Digital Reading Environments as a Teaching Tool in the Secondary Classroom

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Table of Contents

Abstract

The goal of this paper is to investigate the use of digital reading environments as a teaching tool within the secondary classroom. This is an important form of new media text; students are asked to process multiple pieces of information when reading digital text. The use of a digital reading environment in a secondary classroom has the potential to support both struggling readers and readers who excel. While this new learning tool is beneficial for increasing literacy skills and reading comprehension it also has the potential to bring life to inquiry based learning. This paper looks closely at how digital learning environments can enhance reading comprehension, vocabulary, and critical literacy skills. A digital reading environment is an excellent addition to a curriculum that will allow teachers to address the NCATE standard for the use technology and technology-based resources to facilitate developmentally appropriate student learning, while also helping students develop a twenty first century literacy skill. This paper will examine research and practice on students' reading of digital texts. It will also make recommendations for how to use a digital learning environment in the classroom to support readers and develop critical thinking skills through inquiry based learning.

Keywords: digital reading environment, scaffolding support, reading comprehension, vocabulary support, inquiry based learning

Introduction

Reading and vocabulary comprehension are thought to be skills that students obtain in their elementary school education and use readily in secondary school. Unfortunately, many students are not acquiring these skills and are unable to critically evaluate information that they receive when reading both off-line and on-line text. It is necessary for teachers to integrate the use of technology in the classroom in order for students to become critical consumers and so that they are able to participate in a variety of communities both in and out of school (Bransford, Brown & Cocking, 2000). Digital reading environments have the potential to aid literacy (Alvermann, Phelps, and Gillis, 2010) in a variety of ways by helping students think critically while actively participating in the learning process. Students who excel in reading and those who have diverse needs such as struggling readers and English Language Learners can equally benefit from the use of a digital reading environment (Dalton & Proctor, 2008; Cavanaugh, 2006).

This paper will address research underlying the use of digital reading environments as a medium for reading in a secondary classroom. Digital texts are an important form of new media; students are asked to process multiple pieces of information when reading a digital text. As a twenty first century form of new literacy, digital reading environments also pose many challenges to students including, but not limited to, processing many pieces of information at one time and integrating multiple modes of representation. This new reading environment can facilitate literacy learning that is appropriate for a variety of learners and their needs. Digital text has the potential to support the development of students' reading skills. Students who are struggling with reading for a variety of reasons can be considered "at risk readers"; these are students

experiencing a wide variety of physical, cognitive, and environmental problems including the following: learning disabilities, hearing impairments, limited English proficiency, vision impairments, and behavior disorders (Anderson-Inman & Horney, 1998). A digital reading environment also has the potential to aid students who are not struggling with reading comprehension, but need extra support in the development of problem-solving or critical thinking skills. Digital reading environments, with hypertext and hypermedia, are an addition to a curriculum that will allow teachers to address the NCATE standard for the use technology and technology-based resources.

Goals

In order to address the issues of using digital texts in the classroom, this paper will first focus on the general characteristics of a digital reading environment and implications for literacy instruction. The second overall goal of this paper is to address an inquiry based model that will structure support of students' literacy development within a digital reading environment. The paper will address the following questions: (a) In what way has the traditional view of literacy bridged with the modern view of literacy? (b) What is a digital reading environment and how are hypertext and multi-media incorporated in to this new learning environment? (c) In what ways can a digital reading environment using embedded supports benefit reading comprehension? (d) What are the implications for learners and learning, curriculum and instruction and assessment? (e) How can digital reading be used in the classroom?

Literacy and Comprehension

It is important to establish that the traditional view of literacy and reading comprehension has evolved to include digital reading environments. Content literacy, as

defined by McKenna and Robinson (1990), is "the ability to use reading and writing for the acquisition of new content in a given discipline" (as cited in Alvermann et al., 2010, p. 13). For purposes of this paper the definition of content literacy will be used in the discussion of digital reading environments. McKenna and Robinson's definition of content literacy shows the direct impact that reading comprehension has on the acquisition of new content knowledge. The National Reading Panel released a report in 2000, which cites Harris and Hodges' (1995) definition of reading comprehension defining it as "intentional thinking during which meaning is constructed through interactions between text and reader" (as cited in the NICHD report of the National Reading Panel, 2000, p.14). In the discussion of helping students develop reading comprehension and literacy skills it is important to bridge McKenna and Robinson's (1990) definition of content literacy with Harris and Hodges' (1995) definition of reading comprehension. Students need the opportunity to develop thinking skills that allow them to acquire new content and construct novel ideas; active reading and writing have a great impact on students' ability to accomplish this goal.

A credible body of research indicates that successful reading comprehension occurs when the reader is actively engaged with the text by constructing new meanings based on prior knowledge; active engagement is the joint exchange of ideas between the message of the text and the ideas of the reader (as cited in NICHD Report of the National Reading Panel, 2000, p. 39). An active reader is one who engages in strategies such as self-questioning, monitoring and organizing as they interact with the text (Alvermann et al., 2010, p. 6). Active readers monitor their understanding by separating the important

and unimportant information and organizing it in meaningful ways (Alvermann et al, 2010).

Active reading is essential to fluency, and fluency allows for text comprehension. The National Institute for Literacy (2007) defines fluency as "the ability to read text accurately and smoothly with little conscious attention to the mechanics of reading" (p. 11). The ability to decode a text while gathering information with speed and accuracy greatly affects reading comprehension (Dalton and Proctor, 2008; National Institute for Literacy, 2007). Dalton and Proctor (2008) relate students' word recognition and fluency levels to being a gatekeeper, "restricting access to those text students can read independently, or when the purpose is instructional, read with some assistance from a teacher or more able peers" (p. 304). Digital reading environments provide support for those struggling readers so that they are no longer reliant on word recognition and fluency levels (Dalton and Proctor, 2008). This will be discussed further in the scaffolding support section of this paper.

Expanding the Traditional View of Literacy

What is a digital reading environment?

Before discussing how a digital reading environment using hypertext and hypermedia has expanded the traditional view of literacy it is important to define a digital reading environment. Text in a digital reading environment is non-linear, non-sequential, multi-modal, interactive and has flexible authorship (Dalton & Proctor, 2008; Alvermann et al., 2010; Patterson, 2000; Slatin, 1990). Hypertext and hypermedia are integrated in to a digital reading environment in a variety of ways; hypertext links information together showing relationships between them (Alessi & Trollip, 2001, p. 138). A user explores a

hypertext document by clicking on highlighted words or buttons known as nodes; the nodes indicate that more information is available on a given topic. When a user clicks on a node they cause "the system to find the internal representation of the link named by the button, to then traverse the link, to find the node at the link's endpoint, and to display that node as another text passage" (Bieber & Kimbrough, 1992, p. 78). This mirrors the thinking process that will be discussed in the section of this paper regarding the construction-integration model.

Figure 1 is an example of hypertext from the Internet; this particular hypertext can be found on the popular free encylcopedia, Wikipedia. Several words and topics are hyperlinked, indicated by the blue font color (underliend here for emphasis), allowing the reader to click on the hyperlink and find more information on each topic. If the reader were to click on the node 'Stratford-upon-Avon' they would be directed to another Wikipedia entry with more information focused on Stratford-upon Avon. This is an example of text to text hyperlinking.

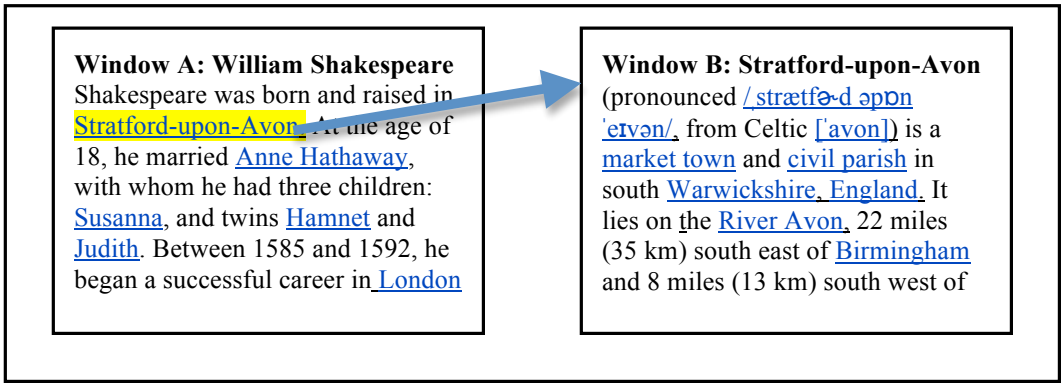

Figure 1: Hypertext from Wikipedia.com

Hyperlinking also includes text to other forms of media such as video and pictures. This version of hyperlinking is referred to as hypermedia. Hypermedia signifies the "integration, extension and improvement of books and other media (including

photographs, video, and audio recording) in the electronic domain" (Alessi & Trollip, 2001, p. 140).

The non sequential structure of hypermedia programs on both the World Wide Web and CD-ROM allows the learner to move through and interact with information in a novel way. It is important to note that there is a distinction between hypertext and hypermedia that is used daily on sites such as MSNBC or AOL that are heavy on hyperlinks and those that educational researchers create to support students and increase reading comprehension. The focus of this paper is on the latter, where hypertext and hypermedia are used to increase students' reading strategies with comprehension supports embedded in their reading material.

Integrating concepts of offline and online literacy.

The view of literacy has changed significantly as digital reading environments have become more prevalent. The National Council for Teachers of English adopted a stance on 21st century literacies in 2008 calling new literacies, "…multiple, dynamic and malleable" (NCTE Position Statement, 2008). The NCTE position on new literacies supports the idea that online literacy does not necessarily correspond with offline literacy; the differences between offline and online literacy necessitate the acquisition of new literacy skills. New litearcy expands the traditional view to include multi-modal litearcy practices, which increases the complexity of content literacy. Multi-modal literacy or digital literacy

> refer[s] to socially mediated ways of generating and comprehending meaningful content through multiple modes of representation, such as oral, print, and nonprint language; visual imagery, including pictures, photos, and icons; sounds; and

> embodied performances to produce digital texts (e.g., blogs, wikis, zines, fanfiction, games, personal webpages) for dissemination in cyberspace. (Alvermann et al, 2010, p. 80)

Engaging with text becomes multifaceted in a digital reading envrionment with the inclusion of hyperlinked text and media; readers are asked to interpret texts while also making active decisions as they read in regards to what route they will follow and what information is pertinent to their learning (Mackey, 2002). Students who engage with twenty first century literacies need to develop the skills to use the tools of technology; they must learn how to "manage, analyze and synthesize multiple streams of simulatneous information" in a complex environment (NCTE Position Statement, 2008).

The *Construction-Integration Model.*

As previously discussed, active processing of a text facilitates learning; this idea is addressed in the construction-integration model of text comprehension where Kintsch (1998) explores the role of knowledge in discourse comprehension. This model shows that both background knowledge and linguistic input have an affect on a student's ability to comprehend a text as a coherent whole (Kintsch, 1988). In this case, "knowledge is represented as an associative net, the nodes of which are concepts or propositions. The nodes of this net are interconnected" (Kintsch, 1988, p.164-165). The 'nodes' that represent concepts within the construction-integration model are mirrored in a digital reading environment with the use of hyperlinks. The nodes discussed in the construction-integration model are representative of the thinking that occurs as a reader is exploring an off-line text; in comparison, an on-line text that uses hypertext or hypermedia can help

extend and support the growth of knowledge by providing the learner with electronic nodes that directly show the extended definition of a word or topic.

This argument is justified by two experiments conducted by McNamara, E. Kintsch, Butler-Songer, and W. Kintsch (1996); these experiments were motivated by the construction-integration model of text comprehension and were conducted to test the interaction of text coherence, background knowledge, and levels of understanding in learning from a text. The construction-integration model suggests that some instructional texts merely require students to create text-base connections, this only allows for reproduction of material; the goal for reading should be to help students create situation models necessary to develop knowledge and link that knowledge to other information.

In order for students to form situation models as they read they need to have adequate prior knowledge and participate in active inferencing (McNamara et al., 1996, p. 4). A coherent text allows students to create a good text base, but does not necessarily aid in their construction of knowledge or contribute to deeper understanding (McNamara et al., 1996). Instead of having students merely fill in the gaps of knowledge that a text may leave, hyperlinks bring in background knowledge to help students fill the gaps as they read. Deeper understanding results when students are able to bridge their own inferences (McNamara et al., 1996, p. 5); hypertext allows for students to choose when they need support in order to bridge inferences.

Through the research conducted on the construction-integration model and other research it is evident that active reading is pertinent to retaining knowledge. When applying the concept of active reading to a digital reading environment it takes on a whole new meaning. The use of a digital reading environment using hypertext and

hypermedia in a classroom has the potential to aid struggling readers and further develop content literacy by supporting their active engagement in a text. In order to address the ideas of literacy instruction using digital reading environments it is necessary to explore the four aspects of professional knowledge. The second part of this paper will address learning environment, learners and learning, curriculum and instructional strategies, and assessment.

Learning Environment

Effectively designed learning environments are learner centered, knowledge centered, assessment centered and community centered (Bransford et al., 2000). The classroom itself is a learning environment and a digital reading environment is an additional learning environment within the classroom. Teachers must be aware that a digital reading environment can be a positive addition to the learning environment already established in the classroom; when effectively designed this addition can focus on learners, knowledge, assessment and community.

A digital reading environment requires scaffolded support because it is a new learning environment. This new learning environment also has the ability to strengthen reading comprehension by creating an on-line environment supportive of meaningful learning:

> This is accomplished in a variety of ways, including embedded supports (e.g. definitions of unfamiliar terms), multiple modalities (e.g., text that can be out loud), and links to useful resources (e.g., background information, concept map, notepad) – all of which can transform electronic text so that it is more accessible and supportive to diverse learners (Anderson-Inman & Horney, 2007, p. 153).

Incorporating embedded supports, multiple modalities and useful links makes information accessible to and supportive of diverse learners. Emphasizing the use of this form of digital reading in the classroom can transform curriculum and instruction in a positive way. New cognitive challenges will arise and strategic processing skills will need to be addressed with learners. Scaffolding vocabulary support, pre-reading strategies, within reading strategies and post reading strategies can help learners become critical consumers of on-line information. In order for these supports to be effective in aiding students reading comprehension and literacy skills the digital learning environment must provide usable knowledge.

Providing Usable Knowledge

When exploring hypermedia the learner processes the information on display and is presented with a series of choices allowing the user a certain level of autonomy over the knowledge that they acquire (Alessi & Trollip, 2001, p. 141). This meaningful interactivity supports learning by providing usable knowledge. The key to providing usable knowledge is through purposeful linking. Jonassen (1997) points out that links should be attached to information that supports "taking and exploring multiple perspectives" (as cited in Alessi & Trollip, 2001, p. 156). Visibility and density of links also affect meaningful learning; links should not overwhelm the user and should be relevant and supportive of purposeful learning. Accessing information in this format requires the learner to process information in a novel way, which makes demands on their literacy skills and often requires them to acquire new literacy skills (Leu et al., 2007, pg 38). Providing opportunity to explore these new literacy skills is essential to the development of critically aware users.

Learners

The use of digital text in the classroom should be learner centered. As stated before, digital text is a learning environment within a learning environment. Both the classroom and the digital text should be learner centered. A learner centered environment "pay[s] careful attention to the knowledge, skills, attitudes, and beliefs that learners bring to the educational setting" (Bransford et al., 2000, p. 133- 134). Students should be permitted to have a 'play phase' when first integrating digital text; this allows them to explore the new learning environment in "low-stress settings with low-stress tasks" (Grabe & Grabe, 2007, p. 41). Allowing students to read digital texts with a partner or in groups is one way to scaffold support for each learner. Students can not be assessed effectively unless they are able to successfully use the on-line learning environment; having students use embedded supports and participate in an online environment prior to assessing their literacy skills is important to authentic assessment.

Strategic Processing

Reinking (1985) emphasizes that using a computer to mediate text requires the reader to examine reading in ways that are different from the examination of conventional print materials (as cited in Reinking & Schreiner, 1985, p. 539). Critically aware users must have strategic knowledge to successfully navigate the variety of complex information available to them in a digital reading environment. Reading in an online environment requires students to be proactive about their choices rather than reactive; they must think before they click. Students inferential reasoning skills and their ability to differentiate between types of links increase with guided practice in digital reading environments (Coiro, 2003). Students should begin to ask questions such as:

"Will this enhance or disrupt my search?" (Corio, 2003). Proctor, Dalton & Grisham (2007) point out that there is a "relatively small body of research on hypertexts designed to support students' strategic processing of text (Anderson-Inman & Horney, 1998; Dalton & Strangman, 2006; Reinking, 1988; Strangman & Dalton, 2005)" (p. 73). This body of research is promising for use with both readers who excel and readers who struggle to comprehend a text.

Curriculum and Instruction: Scaffolding Support

In order to foster the development of critical consumers teachers must scaffold support for the learners in a variety of ways. For the purposes of this paper the discussion will focus on how teachers can integrate hypertext and hypermedia as scaffolds that aid in reading strategies and vocabulary and comprehension support. Using hypertext and hypermedia gives learners control of their learning, but with advisement. Computer monitoring combined with learner decision making has the potential to help develop metacognitive skills; "students are put in the situation of thinking about the decisions they make as they attempt to master the assigned material" heightening their sensitivity to the processes of learning (Grabe & Grabe, 2007, p. 50). Students are able to participate in discovery learning by uncovering and discovering what is to be learned (Grabe & Grabe, 2007) . A dgital learning environment helps increase strategic processing skills and meaningful learning through active engagement with the text.

Active and engaged reading is encouraged in a digital reading environment through the use of the cognitive apprenticeship model; this model helps students acquire thinking skills by modeling cognitive thinking behaviors and then coaching them through

the steps of the thinking process (Collins, Brown & Newman, 1987; Grabe & Grabe, 2007; Bransford et al, 2000). Collins et al (1987) note that

> applying apprenticeship methods to largely cognitive skills requires the externalization of processes that are usually carried out internally… Cognitive teaching methods are designed, among other things, to bring these tacit processes into the open, where students can observe, enact, and practice them with help from the teacher and from other students (p. 6).

Cognitive apprenticeship encourages the learner to reflect on the "differences between novice and expert performance by alternation between expert and novice efforts…" (Collins et al., 1987, p. 6). An important distinction between cognitive apprenticeship and traditional apprenticeship is that cognitive apprenticeship emphasizes decontextualized knowledge that can be used in a variety of settings (Collins et al., pg 7, 1987). This is an important factor in reading comprehension; students need to be able to apply reading comprehension stratagies in a variety of settings in order to participate in literate communities both in and out of school.

The role of the teacher in the apprenticeship model changes with the introduction of a digital reading environment, but as Proctor et al (2007) note, programmable digital reading environments are not supposed to replace the teacher. Programs to increase vocabulary and reading comprehension are meant to create "opportunities to present important information to students in such a ways as to target individual differences" and that will, in the long term, supplement off-line teacher-student interaction (Proctor et al., 2007, p. 73). Making content available to students with embedded supports in an alternative format can assist struggling readers while supporting their growth by

encouraging self-correction and monitoring skills. Embedded supports include, but are not limited to background information, pedagogical coaches who model comprehension strategies, hyperlinked vocabulary support, and TTS read –aloud functionality.

Vocabulary and Comprehension Support

Anderson & Freebody (1983) note that vocabulary acquisition is of utmost importance to reading comprehension outcomes (as cited in Proctor et al., 2007, p. 75). Within a digital reading environment, pedagogical coaches can strengthen student achievement by introducing them to a supportive learning environment; however, their reading comprehension skills will only be affected if their vocabulary knowledge increases as well. Vocabulary instruction is essential to literacy development and to bolstering reading comprehension (Dalton and Proctor, 2008; Marzano, 2004; RAND Reading Study Group, 2002; NICHD Report of the National Reading Panel, 2000).

A digital reading environment using hypertext allows teachers to integrate vocabulary in meaningful ways. Students can click on hyperlinked words to gain deeper understanding or add to their own glossary of words to strengthen their vocabulary. West-Christy (2003) identifies five techniques for assisting struggling readers one of which is to teach important vocabulary (as cited in Cavanaugh, 2006, p. 88). Cavanaugh (2006) takes this technique a step further by suggesting that electronic texts "allow for immediate access to dictionaries and other reference works" so that when students come across an unfamiliar word they are able to quickly access the definition and see its contextual use (p. 92).

Proctor et al (2007) conducted an investigation on the effectiveness of using a digital environment to support reading. The program's design is based on reciprocal

teaching and the principles of Universal Design for Learning (UDL); "UDL advocates that curricular materials be designed with sufficient flexibility that students of varying levels of aptitude, language proficiency, and cognitive functioning may access and learn from equivalent materials" (Proctor et al., 2007, p. 73). During this investigation students had access to comprehension-scaffolding features, such as pedagogical coaches, vocabulary hyperlinked to definitions, translations, example sentences and relevant graphics, and TTS read-aloud functionality to reduce decoding demands of the texts (Proctor et al., 2007, p. 73). The multimedia digital reading environment gave students the choice of eight hypertext that were targeted to support vocabulary development as well as cognitive and metacognitive strategy development. Proctor et al (2007) emphasize the importance of the number of times students accessed the embedded supports available to them. The students who had the greatest comprehension gains "appear to have accessed the strategy coach with greater frequency than those with weaker comprehension gains" (Proctor et al, 2007, pg 86).

Though there were no significant gains in vocabulary and reading comprehension skills, the study conducted by Proctor et al (2007) is worthy of note. The study was conducted over a four week period and there was a lack of explicit connection between the strategies learned in the ULE and the strategies the students were learning in their reading programs (p. 82). The teachers merely used the program as reinforcement. If the program were used over a longer period of time and connected with in-class discussion and explicit instruction on reading strategies and vocabulary development the results may have shown considerable gains.

Reading Strategies

Traditional texts require learners to ask a variety of questions before, during, and after reading. Pre-reading questions include questions such as, "What will happen next? What do I know about this topic? What is the author's purpose? What do I expect to learn from this text?" (Coiro, 2003). When reading in a digital reading environment that includes hypertext and hypermedia "proficient readers also need to plan answers to questions like these: "How should I navigate this information? How can I expect to interact with this environment? What is my role or task in this activity? How can I add to this body of knowledge?" (Coiro, 2003). The learner is required to ask more questions as he or she reads in a new medium; pedagogical coaches can influence their confidence while also modeling the thinking process necessary for reading in any environment – both off and on-line. Pedagogical coaches embedded in a digital reading environment provide learners with instructional support and model reading comprehension skills.

Hypertext and hypermedia are easily manipulated; pedagogical coaches can be adjusted for each learner thus fostering learner-centered instruction. Askov and Bixler (1998) point out that "good literacy instruction focuses on what students want and need to learn rather than on predetermined, generic curriculum usually deliver by a commercial set of materials" (p. 168). It is important that teachers choose programs that can be adjusted to each learner so that they are able to manipulate them to best fit the learner.

Digital reading environments easily integrate leveled texts allowing "students with diverse learning skills and competencies to approach informational materials at a pace they can read with fluency, comprehension, and confidence" (Scholastic, Inc., 2009, p. 5). Digital reading environments allow teachers to stay within students zone of

proximal developmental (Vygotsky, 1978); scaffolding support helps bridge the gap between the distance students actual developmental level and the their potential level of development (Bransford et al., 2000, p. 81). Digital reading environments with embedded supports challenge students enough to stimulate growth while also keeping them engaged in a way that will stimulate growth by providing multiple levels of complexity and challenges (Scholastic, Inc., 2009).

Assessment

Just as digital reading environments expand the traditional view of literacy they also transform the traditional view of assessment. Scaffolding support is embedded in a digital reading environment with pedagogical coaches and vocabulary hyperlinks; formative assessment can also be embedded through worklogs and journal entries. Worklogs allow teachers to see all responses to strategy and vocabulary prompts for each student (Proctor et al., 2007). Teachers can implement the use of an event usage tracker that logs "all student text interactivity, including vocabulary work, strategy responses, and moust click selections (i.e. using the strategy and vocabulary supports; accessing hyperlinked vocabulary items; and posting vocabulary to My Glossary)" (Proctor et al., 2007, p. 83). Tracking progress allows the teacher to see student performance over time in meaningful and authentic activities rather than just one summative assessment.

Authentic assessment can be attained with the use of a rubric. Rubrics allow for objective and consistent assessment; students understand the requirements and are able to refer to rubrics as they work on their assignments. Figure 2 is a screenshot of a rubric template for teachers to create a rubric for students. This screen shot is provided by San Diego State University College of Education:

(Describe here the task or performance that this rubric is designed to evaluate.)

	Beginning 1	Developing 2	Accomplished 3	Exemplary 4	Score
Stated Objective or Performance	Description of identifiable performance characteristics reflecting a beginning level of performance.	Description of identifiable performance characteristics reflecting development and movement toward mastery of performance.	Description of identifiable performance characteristics reflecting mastery of performance.	Description of identifiable performance characteristics reflecting the highest level of performance.	

Figure 2: Screen shot of rubric template

Bernie Dodge, co-developer of the webquest concept for inquiry based learning on-line, developed a rubric for teachers to use when developing their webquest (http://webquest.sdsu.edu/webquestrubric.html). This rubric aids teachers in developing a webquest that will be effective and useful to student learning and development.

Classroom Use

Digital reading environments can be addressed in a variety of ways in the classroom. The focus of this paper is on digital reading environments that use hypertext and hypermedia to increase students' reading strategies with embedded comprehension supports. This type of digital reading environment can be used with a variety of age groups and in a variety of ways within the classroom. This paper is geared towards secondary education; therefore, the focus for digital reading supports in this paper is based on an inquiry model where students are actively engaged with the reading and are assessed in a variety of ways throughout their engagement. The classroom use, for the purposes of this paper, is focused on digital texts that are designed to increase reading

and language comprehension in a variety of environments so that students are able to actively participate in a variety of communities.

Inquiry Based Critical Literacy

Hypertext has a great affect on the learner due to its demands for an active, engaged reader. Patterson (2000) points out that just as a novel is read differently from a magazine, hypertext is read differently from the traditional reading found in school settings (pg 74). The reader must make "deliberate decisions about which path to take within a hypertext web" (Patterson, 2000, p. 77). As the role of the reader changes, so do the demands on reading comprehension. Online reading skills do not necessarily coincide with offline reading skills; students need additional literacy skills in order to reach the demands of an online reading environment. One such skill is critical awareness; it is important for teachers to scaffold this skill in to lessons when using digital reading environments.

Teaching literacy for critical awareness is important to guiding students' literacy practices and developing their ability to interpret and evaluate all forms of text including print and non-print media (Alvermann et al., 2010). Students are consumers of technology both in and out of school; though a school may monitor students activity the outside world does not – it is important to guide students to become critical consumers of media and meida-based products by making them alert, active users of technology. Alvermann et al (2010) suggest that teachers' consider the following questions when implementing the study of critical literacy awareness in regard to hypertext:

1. In manipulating the text to meet our own desire for information (or entertainment), what do we come to know about ourselves that we would not otherwise know?
2. Are hypertext readings of authors' messages privliged in ways that linear readings are not? If so, what might be the consequences of this privleging?
3. How does linking materials in hypertext influence readers' thinking about issues of race, class, gender, ethnicitiy, sexual orientation, ability age, wellness, and other identity markers? (p. 300).

Using these types of questions not only influences the development of curriculum, but also influences the learner and the learning environment; they challenge students to become critical consumers, to deconstruct messages and identify bias as well as question whose voice is represented and whose is not (Dalton & Proctor, 2008).

CAST Strategy Tutor

One program that allows teachers to customize lessons in a digital reading environment using hypertext and hypermedia is Center for Applied Special Technology (CAST) Strategy Tutor; this program is a "web-based tool designed to support students and teachers doing reading and research on the internet. Strategy tutor helps students read, research, collect and understand information better and more efficiently" (CAST Strategy Tutor, 2008). Strategy Tutor allows teachers to create web-based lessons that are embedded with pedagogical coaches and vocabulary support.

Strategy Tutor helps students reflect on and evaluate web-based resources while helping them learn several different reading strategies such as summarizing, questioning, clarifying, predicting, feeling, and visualizing. Students are able to explore these

concepts with support of strategy tutors in each lesson. Teachers are able to create lessons that aid students in gaining literacy skills that can be used in both offline and online literacy. Figure 3.1 is an example of a Strategy Tutor lesson with embedded vocabulary support taken from a lesson on "Desiree's Baby" by Kate Chopin created by Rachel Matthews on April 14, 2010. The teacher informed the students that they would be building background knowledge, reading, comprehending and analyzing the short story with comprehension supports throughout the Internet inquiry. The embedded vocabulary support allows students to find useful definitions as they read.

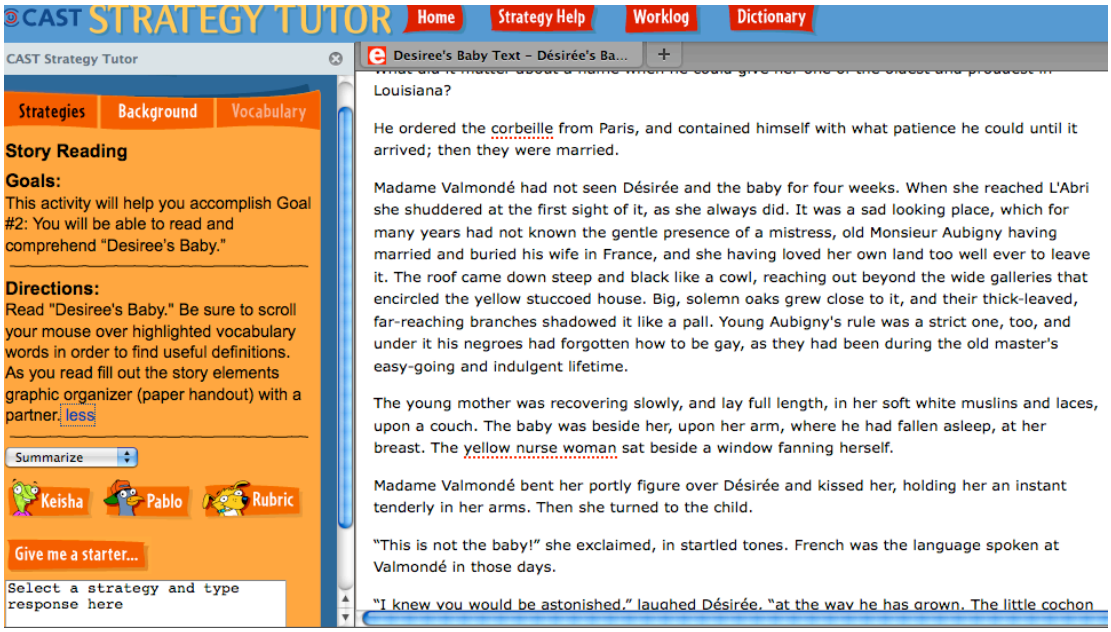

Figure 3.1: Screen capture of CAST Strategy Tutor Lesson by Rachel Matthews showing embedded vocabulary support

Figure 3.2 is another activity from the same lesson on "Desiree's Baby". In this activity the teacher explicitly tells students that they will be building background knowledge on Creole culture and literary criticism. They are directed to read the entry provided and to focus on a specific area of the reading. The teacher supports the students by guiding them in such a way that will build reading comprehension strategies. While figure 3.2 shows the goals and directions for the activity, Figure 3.3 is an example of one of the

strategy coaches provided by Matthews for her students. Matthews customized the strategy tutor for her specific lesson and used language specific to the lesson she created. Notice that students are able to click to hear the tutor's thoughts out loud, this is yet another embedded support for struggling readers.

Figure 3.2 Screen capture of CAST Strategy Tutor Lesson by Rachel Matthews showing background knowledge support

Figure 3.3 Screen capture of CAST Strategy Tutor lesson by Rachel Matthews showing comprehension strategy support

Webquests

Inquiry based critical literacy can be incorporated in to the curriculum through webquests. A webquest, according to webquest.org, "is an inquiry-oriented lesson format in which most or all the information that learners work with comes from the web" (Dodge, 2007). Webquests not only integrate a variety of hypertext and hypermedia that can support struggling readers, but they also help develop problem solving skills. This digital reading environment has the potential to develop students' ability to answer the questions suggested by Alvermann et al (2010). Teachers can design webquests that "foster critical inquiry about some issue, question, or topic by drawing on web based information and ideas as well as critiquing websites themselves" (Beach, 2007, p. 18). Co-developer of webquests, Bernie Dodge, identifies five guiding principles of creating webquests using the acronym FOCUS: (1) Find great sites (2) Orchestrate your learners

and resources (3) Challenge your learners to think (4) Use the medium and (5) Scaffold high expectations (Dodge, 2001). Teachers can use these five principles to create webquests that provide structure and guidance for students (Dodge, 2001). Below are two screenshots taken from a webquest titled, "Investigating the Holocaust" created by two English-Language Arts teachers in Ellington, Connecticut.

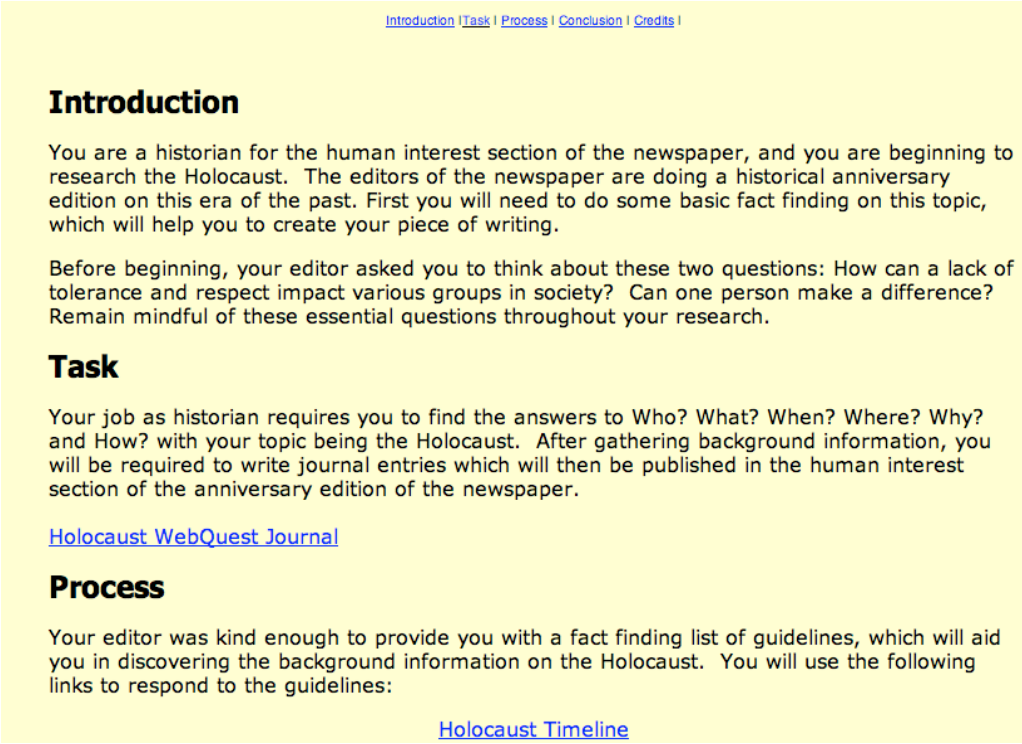

Figure 4.2: Screen shot showing goals of the webquest (Brogle & Pohlman, 1999)

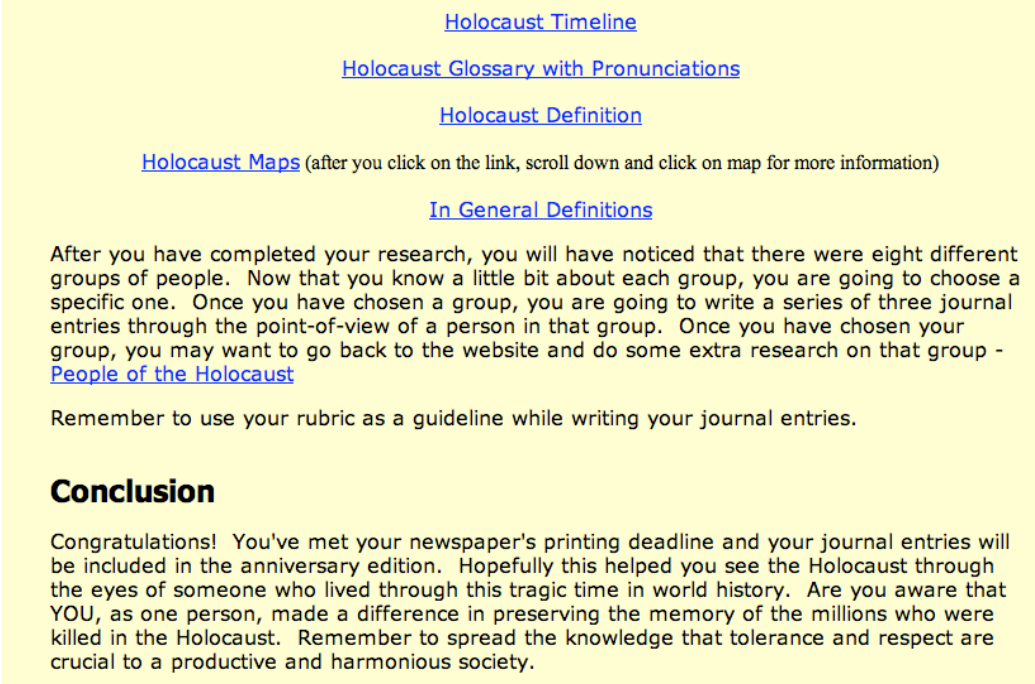

Figure 4.3: Screen shot showing critical based inquiry using hyperlinks (Brogle & Pohlman, 1999)

Brogle and Pohlman (1999) created a webquest that follows the five guiding principles suggested by Dodge (2001). Hyperlinks were used to scaffold students and provide background knowledge as well as vocabulary information. Students are given a choice of where to create their journal entries. They can type them or hand-write them, but the requirements remain the same for both mediums. The journal requirement could be modified where students are asked to submit their journal entries on a class blog or wiki, allowing all students access to one another's work and allowing the teacher to assess their work in an on-line environment.

Implications

My main interest in conducting this research on digital reading environments was to find how the new medium of digital texts are able to aid students' literacy skills with a focus on reading comprehension, vocabulary support and critical inquiry. From this study I have learned what key elements of offline literacy affect students' online literacy

skills. I have also gained a significant amount of knowledge on how to scaffold support for students to acquire new literacy skills that will aid them in both offline and online reading. Digital reading environments can be used to help students analyze their reading abilities and bolster their reading skills. They can also be used to help me assess students' skills as the school year progresses.

The research that I have conducted on digital reading environments greatly affects my future practice as a teacher. I will be teaching seventh grade, English-Language Arts at a school that has technology readily available to its students. Using digital reading environments will allow me to conduct inquiry based learning with my students while also supporting readers who range in ability. I have learned that the most effective use of digital texts with secondary students is when the learning environment scaffolds support while requiring students to think critically about the topic at hand.

Research on the use of digital texts to improve reading comprehension and vocabulary is relatively new and limited; however, combining research on off-line literacy and inquiry based learning allows me to see the benefits of extending literacy practices in my classroom to include digital reading environments. In order to use this information to best benefit my future students I will be sure to create digital reading environments specific to my students and their needs. Using programs such as CAST's Strategy Tutor and creating my own webquests will allow me to have control of the learning environment while also allowing my students a certain level of autonomy over their learning.

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