Lyric Reader: An Architecture for Creating Intrinsically Motivating and Culturally Relevant Reading Environments

Running Title: Architecture for Creating Reading Environments
Lyric Reader

Lyric Reader: An Architecture for Creating Intrinsically Motivating and Culturally Relevant Reading Environments

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Abstract

Given the reading difficulties of all America’s children and the increasing diversity of the student population, it is imperative that reading instruction build upon the diverse knowledge and experiences children bring to the classroom. This paper presents a computer-based architecture, Lyric Reader, that combines proven reading strategies, intrinsically motivating activities, individualized guidance, with reading material drawn from students’ prior knowledge of song lyrics to create “contextualized reading instruction”- instruction tailored to children’s idiosyncratic interests and prior knowledge. Two Lyric Reader applications, Rappin’ Reader and Say, Say Oh Playmate, are presented to provide concrete examples of “contextualized reading instruction”. In addition, Rappin’ Reader and Say, Say Oh Playmate are contrasted to provide examples of how Lyric Reader facilitates the creation of pedagogically consistent but contextually unique beginning literacy learning environments.

Problem

According to the 1994 National Education Goals Report, only 25 percent of America’s students are reading above the competency level set by the Federal Government's Goals 2000 initiative. Most are incapable of perusing printed and written data at a level necessary to function successfully in society. Consequently, these students will not achieve their goals or reach their maximum potential (Kirsh 1992), particularly in a world where increasingly, literacy is becoming an essential component of even the lowest paying jobs. While problems with reading are evident among many school students in America, these problems are particularly acute among minority students. Data from the National

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1 Lyric Reader was developed at the Institute for the Learning Science (ILS), Northwestern University, under the guidance of Roger Schank.
Assessment of Educational Progress (NAEP), report that minority students are experiencing extreme difficulties learning to read.

Combining a substandard reading ability with economic realities, these minority students will have difficulty acquiring jobs to lift themselves out of poverty. Thus, addressing their reading difficulties is an issue that must be addressed. Findings from researchers who have investigated this problem can be categorized as falling into seven main causes: background knowledge (Anderson 1984; Reynolds 1992), instructional strategies (Adams 1990; Clay 1979b; Brown & Palinscar 1994), child’s motivation to read (Eccles 1985; Oldfather 1993, 1995a, 1995b), teacher expectations (Hollins 1996; Page 1987; Lipman 1995), home and community environment (Slaughter-Defoe 1987; Teale 1984; Hale 1986; Heath 1983) and quality of school (Kozol 1991; Burtless 1996). Finding a solution to their reading difficulties is extremely difficult because it necessitates an understanding of the above causes and their interactions. In this paper, I ask the question of what role can computer-based learning environments play in improving all students, particularly minority students, beginning literacy skills.

Researchers have documented that students read and comprehend text better if they have prior knowledge of the text (Schank 1977; Rumelhart 1980; Seidenberg & McCleland 1989; Spiro 1980). Learning Scientist have documented the importance of contextualizing instruction (Collins 1988). Psychologist have reported that a student’s motivation (Eccles & Wigfield 1995; Guthrie & Alao 1997; Wigfield 1997) to read is a key determinant of whether or not they will become successful readers.

Given these research findings one might expect that creating “contextualized reading instruction” - instruction tailored to the interests and prior knowledge of each child - might seem an effective approach to improving students’ reading ability.
Difficulties of Implementing Contextualized Reading Instruction

Most teachers have accepted the concept of individual differences, this acceptance unfortunately is not generally reflected either in their pedagogical practices or in the structure of the reading programs in which they teach. Educators continue to spend the majority of the school day engaged in whole-class instruction. Reading programs frequently mandate activities that clearly conflict with the individual differences of children. If a reading program is to be truly effective, educators must close the gap between commitment and practice. Reading programs must provide for the individual differences of children. As researchers search for methods to bring teachers’ views and practices more in sync, technology has risen as a possible tool to help bring individual instruction to the classroom. Many researchers have studied the ability of technological interventions to help teachers make this transition. This paper attempts to focus on such technology by defining the necessary components to create an individualized computer-based learning environment for beginning reading instruction.

The use of technology as the medium of delivery for the instructional methodology outlined above is crucial because of the pressures the implementation of such a methodology would place on teachers. To successfully implement a contextualized reading instruction teachers would need to:

- Select reading material that draws from the experiences of each child in their class.
- Master multiple instructional strategies.
- Know the individual sight vocabularies of each child in their class.
- Tailor reading instruction for each child.
- Spend a large of amount of reading time with each individual child.
- Keep track of students’ performance, since adding multiple instructional plans will increase the bookkeeping for the teacher.
Such expectations might be reasonable in classrooms with a ratio of five children to every
teacher, but we are dealing with classrooms with a 25 to 1 student/teacher ratio.
Fortunately, technology enables us to provide reading software that aids the teacher in
implementing individualized reading instruction. The decreasing cost of educational
technology makes it reasonable to provide software for the classroom.

**COMPUTER-BASED BEGINNING LITERACY LEARNING ENVIRONMENTS:**

This paper proposes an architecture, Lyric Reader, that structures the creation of
learning environments that combine proven reading strategies, intrinsically motivating
activities with reading material drawn from students’ prior knowledge. The objective of
Lyric Reader is to integrate curriculum in classrooms that will effectively enable all
students to build upon their prior knowledge and intrinsic interests. Before presenting the
details of the architecture, it is helpful to offer illustrations of its products in the form of
two software applications *Rappin’ Reader* and *Say, Say Oh Playmate.*

**Rappin’ Reader**

*Rappin’ Reader*, the first Lyric Reader application, was designed for a target
audience of low SES African American boys. *Rappin’ Reader* is an interactive
multimedia computer application designed to improve students’ reading ability. *Rappin’
Reader* uses the student’s familiarity and fascination of music by giving the student the
task of writing songs for his/her favorite musical group or artist. The student’s first
assignment is to serve as the artist’s or group’s junior writer. As the junior writer, the
student is placed in charge of one of the artist or group's hit songs and is given tasks
(find the missing words, unscrambling the songs words, writing the correct word in a
phrase) that require him/her to use their knowledge of the song's lyrics to read and
manipulate the lyrics of the song. After the student has demonstrated his ability to read
the words of the song, he is promoted to head writer. As head writer, the student has
two tasks. First, the student must use his creativity to write a parody. Second, the
student can audition to become a rapper for the studio. To audition, the student has to
create a music video. First, the student creates pictures to illustrate his rap, second, the
student writes his lyrics. Finally, the student records his lyrics. The final product is a
synchronized video of the student’s written lyrics, sung lyrics, and illustrations.

Screen Shots

Figure 1: Reconstruct lyrics activity:
The student is told to finish the sentences by
finding the missing word so that the album can
be printed. Whatever sentence they create they
hear the rapper rap it to them.

Figure 2: Unscramble sentence
activity: The words were dropped on the way
to the printer. The student is told to
unscramble the words. Again, they can hear
what they create.

Figure 3: Create new song activity:
The student has performed well, therefore, the
boss wants the student to make an audition
music video. The student’s first task is to write
his/her own original song.

Figure 4: Video premiere activity: The
student’s lyrics, pictures and sound are
synchronized and shown to the boss and talent
search committee. The student is offered a job
as a rapper.
Say, Say Oh Playmate

Say, Say Oh Playmate, the second Lyric Reader application, was designed after I was challenged to answer the question “Is the instructional methodology upon which Rappin’ Reader is developed generalizable to other types of music?” I decided to answer this question by building a new learning environment that would appear to girls, particularly African American girls. Say, Say Oh Playmate uses well-known clap routine lyrics, (i.e. “Miss Mary Mack”) as reading material. As with Rappin’ Reader, the student’s oral language serves as a scaffold for the acquisition of sight vocabulary. Similar to Rappin’ Reader, Say, Say Oh Playmate uses a combination of whole language, phonics, and "onset and rime" reading instructional strategies to create an individualized reading experience for each student.

To create an authentic environment, the student is invited to join a clapping group in a fictitious neighborhood by the animated leader, Sam, who is the student's guide throughout the application. The student's goal is to teach a clap routine to younger animated kids. This task involves assembling the words to the song and assigning the correct clap to each word. If the student does not know the routine, they can learn it by practicing with Sam.

The system has eight songs and a dictionary with over 1400 words. For advanced readers, the system becomes a tool for learning to create new lyrics and clap routines. Students are able to create routines from scratch or by modifying existing routines.
Figure 5: Learn clap routine activity: Student learns the clap pattern for existing clap routines.

Figure 6: Reconstruct lyrics activity: Student reconstructs the lyrics to existing songs.

Figure 7: Reconstruct clap routine activity: Student reconstructs clap pattern of existing songs.

Figure 8: Performance activity: Student sees their routine performed by the animated helpers.

How Similar are Rappin’ Reader and Say, Say Oh Playmate

Rappin’ Reader and Say, Say Oh Playmate on the surface appear quite different but in reality both systems are quite similar. For instance, students using both systems receive the same instructional guidance while performing seemingly different tasks (i.e. “finishing the printboard” and “reconstructing clap routine lyrics”). The tasks are designed to appeal to specific audiences while providing an opportunity for students to use their oral knowledge of song lyrics to build their literacy skills. Students using either system do the following types of activities:
Lyric Reader

- Listen to lyrics to get familiar with the song.
- Recreate lyrics to an existing song.
- Construct lyrics for a new song.
- See the original routine and their routine performed.

However, the delivery mechanism is adapted to appeal to different target audiences. In analyzing the differences between *Say, Say Oh Playmate* and *Rappin’ Reader*, the below adoptions are needed to enable the creation of both environments.

**Content**

The first obvious difference between both environments is the lyrics that serve as reading material. After the target audience is selected, a corpus of music lyrics is chosen that is drawn from the target audiences lived experiences. Thus, since rap music is prominent in lives of African American boys it was chosen as the genre of music for *Rappin’ Reader*. Likewise, since girls around the world play clapping games, especially girls of African descent, clap routine lyrics were selected as the music genre for *Say, Say Oh Playmate*. While the lyrics used in both systems are different, there is an overlap in words used. Figure 9 provides an example of lyrics used in both systems. Twenty percent of the words used in the example *Rappin’ Reader* song appear in the *Say, Say Oh Playmate* song. The overlap in words is an important issue mainly for teachers using a phonics-based reading program that systematically exposes children to words since these types of reading programs attempt to standardized the words to which students are exposed. However, for teachers implementing a literature-based program or a whole-language reading program, the variety between words in songs is comparable to the variety of words in books student self select to read.
**Figure 9:** Example of Texts used in Lyric Reader Applications

<table>
<thead>
<tr>
<th><strong>RAPPIN’ READER</strong></th>
<th><strong>SAY, SAY OH PLAYMATE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Every Saturday, I'm pumped and ready to flow so I get up, and get ready, to go to</td>
<td>Miss Mary Mack, Mack, Mack</td>
</tr>
<tr>
<td>the mall Throw on the F-I-L-A, gear down to the shoe my clean red, white, and blue.</td>
<td>All dressed in black, black, black</td>
</tr>
<tr>
<td>Call my boy Dee, told him to meet me there at 3 cause I know this 'il cute girl</td>
<td>With silver buttons, buttons, buttons</td>
</tr>
<tr>
<td>wanting to meet me caught a ride on the 4-3, sitting at the window seat staring at</td>
<td>All down her back, back, back</td>
</tr>
<tr>
<td>the folks on University Walking through the place and found my boy Dub Saw the</td>
<td>She asked her mother, mother, mother</td>
</tr>
<tr>
<td>honey with a friend by the court getting some grub So it was me, Dee, her and she</td>
<td>For fifteen cents, cents, cents</td>
</tr>
<tr>
<td>chillin with ice cream see trying to get them to go with us to the movie</td>
<td>To see the elephant, elephant, elephant</td>
</tr>
<tr>
<td>The Mall The Mall, best place to be</td>
<td>Jump over the fence, fence, fence</td>
</tr>
<tr>
<td>The Mall The Mall, where its' all day fun</td>
<td>He jumped so high, high, high</td>
</tr>
<tr>
<td>The Mall The Mall, best place to be</td>
<td>That he reached the sky, sky, sky</td>
</tr>
<tr>
<td>The Mall The Mall, we'll be back next week to get our laugh on…</td>
<td>And he didn't come back, back, back</td>
</tr>
<tr>
<td></td>
<td>'til the Fourth of July, 'ly, 'ly</td>
</tr>
<tr>
<td></td>
<td>And I love coffee, coffee, coffee</td>
</tr>
<tr>
<td></td>
<td>And I love tea, tea, tea</td>
</tr>
<tr>
<td></td>
<td>And I love boys, boys, boys</td>
</tr>
<tr>
<td></td>
<td>And the boys love me, me, me</td>
</tr>
<tr>
<td></td>
<td>I went to the river, river, river</td>
</tr>
<tr>
<td></td>
<td>And I couldn't get across, 'cross, 'cross</td>
</tr>
<tr>
<td></td>
<td>And I paid five dollars, dollars, dollars</td>
</tr>
<tr>
<td></td>
<td>For the old gray horse, horse, horse</td>
</tr>
<tr>
<td></td>
<td>And the horse wouldn't pull, pull, pull</td>
</tr>
<tr>
<td></td>
<td>And I swapped him for a bull, bull, bull</td>
</tr>
<tr>
<td></td>
<td>And the bull wouldn't holler, holler, holler</td>
</tr>
</tbody>
</table>

**STATISTICS**

<table>
<thead>
<tr>
<th><strong>RAPPIN’ READER</strong></th>
<th><strong>SAY, SAY OH PLAYMATE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total words = 157</td>
<td>Total words = 148</td>
</tr>
<tr>
<td>Total Dolch words =96 = 61%</td>
<td>Total Dolch words =63 = 43%</td>
</tr>
<tr>
<td>Unique Dolch words = 48 = 50%</td>
<td>Unique Dolch words = 23 = 37%</td>
</tr>
<tr>
<td>Total non-Dolch words = 61 = 39%</td>
<td>Total non-Dolch words = 87 = 59%</td>
</tr>
<tr>
<td>Unique non-Dolch words = 44 = 72%</td>
<td>Unique non-Dolch words = 35 = 41%</td>
</tr>
</tbody>
</table>

**Context**

Besides the differences in reading material, a big difference between *Rappin’ Reader* and *Say, Say Oh Playmate* is the context of the learning environments. Figure 10 provides an overview of the components that combine to create the context in which both environments are situated.
**Figure 10:** Instantiated Context Builder in Lyric Reader Applications

<table>
<thead>
<tr>
<th></th>
<th><strong>RAPPIN’ READER</strong></th>
<th><strong>SAY, SAY OH PLAYMATE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cover Story</strong></td>
<td>All the writers at a recording studio have quit and the studio is in desperate need of writers.</td>
<td>The younger members of the neighborhood clapping troop need to learn to perform a set of clap routines.</td>
</tr>
<tr>
<td><strong>Role</strong></td>
<td>Writer for one of the recording studio’s rap artists.</td>
<td>Member of neighborhood clapping troop.</td>
</tr>
<tr>
<td><strong>Mission</strong></td>
<td>Get the lyrics to a song printed correctly on a CD cover.</td>
<td>Teach younger neighborhood girls how to perform a clap routine.</td>
</tr>
</tbody>
</table>

**Pedagogical Framework**

**Tasks**

Lyric Reader systems are designed to embed instruction in authentic challenging tasks. To achieve this goal the tasks must be chosen based on the target audience and genre of music lyrics. For *Rappin’ Reader* the student’s mission is to write the lyrics on the CD cover. For *Say, Say Oh Playmate* the student’s mission is to teach the young girls the clapping routine. To achieve these missions tasks have to be designed to lead the student through the completion of the mission and the steps of the **BRAVO** methodology.
**Figure 11:** Instantiated Task Framework in Lyric Reader Applications

<table>
<thead>
<tr>
<th></th>
<th><strong>RAPPIN’ READER</strong></th>
<th><strong>SAY, SAY OH PLAYMATE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LISTEN</strong></td>
<td>• Listen to song performed in Listening Studio</td>
<td>• Perform the clap routine with Sam the helper.</td>
</tr>
<tr>
<td><strong>RECONSTRUCT</strong></td>
<td>• Fill in missing lyrics</td>
<td>• Teach girls to sing song by organizing leaves</td>
</tr>
<tr>
<td></td>
<td>• Unscramble lyrics</td>
<td>• Teach girls to clap routine by organizing hand prints</td>
</tr>
<tr>
<td></td>
<td>• Create a “club” version of song</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Find and fix printer’s spelling errors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Spell the missing words</td>
<td></td>
</tr>
<tr>
<td><strong>CONSTRUCT</strong></td>
<td>• Write a parody rap</td>
<td>• Construct new version of clap lyrics</td>
</tr>
<tr>
<td></td>
<td>• Write original rap lyrics</td>
<td>• Record lyrics</td>
</tr>
<tr>
<td></td>
<td>• Create illustrations for rap</td>
<td>• Construct new clap routine</td>
</tr>
<tr>
<td></td>
<td>• Record rap lyrics</td>
<td></td>
</tr>
<tr>
<td><strong>PERFORM</strong></td>
<td>• See original rap video performed in recording studio</td>
<td>• See animated girls perform clap routines</td>
</tr>
</tbody>
</table>

**Graphics**

The choice of graphics is driven in part by the task selection but is also directly affected by the culture of the target audience. For example, *Say, Say Oh Playmate* was designed to appeal to all girls, however, when we designed the graphics we specifically designed them to reflect the reality of an African American student living in a large Midwestern housing project. If we were targeting the system for suburban students the graphics
would look different. For instance, instead of the main area being the front of a row house, the main area might be a student’s backyard or neighborhood playground.

**Figure 12:** Graphics used in Lyric Reader Applications

<table>
<thead>
<tr>
<th>HELPERS</th>
<th>RAPPIN’ READER</th>
<th>SAY, SAY OH PLAYMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETTING</td>
<td>The interface is situated in the office of a fictitious recording studio.</td>
<td>The interface is situated in an urban neighborhood.</td>
</tr>
</tbody>
</table>

**The Necessity for Building an Architecture**

The two computer-based learning environments presented above provide a glimpse as to the effectiveness of “contextualized reading instruction”. However, in order for the glimpse to become a full vision it must be easy to create multiple contextualized
versions of these successful learning environments. In the remainder of this paper, I will present an architecture, Lyric Reader, that enables efficient and authentic version of both *Rappin’ Reader* and *Say, Say Oh Playmate* to be created. Both *Rappin’ Reader* and *Say, Say Oh Playmate* are Goal-Based Scenarios (GBSs). GBSs allow students to pursue well-defined goals and encourage learning in service of achieving those goals in a learning-by-doing environment (Schank 1992). It is important that the goals students are assigned in GBSs are of intrinsic interest to the students so that they will be motivated to pursue the goals and, thus, in the process learn the skills, processes and cases the GBS is designed to confer.

One question that must be answered is “who should create the contextual instantiations of proven successful learning environments?” the original learning environment designer or individuals more familiar with the audiences for which the environments will be developed? The two learning environments described above were contextualized for an audience of which I have a strong connection—African American children. It is no accident that I designed these two environments for this audience. I grew up listening and still do listen to rap music. As a young girl I spent countless hours playing clapping games. I contend that *who we are* influences the learning environments we build, thus, if we want to build diverse learning environments we need designers who have diverse experiences. Given the demographics of the developer community it is unlikely that the diverse experiences of students is matched by the diverse experiences of designers.

I hypothesize that tools need to be developed to enable non-programmers to develop learning environments for audiences with whom they are intimately familiar. This will enable developers to focus on developing new tools and products while enabling people intimately familiar with the context and lyrics of the proposed system to bring their knowledge to bear. However, this presents a problem. While these designers will be...
familiar with the target audiences, and therefore able to contextualize the learning environment, it is likely that many of these designers will be an expert in the pedagogical approach upon which the learning environments are built. Thus, they will be unable to build a contextual learning environment that is pedagogically sound.

Hence, while Lyric Reader should enable designers to contextualize learning environments, it must insure the pedagogical soundness of these applications. To address this issue designers of Goal-Based Scenarios have begun to develop GBS Tools to facilitate the efficient creation of GBSs. At present eight GBS tools have been designed and or implemented (Schank 1994; Bell 1998; Cleave 1997; Dobson 1998; Korkuska 1997; Towle 1998). The eight GBS tools share a) adherence to the GBS design philosophy; b) a strong task model that constrains designers’ degrees of freedom and, as a result, insure pedagogical soundness of learning environments (Bell 1998).

Like previous GBS tools, Lyric Reader is based upon a strong task model that scaffolds the designer through the process of contextualizing a learning environment while ensuring each environment is pedagogically sound.

**ARCHITECTURE FOR BUILDING THESE SYSTEMS: LYRIC READER ARCHITECTURE**

The Lyric Reader architecture achieves this combination of consistent instruction and intrinsically motivating tasks because of two of its components: the pedagogical framework and the context builder. The pedagogical framework is responsible for providing the instructional core for all Lyric Reader systems. The pedagogical framework is the common link that binds all Lyric Reader systems together. In addition, its existence assures teachers and parents that students using different Lyric Reader applications receive similar instruction. The context builders role is to aid designers in contextualizing Lyric Reader applications for their target audience. The pedagogical framework can be thought of as the engine of a car and the context builder the car’s body and accessories. For
example, when two people buy the same make and model they both get the same engine. However, each buyer personalizes the cars, for example, by deciding the color, number of doors, wheels, seat covering and stereo. Tools have been created to assist designers of Lyric Reader systems in entering this data. Figure 1 presents the components of the Lyric Reader architecture.

![Diagram of Lyric Reader Architecture Components](image)

**Figure 13:** Diagram of Lyric Reader Architecture Components

**Content**

The content builder contains the information about the text that students will be reading. Students can access definitions, example sentences, similar words, rhyming words and
part of speech information for any word in a song. This information is made available to help the student expand their knowledge of words to include semantic information.

In addition to providing semantic information, the content builder is responsible for getting and storing sound information about every word in the song. This information allows a Lyric Reader application to playback students’ attempts at constructing lyrics. For example, if students create the line “Miss Mary Mack Black Black” (the correct line is “Miss Mary Mack Mack Mack”) they will hear the system playback “Miss Mary Mack Black Black”. This is a cornerstone of the Lyric Reader Architecture because it allows students to use their phonological knowledge of lyrics as a scaffold in developing their orthographical knowledge. Thus a student familiar with the song Miss Mary Mack, upon hearing the system playback “Miss Mary Mack Black Black” will know that the lyrics are incorrectly placed because the song did not sound correct.

**Context**

The context builder is the component of the Lyric Reader Architecture responsible for contextualizing an application for a given target audience. The four component are:

- **Cover Story**- The cover story is the background story line that creates the need for the mission to be accomplished. It needs to be interesting and intrinsically motivation for the student. In Lyric Reader systems it is important that the cover story be based on an activity that is drawn from the student’s life experiences and activities that involve the genre of music around which the application is being developed. When deciding upon a cover story, it is important to consider whether the story will allow enough opportunities for the students to practice their reading skills.

- **Student Role**- The role defines who the student will play within the cover story. When defining the student’s role, it is important to think about whether the role is really the best person in the scenario to be required to practice the necessary skills. When defining the student’s role, it is important to think about whether the role is really the best person in the scenario to be required to practice the necessary skills.

- **Student Mission**- The objective of the mission is to give the student a goal she will be motivated to pursue. It needs to be somewhat realist in nature. It should take the form of a goal that a real person would plausibly need to
achieve for an important reason. The mission for a Lyric Reader application should also require the student to read and use the words in the lyrics correctly in order to achieve the goal successfully.

- **Interface**—The interface for each Lyric Reader application is designed around the musical genre chosen for the system. The goal is to situate the student in an environment that is related to the musical genre. In addition, Lyric Reader is designed to draw on the cultural affordances that students bring to the classroom, thus, icons are chosen that have existing meanings to students. To guide the interface designer each task has a template of graphic items that are needed. This template is given to the designer to instantiate based upon the musical genre of the system.

**Pedagogical Framework**

The pedagogical framework consists of four modules that interact to create the instructional theory and guidance for Lyric Reader applications. The four components are:

- **BRAVO Methodology**—The overarching instructional methodology that uses students oral language to scaffold their acquisition of a written language.

- **Task Framework**—Types of tasks that every Lyric Reader application contains. These tasks are designed to successfully walk the student through the steps of the BRAVO methodology. The task framework is instantiated differently for each application.

- **Word Recognition Strategies**—A combination of phonic-based decoding strategies used to help students when they experience trouble with a given word.

- **Guidance Counselor**—Role is to successfully guide student through task by helping her resolve expectation failures.

Below are detailed descriptions of each pedagogical framework module.

**BRAVO Methodology**

The instructional component of the Lyric Reader architecture is based upon an instructional methodology I call **BRAVO** (Bridging Readers’ Acquisition of sight Vocabulary via Oral language). **BRAVO** is designed to use students’ existing oral language as a scaffold to help students build their sight vocabulary. It uses the contextual, meaning, and phonemic knowledge that students have about words in their oral vocabulary to scaffold their acquisition of orthographic knowledge. This
knowledge acquisition builds students’ sight vocabulary. Once a student knows a word's orthography that word belongs to the student's sight vocabulary.

The BRAVO methodology combines culturally relevant reading material, word recognition strategies and a five step word adaptation program that scaffolds the student through the process of adapting an oral vocabulary word into a sight vocabulary word. Below are descriptions of each of the components.

- **Hearing**-Since BRAVO uses the student’s oral language as a scaffold, the first step of the process is for the student to hear the word, thus activating the word’s phonemic representation in the student’s mind. In essence, this step is designed to activate the oral knowledge that the student has of a word.

- **Seeing**-Upon hearing the word, the next step of the process is for the student to see the word. Now the student can make a connection between a word’s phonemic and orthographic representations. A student at anytime can request to hear what a word sounds like.

- **Using**-For a student to add a word to their sight vocabulary the student has to “do something” with the word. If this were not the case then building a sight vocabulary would be easy, since all a student would have to do is read a word and it would become a part of our sight vocabulary. The activities in Lyric Reader (described later) are designed to require the student to have to think critically about the words in order to construct an artifact.

- **Constructing Meaning**-BRAVO assumes that a student understands the meaning of many of the words in their oral vocabulary. For those words a student does not understand, it is important to provide an opportunity for the student to construct a meaning. Lyric Reader provides this opportunity. When the student does not know the meaning of a word an example sentence, definition, and similar words are provided.

- **Writing**-This step reinforces the connection between oral and written language. Writing a word enables a student to strengthen his/her ability to recall a word (Clay 1990). Researchers (Sulzby & Teale 1986) have documented the role that writing plays in students learning to read. Programs, for instance IBM’s “Writing-to-Read”, have been developed to purposely build the connection between the two. It is possible to look at a student’s writing to get an understanding of his/her knowledge of letter-sound relationships. Thus writing is an important component of the BRAVO methodology.

Above, I have laid out the steps that I hypothesize will allow a student to adapt their oral vocabulary into a sight vocabulary. At times the student will need help
accomplishing a step. To help a student through this process, word recognition strategies are included in the BRAVO model. These strategies differentiate Lyric Reader from all other computer-based learning environments that focus on improving students’ reading skills. When a student is stuck it is time to give specific phonics. Lyric Reader provides this instruction via word recognition strategies.

Task Framework

In designing activities to aid students in adapting oral words into sight words, I hold to the principle that the students should construct artifacts. It is through this construction process that students will have to grapple with learning the orthographic representations of the words in their oral vocabulary. Thus, the student using Lyric Reader has two major goals:

- Reconstruct a Song
- Create a Song

How these goals are achieved depends on the activities used. The below activity structure uses a Goal-Based Learning approach (Schank 1992 Schank, Bell & Jona 1994) to implement the BRAVO methodology. The activity framework is designed to aid students in 1) adding the words of the song to their sight vocabulary, 2) practicing and improving their creative writing skills, and 3) learning the meaning and use of unfamiliar words while reconstructing and creating a song. To achieve these goals four activity units have been designed for the Lyric Reader framework. The activity units and their objectives are:

- **Listening**- The goals of the listening unit is to start the student thinking about the connections between oral and written language. In addition, this section provides an opportunity for students who are not familiar with the song to spend time learning the song. This is important because the Lyric Reader system assumes that the student has baseline knowledge of the lyrics. Lyric Reader uses this knowledge to scaffold the student. Thus, if the student does not have the requisite song knowledge then the student would be at a disadvantage using the system. This is one of the only passive activities in the system.
• **Reconstruction** - The pedagogical goal of the reconstruction unit is for the students to use their knowledge of the song lyrics to reconstruct the lyric and in the process add the words of a song to their sight vocabulary.

• **Construction** - The pedagogical goals of the construction unit is to get the students to learn new words by exploring words in a dictionary. In addition, the construction task is designed to allow the student to connect reading and writing.

• **Performance** - The performance task provides an opportunity for the students to show their work to others. In addition it provides a stage for parents, teachers, and other students to view and comment on the students’ work. This combination of extrinsic motivation to show their work to others and intrinsic motivation to have others like their work will combine to motivate the students to work hard at construction a new song.

**Reconstruction Unit Learning Cycle**

The Reconstruction unit achieves the goal of helping students use their prior knowledge of song lyrics to scaffold their acquisition of sight vocabulary by enabling students to learn experience expectations failures (Schank 1977). Asking students to reconstruct lyrics to songs of their choice enables students to build their beginning literacy skills by experiencing expectation failure. Since students are relying on their knowledge of the song lyrics, they often quickly try to construct the lyrics. It is when the students hear their constructed lyrics played back to them that they often experience an expectation failure because the song will not sound correctly. At this point, the student is able to focus (maybe with the help of the system) on the parts of their lyrics that are incorrect. The student is ready to receive specific word recognition help because she has realized that she has a problem. Below is a diagram of this process.
The process is repeated many times over the course of reconstructing lyrics. The number of times the student repeats the cycle is dependent on the student’s reading ability and knowledge and familiarity with the song. The expectation failures that the students have are opportunities that if recognized and dealt with properly can turn into learning moments. With each mistake and try at constructing the lyrics, the student is building her written language; she is focusing more and more on the letters that make up individual words and she is strengthening the bond between the phonological, contextual and meaning representations of the word and its orthographic representations.

Word Recognition Strategies

As Figure 14 illustrates, at times students will need guidance to successfully reconstruct lyrics, for instance, help finding and/or correcting an orthographic error.
One form of guidance the systems provides is specific word recognition guidance. Below are descriptions of the word recognition strategies used Lyric Reader. All of the strategies concentrate on helping the students understand the relationship between the phonemic and orthographic representation of problem words.

Analogical

Research has shown that advanced readers make analogies between known and unfamiliar words in order to read unfamiliar words. If they come across a new word that is similar to a word they already know, they start with the pronunciation of the known word and make the necessary changes. Goswami (1988) argues that beginning readers are also able to use analogies to read words if they are explicitly made aware of the strategy. If students become explicitly aware of the similarity between two words, they can use this similarity to learn a new word.

Lyric Reader provides individualized analogy instruction because it keeps a list of all the words that a student has learned using the system. For example, a student is trying to construct the line “I missed the bus” from the rap song I Missed the Bus and is experiencing difficulty finding the word “missed”. During a prior use of a Lyric Reader application, the student learned the word “kissed”. The application tells the student that "missed" and "kissed" sound very much alike and gives the student another chance to read the word before proceeding to phonetically pronouncing "missed". By explicitly making the students aware of their ability to create analogies, the Lyric Reader application is helping the students enhance a critical reading skill.

Morphemic

The morphemic strategy is used when a student experiences problems with a word that contains a word that Lyric Reader believes is part of the student’s sight vocabulary. Teaching the student the word "baseball" by using the fact that the student already knows
the word "base" is an example of the morphemic strategy. Once Lyric Reader has made the student aware of the word he/she already knows, then it will concentrate on the part of the word that the student does not know by using another word recognition strategy to help the student read the word. After the student is successful in reading both words, he will get practice in reading the combined word.

Onset and Rime

The *onset and rime* strategy of Goswami and Bryant (1990) is a useful word recognition strategy when the problem word is not similar to or does not contain any words in the student’s sight vocabulary. The *onset and rime* strategy groups phonemes into easy to learn rimes. For example, the onset and rime strategy divides the word "cat" into "c" and "at", "string" into "str" and "ing" and "light" into "l" and "ight".

These units are easier for students to learn for at least two reasons

- **Natural sounds** - The phoneme clusters of the onset and rime strategy, are natural sounds that we speak in our everyday language, whereas the sounds of individual phonemes are not natural sounds that we make. For example, "at" and "ing" are rime cluster that are very easy for students to speak.

- **Less blending** - For example, given the word "string", the onset and rime strategy only requires students to blend two phonemic cluster "str" and "ing", whereas, the traditional phonics approach would require students to blend "s" "t" "r" "i" "n" "g".

Phonics

The phonics strategy is the strategy of last resort. It is utilized only if the other word recognition strategies are not applicable. The phonics approach takes a word, (for example “string”) and divides it into its individual phonemes (i.e. "s" "t" "r" "i" "n" "g"). The student is taught to sound out each phonemes in isolation. To teach students to pronounce individual phonemes, teachers combine the phonemes with other sound units to produce a phoneme sound that the students can say. For example, when students are
taught to pronounce the phoneme sound for the letter "b", the "b" phoneme is combined with the "uh" sound to produce the "buh" sound. Once this is accomplished, the student is taught to blend the phonemes sounds together into a word.

Example of Word Recognition Strategies

Below is an example of the clues that each of the above word recognition strategies would produce when applied to the same word. In addition this table gives an example of how the same word can be presented in multiple formats to aid a student in when he is experiencing trouble. This ability to present one word via multiple strategies provides the opportunity to individualize word recognition help for each student.

<table>
<thead>
<tr>
<th>Word</th>
<th>Analogy</th>
<th>Morphemic</th>
<th>Onset &amp;Rime</th>
<th>Phonics</th>
</tr>
</thead>
<tbody>
<tr>
<td>missed</td>
<td>kissed</td>
<td>miss, ed</td>
<td>m, issed</td>
<td>m, i, ss, ed</td>
</tr>
</tbody>
</table>

Table 1: Example of Word Recognition Strategies applied to a given word

**Guidance Counselor**

One of the major objectives of Lyric Reader applications is to create a computer-based environment where students can receive one-on-one individual contextualized guidance. In particular, the goal is to develop a tutoring model that uses students’ prior knowledge, existing sight vocabulary, and reading errors to create individualized guidance. If one takes a closer look at the help the parents-tutors provide, one will see that their help is contextualized. Many factors influence the help that a tutor gives, for instance:

- The student’s sight vocabulary
- The student’s prior knowledge
- Whether or not the student likes to read
- The student’s reading ability
- The type of reading error made by the student
• The tutor’s goal for the reading session

• The student’s temperament

These factors and others interact to create each student’s idiosyncratic reading experience to which a tutor must respond. For example, if a tutor has exerted extreme effort getting a student who does not enjoy reading to read then the tutor is less likely to critique every error the student makes because of both the student’s dislike of reading and the tutor’s goal of getting the student to enjoy reading. Lepper (1988) argues that a major goal of tutors is to keep their students from being discouraged. The same tutor working with another student who makes the same mistake but who enjoys reading is likely to critique more of the student’s reading errors because he does not have to worry about motivating the student to read.

The model of human tutoring on which the Lyric Reader Tutor is based assumes that a human tutor monitors a student’s problem solving and looks for opportunities to employ one of a set of teaching strategies that he feels will help a student to correct an error, confront a misconception, or generalize some knowledge. The tutor’s ability to provide meaningful guidance rests on his ability to follow the student’s attempt at solving a problem. When a tutor is helping a student learn to read the tutor is able to follow the student’s problem solving process by having the student read aloud. This enables the tutor to follow the student as they read, thus allowing the tutor to track the student’s errors.

Types of Guidance

Besides monitoring the student’s problem solving the tutor needs to have guidance strategies that will help it determine if and when it should intervene in the system and provide guidance for the student. The general guidance strategies of the Lyric Reader tutor are:
• **Help Student Detect Errors**-The purpose of this strategy is to help a student realize that an error has been made. The approach taken by the system is to suggest that the student listen to the system “sing” the “constructed” lyrics. The pedagogical foundation for this strategy is the hypothesis that students can use their oral knowledge of a familiar song to guide their acquisition of that song’s lyrics into their sight vocabulary.

• **Focus Student’s Attention on Errors**-The goal of this strategy is to focus the student’s attention on the words in her reconstructed lyrics that are incorrect. The hypothesis is that sometimes a student is unable to correct an error because she does not know where the error lies. This strategy is responsible for helping the student figure out where her error lies. The Lyric Reader system both visually shows and verbally shows the student the words in her reconstructed lyrics that are incorrect.

• **Give Student Hints**-The goal of this strategy is to provide specific hints to help a student figure out the missing or incorrect words in the reconstructed lyrics. Many times a student is unable to figure out a word without specific guidance in helping the student understand the orthographic representations of the missing words. During these times the Lyric Reader tutor provides word recognition help by using the proven word recognition strategies—analogy, onset and rime, morphemic—to give the student spelling hints.

The above guidance strategies form the basis for the Lyric Reader Tutor. Although there are only three strategies, there are multiple instantiations of these strategies to allow the Lyric Reader tutor to provide tailored guidance for students.

**Example of Guidance Strategies in Use**

The help strategies are consistent across all Lyric Reader applications. This is one method of assuring that students receive consistent instruction. However, as stated above the decision of which strategy to use in a given situation is determined by the current context and the student’s prior use of the Lyric Reader application. Below is a transcript of a first grade student, Vernae, receiving guidance while using the *Say, Say Oh Playmate*. Vernae is working on the reconstruction activity and is charged with reconstructing the phrase “Miss Mary Mack Mack Mack/all dressed in black black black”. Following is a transcript of how Sam, the computer tutor, interacts with Vernae to aid her in recognizing and correcting her errors and finishing the stanza. The transcript begins after Vernae has constructed the line “Miss Mary Mack Mack Mack/all
dressed in back”. The transcript is segmented to highlight the different tutoring strategies that the system uses to scaffold Vernae.

| Line 1: Sam speaks: Vernae, you should click on the microphone to listen to what you have written so far |
| Line 2: Vernae’s action: Clicks on the microphone |
| Line 3: Sam speaks: Okay here goes your song |
| Line 4: Sam sings: “Miss Mary Mack Mack Mack all dressed in back” |

**Segment A:** Tutor helps Vernae detect an error

In the example above, the tutor initially uses the *error detection strategy* by suggesting to Vernae that she listen to her work. This strategy is based on the hypothesis that Vernae can use her oral knowledge as a scaffold to acquire her written knowledge. In this example, it is believed that if Vernae hears what she has constructed then she will hear that there is a discrepancy in what she created and what she was trying to create.

| Line 5: Sam speaks: Click on the magnifying glass in the bookbag if you need a hint on a specific word |
| Line 6: Vernae’s action: Clicks on the magnifying glass |
| Line 7: Sam speaks: You’ll notice the cursor looks like a question mark. That means you’re in hint mode. Click on a sidewalk square and I’ll give you a hint on what word belongs there. Also, if you click on a leaf I will read the word on the leaf. |
| Line 8: Vernae’s action: Clicks on the sidewalk square that should contain the word “black” |
| Line 9: Sam speaks: The word you have selected “back” is wrong but it does contain the same ending sound “ack” and spelling “a” “c” “k” as the word you are looking for. Here is a spelling clue. |
| Line 10: System action: writes the rime “ack” below the sidewalk square |

**Segment B:** Tutor gives Vernae a hint

The *error detection strategy* appears to have helped Vernae recognize her error because when the tutor next uses the *give a hint strategy* by suggesting that Vernae get a hint on the word that belongs in a sidewalk square with which she is having problems, Vernae decides to get a hint for the sidewalk square that contains “back”. For Vernae to ask for a
hint for this square suggests that she realizes that “back” did not belong in the square. However, even though Vernae knew that “back” was wrong she did not know how to correct her error. Thus, the hint that Sam, the tutor, gives Vernae enables her to narrow her choices of possible word to “mack”, “back”, and “black”.2

| Line 1: Sam speaks: | Click on the eraser and then go to the word you want to erase and click again. The word you erased will disappear |
| Line 2: Vernae’s action: | Clicks on the eraser and erases the word “back” |
| Line 3: Vernae’s action: | Clicks on the leaf that has the word “black” and drags and drops it on the newly emptied sidewalk square |
| Line 4: Vernae’s action: | Clicks on the leaf that has the word “black” and drags and drops it on the next empty sidewalk square |
| Line 5: Vernae’s action: | Clicks on the leaf that has the word “back” and drags and drops it on the newly emptied sidewalk square |
| Line 6: Sam speaks: | You should click on the chalk and I will check your work |
| Line 7: Vernae’s action: | Clicks on the chalk |
| Line 8: Sam sings: | Miss Mary Mack Mack Mack all dressed in black black back |
| Line 9: Sam speaks: | Great! I wrote in chalk the words you got right. The leaves left don’t sound exactly like the song you picked. See if you can figure out what’s what wrong. |
| Line 10: Vernae’s action: | Clicks on the eraser and erases the word “back” |
| Line 11: Vernae’s action: | Clicks on the leaf that has the word “black” and drags and drops it on the newly emptied sidewalk square |
| Line 12: Sam speaks: | Things look pretty good, click on the chalk and I’ll check your work |
| Line 13: Vernae’s action: | Clicks on the chalk |
| Line 14: Sam sings: | Miss Mary Mack Mack Mack all dressed in black black black |
| Line 15: Alright, you got it! You’re finished with this part of the song. I’ll clear the sidewalk for the next part of the song |

Segment C: Tutor focuses Vernae’s attention

2 She is able to narrow her choices to this list because these are the only available words on the screen that contain the “ack” sound.
Lyric Reader

Since Vernae has already used the word “mack” and knows that “back” is wrong, she decides that “black” is the correct answer and fills two of the empty spots with “black”. Then, for some reason, Vernae decides to use the word “back” again. Now the tutor suggests that Vernae check her work, thus allowing the tutor to use the focus attention strategy to show her that the only sidewalk square that is incorrect is the one containing the word “back”. This is a visual clue. After Vernae sees that “back” is wrong, she erases it and drops the word “black” on the empty sidewalk square. This time when Vernae checks her work, Sam tells her that everything is correct. This strategy provides direct feedback to the student. When Vernae clicks the chalk, she gets a visual depiction of what is correct and wrong. In addition, the verbal feedback is designed to apprise the student of the improvement she has made over time.

In the transcript above, we see that Sam used all three tutoring strategies to help Vernae learn the difference between “back” and “black”. A careful look at the tutor’s intervention shows that the tutor suggests to the student actions to take to get guidance.

Conclusion

In this paper, an architecture, Lyric Reader, for developing contextualized reading instruction has been put forth. This architecture enables the efficient creation of computer-based learning environments from which students receive pedagogically sound instruction while reading material that is both familiar and motivating. To date two environments, Rappin’ Reader and Say, Say Oh Playmate have been developed and evaluated (Pinkard 1998a; Pinkard 1998b). Currently effort is being undertaken to create a Lyric Reader tool set that will enable non-programmers to develop new instantiations of Lyric Reader. Thus if computer-based contextualized reading instruction learning environments, such as these, can be widely introduced to schools we will be able to take a snapshot of what reading instruction might look in classrooms in the near future. In these classrooms one would find some children receiving individual instruction from the teacher, other children
reading real books or writing stories, some children using *Rappin’ Reader*, others using *Say, Say Oh Playmate*, and still others using *Nursery Rhyme Reader*. Such a classroom will allow each child to get the benefits of using their own idiosyncratic background as a scaffold for learning.
Lyric Reader

WORKS CITED


