task analysis, process flow analysis and finally, designed and implemented features of the prototype. The article will conclude with a description of features to be implemented in future design phases.

Unique Partnership

The Literacy Access Online (LAO) project began as a Steppingstones to Technology Innovation for Students with Disabilities grant from the Department of Education. Several faculty at the Helen A. Kellar Institute at George Mason University (GMU) and representatives from the Parent Educational Advocacy Training Center (PEATC) collaborated on the project to attempt to combat the problem of a lack of support for parents and reading or literacy facilitators who work with children with disabilities. The grant proposed an innovative Web-based resource for parents and literacy facilitators to access information and training on literacy techniques and computer accessibility options for children who may have a broad variety of disabilities.

Student Designed. One of the most unique caveats of the grant was that Masters and Doctoral students would design the proposed Web-based resource as a core part of their coursework in the Instructional Technology Immersion program at GMU. Through the Immersion program, graduate students participate full-time in an authentic instructional design project learning the instructional design process by *doing* design. Supported by faculty in instructional design and assistive technology, two Doctoral students and 10 Masters students comprised the first GMU design teams who developed the beginning phases of the project over two semesters.

In the LAO project, students interacted with clients and subject matter experts to define the problem using a performance-centered needs analysis approach. Next, the group selected EPSS as the most appropriate delivery medium for the proposed solution as well as designed and developed a Web-based prototype for usability and formative evaluations. In this process, students gained realistic experience interacting with literacy experts, reading specialists and parents while working on a valuable project that will ultimately provide a new means of support for literacy facilitators and children with disabilities

Performance Problem and Analysis

² The terms reading facilitator, literacy facilitator and facilitator are used interchangeably in this article.

As Rossett (1992) indicates, finding and disseminating information about the cause of a performance problem - as well as the optimal and actual performance related to the task - is crucial to appropriately implementing human performance technology. A thorough needs analysis examining the issues of literacy and web accessibility was conducted by GMU graduate students and supervised by faculty to begin a systematic process of design and development. The analysis reviewed related literature and national statistics on reading requirements of children in grades 4-8 as well as current practice of reading strategies and availability and accessibility of technology for those with disabilities. In addition, various subject matter experts in the areas of literacy instruction, accessibility and reading techniques were consulted. To better determine the overall need, both expert and novice literacy facilitators were also observed and interviewed.

Performance Problem. The goal of literacy for all children, including those with disabilities, is a current national focus. With an estimated 40% of all children in the third grade reading below grade level (NAEP, 1996), difficulty in reading is prominent for many children, but particularly acute among students with disabilities. Some national initiatives are attempting to address some of the problems that children with disabilities face, however, most of the efforts are with young children below grade three. Furthermore, reading specialists do not often work with special education students and, instructors in charge of these children do not often possess specialized training or skills in reading techniques and strategies. Support at home for children with disabilities is also variable. Typically, parents have limited skills in reading strategy techniques and computer accessibility issues making it more difficult to encourage their children's success in reading. These children often do not receive the same opportunity to interact with technology because of limiting factors of software and hardware design that prohibit their access to valuable on-line resources.

Results of Needs Analysis. Information from the 1998 reading assessment conducted by the National Assessments of Educational Progress confirmed that there is a definite deficit in reading levels of children in grades 4 and 8 across the U.S. Although there is not much specific research regarding reading skills of students with disabilities, it is apparent from the lack of available resources that they are in great need for literacy skills support.

While children with disabilities have a definite need for support, the facilitators who work with them are also working at a disadvantage. Facilitators most often work independently of schools with little or no training or proficiency in teaching reading strategies. Support for these individuals is limited by a significant lack of research-based information and tools available for their use (Koppenhaver and Yoder, 1993). LAO project interviews and observations of both expert and novice literacy facilitators confirmed this assumption and revealed a significant lack of knowledge concerning the best practices of literacy instruction among teachers and parents who work with children with disabilities in the northern Virginia area.

Defining the Performer or Target Audience. The performance analysis conducted with literacy facilitators clearly determined the target audience or performers involved in the task. Interestingly, in this specific task of facilitating the reading process, the GMU

design team concluded that the literacy facilitator, not the child with a disability, has a greater need for support and resources. The analysis revealed that by better supporting the facilitator, the child could receive better guidance and significantly benefit from improved reading sessions. However, it was also noted that during actual reading sessions, the facilitator and student worked closely together as an interactive dyad. After much debate and discussion, the GMU design team determined that they would attempt to address the facilitator-child interaction, focusing primarily on the literacy facilitator's needs in enhancing the child's reading skills and incorporating specific support for the child's disabilities at a later point in the design process.

Determination of EPSS as a Design Approach

The GMU design team's comprehensive analysis revealed numerous environmental obstacles including a lack of tools, skills, knowledge and strategies for the literacy facilitators (Rossett, 1992). Given the importance of supporting the facilitators who lack knowledge and tools to properly conduct a reading session with children dependent on assistance, these dedicated individuals qualified as people who "need support on the job" (Brown, 1996, p.1-6). However, that support required a more comprehensive approach than could be provided by a typical Web site containing shallow sources of information. Therefore, it was determined through systematic analysis that an appropriate design approach would involve a Web-based electronic performance support system (EPSS).

The attributes of the performance situation matched well with the requirements of a PS intervention which include features such as: a lack of prior knowledge or training; required sequence, depth and repetition of information that varied for the individual; different responses and strategies needed for each performer; and an environment where both masters and apprentices can communicate dynamically and anticipate the needs of the learners (Gery, 1991).

Project Goals and Selection of Content

After realigning the goals of the project with the results of analysis and selection of an appropriate delivery mechanism, the team revised the goal of the project to encompass the development of a Web-based PS environment. Such an environment would provide guidance in the best practices in literacy acquisition as well as support, resources and interactive modules for the novice facilitator to implement at the time of need. Because there were so many areas of support to be developed, the GMU design team chose to concentrate on designing a prototype that demonstrated guidance through a pre-determined reading selection and turned their attention to selecting the reading strategy that could be implemented into the Web-based PS system.

Determination of Reading Strategy Content. Given the scope and varying philosophies involved in reading instruction literature, implementing best practices in reading instruction into an EPSS environment is an ambitious goal. Fortunately, faculty members specializing in the area of literacy were available for consultation on the project. Additionally, one student design team member was trained as a reading

specialist and also helped to guide the section of content to be addressed in the system. After multiple interviews and conversations with the specialists in reading and literacy, Guided Reading (see for example, Fountas and Pinnel, 1998) was used as a basis for a reading approach that could be customized and adapted for on-line strategy implementation into the EPSS system. Although, not implemented directly in the EPSS, Guided Reading provided a starting point that contained reasonable balance between the various approaches to reading (e.g. Word attack, Comprehension, or Phonics) while focusing on strategy for instruction delivered in a meaningful context that is relevant to the child.

Guided Reading as a Reading Strategy. Guided Reading is an integrative approach to reading instruction that builds on children's knowledge to facilitate the decoding process. More than a simple strategy, the Guided Reading Process encourages students to think metacognitively about how they read and what strategies they will use when they encounter difficulty. Proponents recommended that this approach should be taught in relation to literature that is relevant to the interests of the child.

The Guided Reading Process recognizes that students' use of decoding strategies falls into three categories also referred to as cueing systems. Throughout reading, students will decode words semantically (thinking about what makes sense), syntactically (thinking about what sounds right) and graphophonetically (thinking about what looks right). While proficient readers seem to have an intrinsic understanding of these cueing systems, students struggling with reading need to be taught these skills as well as ways to consider which strategies are appropriate.

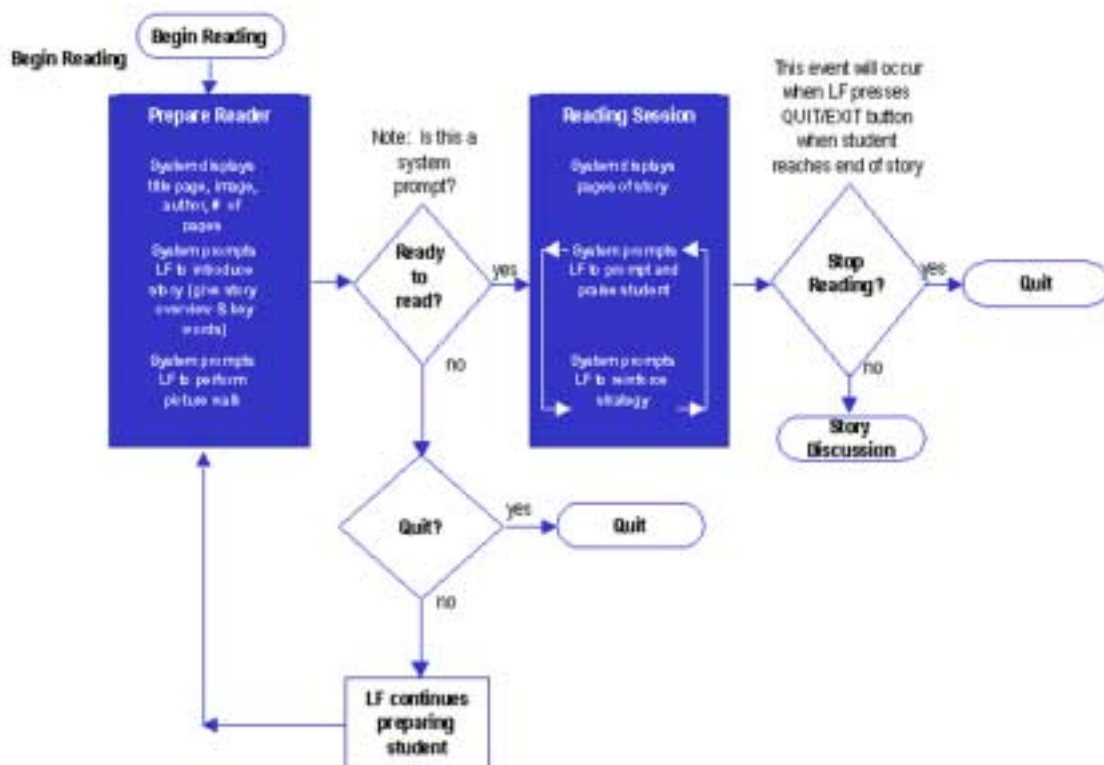
The literacy facilitator uses direct feedback to reinforce these strategies throughout the reading process. Because the Guided Reading Process involves interplay of prompting, praising, and skill as well as strategy instruction, literacy facilitators (who may be parents, teachers, or volunteer tutors) should be highly trained in the field of reading instruction. Furthermore, their expertise must be adaptive and flexible. That is, they must have the ability to monitor their current level of understanding and recognize when it is not adequate (Bransford, Brown, & Cockin 1999).

Formative Evaluation of Guided Reading Process and Literacy Facilitators. The Guided Reading process was streamlined, adapted and customized for an on-line environment. The process was tested with facilitators with no training in reading strategies and children with disabilities at the Kellar Institute's computer camps. In this context, these strategies were successfully taught and implemented in face-to-face, one-on-one reading activities with several facilitators and children. Of interest during this testing was that literacy facilitators did very little preparation, even when provided with the information in advance. It was clear from the formative evaluation sessions that most parents and reading tutors did not have the time to read through resources or review a tutorial before a reading session with a child. These conclusions further supported the selection of "just-in-time" access to reading strategy information and guidance for the facilitator during the reading session as well as confirmed that those with no training could lead children through an adapted Guided Reading process.

Defining the EPSS

The GMU design team followed Brown's (1996) model of EPSS design and development. This model delineates the steps of define, design, develop and deliver as an approach to the development of an EPSS solution. Closely related to needs analysis, but more focused on the delivery technology, the "define" stage provides a foundation for a more successful design phase that follows by concentrating on the performers and their task.

Task Analysis and Process Flow Chart. A task analysis or breakdown of the performers' task was conducted with a reading specialist and child, using the Guided Reading process. This breakdown revealed that a facilitation session was much more than simply reading a story once. In addition to reading a story, the session should involve a series of story introduction and post-reading activities which support the child in developing independent reading skills. To capture the facilitation process, the team created a process flow chart that not only documented the existing process, but also modified that process to meet the needs of the novice facilitator reading in the online environment. Figure 1 shows a sample section of the flowchart that represents the pre-reading activity and reading sections of a Guided Reading session. Creating the process flow helped to adapt the structure of conducting this task to an on-line environment as well as identify points where the facilitator needed specific support using reading strategies and making decisions.



The team also identified data related to the student’s performance and general capabilities to be gathered in a database during a reading session to help tutors make decisions about reading activities.

Identification of Performer Tasks. The GMU design team used the process flowchart as a starting point for defining the specifics of the facilitators and child’s reading session and related facilitator tasks. The team identified the tasks that required support and broke each of them into their component parts using Brown’s (1996, p.7-7) task breakdown sheet. Table 1 shows the breakdown of the tutor task, “praising the student” to be done during the reading session. The team added an additional column, titled "Design Issue," to capture design ideas for how the task could be supported online.

Table 1: Task Breakdown Sheet: Praising the Student in Guided Reading Process

Task	Work Required	Result	Resources and Techniques	EPSS Support	Design Issue
1st Reading-Facilitator Praises Student	<ol style="list-style-type: none"> 1. LF recognizes good reading 2. LF recognizes good independent use of tools & strategies 3. LF recognizes good behavior 4. Selects correct praise 5. Praises student 	<ol style="list-style-type: none"> 1. Student receives positive encouragement 2. Motivation 3. Strengths of student are recognized 4. Metacognitive learning process reinforced for LF and student 5. LF recognizes strategies for this student 6. Student encouraged to use strategies, transfer 7. Lower frustration level 	<ol style="list-style-type: none"> 1. Good guidelines for <ul style="list-style-type: none"> • Use of tools • Use of strategies • Good reading • Good behavior 2. Matrix -- compare general problems and appropriate effective praise 3. Individualized praise recorded student specific 4. LF action 	<ol style="list-style-type: none"> 1. Link to guidelines, icon driven 2. Trigger individual praise record 3. Periodic praise reminder automatic 4. Matrix link 5. End of session reinforcement of praise for good LF praising of student 6. Timing 	<ol style="list-style-type: none"> 1. Rollover: praise reminder as next button is hit

The design team analyzed the tasks requiring EPSS support, but only selected certain tasks for development during the current semester-long project phase. The team based decisions about which tasks to support on the criticality of the basic reading process and the technical requirements to implement that support. The goal was to select support tools for development that would complete an entire reading session and could be used to create an HTML prototype.

Design of the Literacy Explorer

The design process was based on integrating information from the analysis, define phases and the modified process of Guided Reading. The task breakdown sheet, along with the process flow chart, was completed on all tasks involved provided the framework needed to move into the design phase of the initial prototype. Much of the design work was initially focused on interface development of the on-line EPSS. Of special consideration were the implications of designing for an interactive dyad of both facilitator and child. In an on-line EPSS environment, the student and tutor would be reading from the same computer screen and attempting to providing support for the facilitator while not distracting the student was a definite challenge.

Interface Design. Team designers created a Web-based template for the reading session, using a neutral color that indicated screen space geared for facilitator support. This area surrounded a larger, more colorful screen area in the center dedicated for display of reading material for the child. The intent of the interface design was to focus the child on the central area of the screen and provide a less-distracting surrounding space for facilitator prompting and guidance. This design was based upon the implications of having the facilitator and child dyad together viewing the same computer screen. Whenever possible, icons were chosen for facilitator cues in order to avoid competing with the student text. The basic template was modified to match the facilitator support needed for each step of the reading process. The team then chose a camping metaphor to complement the interface design and make the web site more inviting for children. A sample screen illustrating the simplicity of design of these elements is included in Figure 2.



Figure 2 inserted about here

Storyboarding Design Elements. Once an interface template was created, the team then created storyboards specifying of the contents of each screen. The sections based on the Guided Reading approach with on-line facilitator support have currently been storyboarded and developed into a basic prototype with limited functionality. The storyboards provide documentation of reading content for the child on each screen, facilitator support, and refer back to the specific EPSS task breakdown and the database model. This documentation will prove useful communicating these ideas to a second team that will tackle the next phase of design and development.

Three Forms of Support. The specific support for the literacy or reading facilitators was delineated into three separate forms: process, reading strategy and decision-making support. Process support is the assistance provided to the facilitator in implementing the modified Guided Reading process in its entirety and guides the reading facilitator through necessary pre- and post-reading activities. Reading strategy support is also designed into the system helping facilitators apply consistent reading strategies based on the Guided Reading approach at appropriate times during a reading session. The decision making support involves assisting the facilitator with assessment of the child’s performance and to recognize his or her strengths and weaknesses in order to select activities that will provide practice in areas that need improvement. The decision making support will be designed and implemented in detail in the next phase of the project.

Implemented Features of the Literacy Explorer

Overall Features. Specific features that implement supportive mechanisms for the reading facilitator and align with Gery’s (1991) attributes of EPSS design are listed in Table 2.

Attributes of EPSS (Gery, 1991)	Design of Literacy Explorer
Integration of information, tools and methodology for the user	Integrated features include: <ul style="list-style-type: none"> • Resources and links on reading approaches and assistive technology, (information) • Structured guidance through reading session through reading session planner, note-taking guide, strategy reminders and decision support (tools) • Implemented theoretically-based reading strategies, tutorials in reading and tutoring strategies, process and activity guidance (method)
Interactive advisory system that can accept, manipulate, monitor and store data	Limited advisory system: <ul style="list-style-type: none"> • Accepts and stores notes/data on individual student capabilities for later reference by same or different facilitator • Accepts and stores information on negotiated goals for session and future objectives for facilitator/student reading session

	<ul style="list-style-type: none"> • Guides facilitator through selecting future reading activities, by asking questions about goals and performance • Directs facilitators toward appropriate reading material based on student profile and assessment • Prompts use of strategies based on specific points in reading process
“Infobase” of information that user will inquire against, access or have presented to him or her to do the job	<p>Varying sources and amounts of information through providing:</p> <ul style="list-style-type: none"> • Central location for facilitators to find and use Web resources related to reading approaches and accessibility issues • “Layers” of information controlled by the facilitator related to reading strategies from simple hints, to text prompts, to elaborated explanations and finally, theoretical rationale
Various types of information organized and presented in multiple ways	<p>Reliance on:</p> <ul style="list-style-type: none"> • Both visual (iconic visual hints) and textual (prompts, explanations and rational) representation of information • Information on reading approach is provided in tutorials, supplemental reading and on-demand during a reading session. • Metaphor depiction of student reading capabilities for selection of appropriate Web readings
Determine different views on information	<p>Customized information through providing:</p> <ul style="list-style-type: none"> • Facilitator section to set up student profile, explore strategies ahead of time or during session • Facilitator access to previous session notes, goals and progress and ability to compare notes on a particular child • Students primary focus in central location on screen, colorful and large images, while facilitators prompts are monochromatic and subtle to not detract student attention
Interactive productivity and application software	<p>Additional software implemented by incorporating:</p> <ul style="list-style-type: none"> • Prompting of use of accessibility wizards included in Windows software • Accessibility applications such as Text to Speech and others to accommodate a wide range of users with various disabilities • Information on a wide range of interface elements geared toward specific disabilities • Drawing, flowcharting application tools to support the reading process • Session planner
Interactive training sequences	<p>Implemented by including:</p> <ul style="list-style-type: none"> • Small tutorials (Skill builders) to support the reading process on topics such as word attack, phonics, write to read, etc. • Use of the prompting cues, session planner and

	the use of the Internet as a reading resource for specific support in the Guided Reading process
Monitoring, assessment and feedback	<p>Limited tracking mechanism that provides:</p> <ul style="list-style-type: none"> • Information on student’s progress, capabilities and goals • Suggests to facilitator approaches, strategies or breaks at appropriate points in process • End of reading session questionnaire, to encourage facilitator to reflect on their own performance as a tutor • Tracking use of site and reminding facilitators where they ended previous sessions • As the Expert area, where a facilitator can consult a reading expert

Table 2 inserted about here

Some of these features have been designed and documented in detail but are not yet implemented into the Web-based prototype. The most significant performance support features currently include providing the reading or literacy facilitator with specific guidance implementing an adapted Guided Reading process as he or she is reading online with the child. The facilitator is initially guided screen by screen through pre-reading activities. These activities include suggestions to the facilitator help make the story relevant to the child, as well as an opportunity to review the pictures and predict story events with a short game to familiarize the child with new words contained in the story.

Implemented Reading Session Activities and Support. While the child reads the story, a menu of icons located towards the top of the screen or Web page are available to guide the facilitator in the use of reading strategies when the child has difficulty. The smaller icons, following the selected camping metaphor, were chosen to avoid visual competition with the story text located in a large central window for the child. This design decision directly reflects consideration of the facilitator-child dyad as the target audience in attempting to visually designate screen areas for both members of the dyad and avoid directing the child’s attention away from the task.

Each icon represents a type of cue that helps the tutor remember specific reading strategy tasks that he or she can implement with the child during the reading session. Information on the use of appropriate reading strategies are structured in “layers” of information (Gery, 1995). During a reading session the facilitator passes the mouse over the icons to have roll over text appear in the form of a directive phrase such as “Look at the picture” or “Think about the story”. These phrases are designed to prompt the facilitator to implement specific guided reading strategies. For more detailed information, the facilitator can click on the icons for scripted questions such as “Does that make sense?” or “What is happening in the story?” to use with the child. In addition, the facilitator may access a form of a job aid prior to the reading session listing all the icons, prompts and available questions. The layers of information provide a form of scaffolding in that once

the facilitator is familiar enough with the scripted questions, he or she may rely on just the icons or the roll-over text prompts to remember to implement these strategies with the child.

Additional forms of support are provided such as comprehension questions that can be accessed on every third screen of the story text or may be accessed by the facilitator at the end of the story depending on the his or her preference. General guidelines for the reading session such as “Try to keep the session lighthearted and fun” are also provided in order to promote affective support during a reading session. A session planner sheet allowing the facilitator to record specific words the child had difficulty with and specific things to praise along with additional notes about the child’s performance can be accessed and printed. The session planner also allows the facilitator to keep track of what things he or she did during the session that were most helpful to the student, what difficulties arose and what he or she would do the next time. Potentially, this information could also be shared with other facilitators who may work with the same child and will be addressed in the next phase of design.

In the post-reading activities, performance support is afforded to the facilitator to provide the child with small tutorial-like reading activities that are targeted to improve specific skills. These activities refer back to the story the child has just read and address specific reading activities such as locating the silent “e” sound, writing to read, locating rhyming words or ordering story events. These “skill builder” activities are totally contained within the Literacy Explorer and are enhanced with online forms and worksheets. Although suggested as a post-reading activity, the skill builders can be accessed at any point prior, during or after the session providing a maximum amount of user control.

Future Design and Development of the Literacy Explorer

A basic prototype of the Literacy Explorer as been developed at this point illustrating some specific means of performance support for the reading facilitator-child dyad during a reading session. New Immersion student groups have started to evaluate the existing prototype for usability and address some of the design features listed below. In addition, the number of contained stories will be expanded and additional technical functionality will be added. The following features have been conceptualized and will be implemented during future phases of the LAO project including:

- Database infrastructure permitting storage and tracking of data for each child and facilitator
- Means for sharing information with other facilitators (teachers or parents) about a specific child
- Sharing of techniques, skills with other facilitators and parents through computer conferencing and chat features
- Incorporation of accessibility options designed to address special needs (Text to Speech, etc.)
- Capability to import selected Web site text into the Literacy Explorer for the child to read maintaining the facilitator prompting and providing additional activities that are independent of reading content

- Resources and tutorials will be added related to the use of the Web, literacy as well as a clearinghouse for information related to assistive technology.
- Means of assessment of reading levels designed and developed with additional stories incorporated into the EPSS

Conclusion

The use of performance technology for specific initiatives in education is a fairly new enterprise. Electronic Performance Support Systems can present an elegant solution to providing guidance and support for those who are committed to improving the reading skills of children, particularly those with disabilities. Given the evidence of a dramatic lack of training, skills and knowledge, literacy facilitators are in need of a system that is accessible, easy-to-use and provides a consistent approach to help improve their strategies with children. Capitalizing on a systematic process, the design teams at GMU are committed to making this system a reality. The LAO project not only provides an opportunity for graduate students to participate in the design and development processes related to performance technology solutions but also to play a part in supporting the goal that indeed, all children can read, with the support and guidance of a skilled literacy facilitator.

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Dr. Michael Behrmann received his Ed.D. in Special Education from Teachers College, Columbia University in 1978. He was a participant in the Professional Leadership Program on assignment to the Governmental Relations Unit of the American Educational Research Association. He is currently the Helen A. Kellar Professor of Special Education in the Graduate School of Education and the Director of Helen A. Kellar Institute for Human disAbilities at George Mason University. Dr. Behrmann's current professional activities include the directorship of a state funded training and technical assistance center (TTAC) for Superintendent's Region 4 of Virginia; a technical assistance project in the Department of Rehabilitation's Northern Region for the Virginia Assistive Technology System (VATS); a federally funded grant developing LiteracyAccess Online, an accessible web site to enable parents, teachers and tutors to teach literacy skills to children with disabilities. He is also working with the Executive Training Services Office in the Department of Defense and is developing a technology based instructional design and development partnership between GMU's Instructional Development & Design program and DoD.

Jen Page graduated in December from George Mason University's full-time Immersion program in Instructional Design. As a Master's student, she worked on the Literacy Access Online project for two semesters. Jen currently works at an e-commerce start up company on the interface design team responsible for creating an online buying experience for industry-specific, business-to-business transactions. Jen is also pursuing her interest in K12 education, working on an a special project with the Kennedy Center's ArtsEdge, their online arts education site.

Brenda Bannan-Ritland is an Assistant Professor at George Mason University in Fairfax, VA. Dr. Bannan-Ritland teaches in the Instructional Design and Development track of the Instructional Technology program under the Graduate School of Education. Her research interests include Web-based instruction and training, specifically the application of theoretically-based instructional strategies to the Web and the design and development of constructivist learning environments. Brenda has co-edited a special issue of *Educational Media International* on Web-based instruction and is on the editorial board of the *WebNet Journal*. Brenda has also co-authored several articles in the *American Journal of Distance Education*, *Educational Technology*, *Educational Media International* and written several chapters in books such as *Web-based Instruction*, and *Web-based Training*. Brenda has also presented on these topics at numerous national and international conferences.

Emily Egerton is a doctoral student in the Instructional Technology program at George Mason University. She earned her bachelor's degree in Psychology and Business Administration at Rollins College and her Master's Degree in Education at the University of West Florida. Before entering the doctoral program full time, she worked in both elementary and middle schools as a general education teacher and reading specialist.