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CHILDREN'S LITERACY PERCPETIONS AS THEY AUTHORED WITH HYPERMEDIA

A Dissertation

SUMITTED TO THE GRADUATE FACULTY

In partial fulfillment of the requirements for the

degree of

Doctor of Philosophy

By

Sandra Kay Goetze

Norman, Oklahoma

1999

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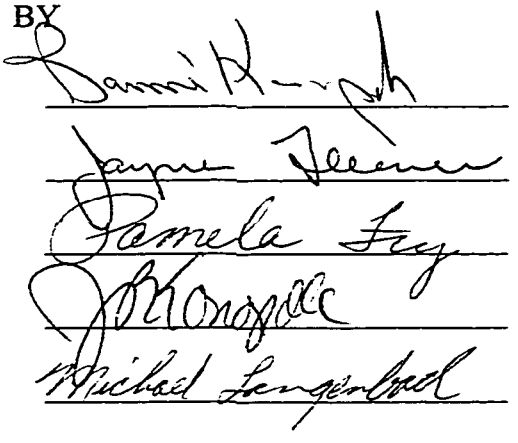
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CHILDREN'S LITERACY PERCPETIONS AS THEY AUTHORED WITH HYPERMEDIA

A Dissertation APPROVED FOR THE

DEPARTMENT OF INSTRUCTIONAL LEADERSHIP AND ACADEMIC CURRICULUM

BY



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Abstract

This study explored children's literacy perceptions as they authored with hypermedia within the context of classroom literacy lessons. The children authored two hypermedia projects and linked these projects to novels that they read in their classroom. The learners used two different multimedia link authoring tools to author. The hypermedia projects were based on critical literacy themes suggested by the children in the classroom.

The first hypermedia project was based on one novel and the children authored in teams of two to create a stack-like presentation of their perceptions of the novel. The second project utilized an Internet web authoring to tool. The children applied their knowledge from learning the link authoring process to create a web-based project related to three novels they had read in class. The three novels were intertextually linked by a central social issue theme and formed the basis for the link authoring project.

Findings indicated that the children made a distinction between two types of literacy with regard to writing. Their definitions of literacy reflected both linear and non-linear types of reading and writing. Writing conventions utilized by the children included traditional writing and non-linear writing conventions and tools. Non-linear writing conventions and tools added to the meaning of documents based on the sign systems chosen by the children. The children constructed meaning within their documents through their use of semiotic sign systems. Notions of readability were redefined to reflect new definitions of literacy and included design and semiotic sign systems as a way to mean for the anticipated reader.

Chapter One: Introduction

Technological Changes In Education

Technological changes since 1980 have moved fast and fiercely. No where has this change had a greater impact than on the modes of reading and writing. The ways we read and write now are augmented to include such means as E-mail and World Wide Web. Learners are able to send and get quick responses to E-mail. On the World Wide Web, learners encounter conflicting interpretations of text and must be able to generate good key terms when searching for information so that they can sort through these interpretations. These changes are beginning to impact literacy instruction as more schools come into the on-line environment and seize it as a way to promote literacy understanding throughout the curriculum.

The Uses of Hypermedia

One particular technological change is the use of hypertext to author. According to Reinking (1997), the use of hypertext can be seen as an extended metaphor to guide reading, writing, and thinking. It is only in the hypertext environment that readers and writers can digress, jump around, and link to others' writing. The literacy experience can become collaborative and intertextual. The social element of learning, involving intertextuality and collaboration, is also expanded with technology as learners read and write in real-time with those halfway around the world and have their learning scaffolded by many capable others. This dialogic use of text functions as a vehicle to generate meaning with each new reader and writer who comes into contact with it (Wertsch, 1991). Salomon, Globerson and Guterman (1989) refer to this type of learning as computer mediated communication (CMC). According to

these researchers, this term suggests that a computer provides a zone of proximal development for reading and writing that leaves the learner with socially constructed knowledge that is carried off into other forms of reading and writing away from the computer.

Technology's Impact on Schools and Literacy Learning

The notion of literacy learning is very different from the type of literacy learning that traditionally has been supported in our schools. The question of how this type of interaction with print fits with literacy instruction in schools as a new tool becomes salient. With the use of CMC and computer software packages to support literacy learning, traditional models of literacy thought and instruction must be recast. Hypertext allows learners to construct multiple interpretations of a text (Bereiter & Scardamalia, 1989). Learners can reflect on their actions and try on new perspectives. Thus, literacy practice becomes broader and more authentic (Pea, 1993).

Purposes and Research Questions

The purpose of the present research was to understand children's perceptions of their literacy development and the extent to which technology contributed to their literacy development over a period of time. Two main questions from this purpose guided the study: (1) What were children's literacy perceptions as they authored with hypermedia? and (2) What were children's literacy perceptions of their writing growth as they authored with hypermedia? When technology is introduced as a factor to be incorporated into these perceptions, different ways of thinking may be introduced (Leu, 1996). A pertinent example of this might be book reading and reading on the Internet. Book reading is a linear process. One can read paragraphs

and pages forward or backward, but essentially reading can only move in one way. Web reading, or reading on the Internet with hypertext-markup language (HTML) based documents, is a non-linear reading process. It has also been described as a multi-linear reading process (Reinking, 1998). One can read backwards, forwards, jump to term definitions inside the document, read excerpts that go with video or audio clips, and jump to other documents embedded in the original document. This way of reading and writing can be related to notions of intertexuality (Reinking, 1997).

Constructing Meaning

Intertextuality looks at the joining of ideas from multiple texts and the formation of new interpretations based on these texts (Bloome & Egan-Robertson, 1993) The authors also define intertexuality as social construction within the learner for the purposes of reading and writing. Social semiotics also is included in this definition in that intertextuality is seen as a resource that is inherent in language for making meaning. The social semiotic use of signs and symbols is directly linked to who we are, and ideational and textual functions (Labbo, 1996). Intertextuality is also linked to learning because of the judgements the learner makes while constructing meaning. Constructing meaning in the realms of reading and writing has grown to include new ways to represent the knowledge gained from intertextual considerations by the learner. Semiotics or intertextual semiotics are contributing factors in non-linear reading and writing (Bloom & Egan-Robertson, 1993).

Linear and Non-linear text as a Meaning Making Process

Non-linear reading allows the reader to acquire intertextual excerpts all in the same document, thus representing the way we think. Individuals tend to think in ways that jump around. Readers digress, want to explore extended ideas, define terms, or gain clearer understanding of what the writer is saying by exploring both inside and outside the document. Readers also can draw some of the same parallels with writing. When one writes in a linear mode, the idea of revising allows the inclusion of new ideas, but basically the writing is one-dimensional. An idea or term cannot be defined by clicking on the word. Examples cannot be shown with actual video clips or even the use of someone else's writing to help illuminate one's own. This semiotic aspect takes on a greater role with the use of hypertext-markup language (HTML). HTML authoring allows the writer and reader to engage in all of these processes and also allows the writer to use multiple sign systems to express what he or she is trying to say.

Given this notion of non-linear text, it is appropriate to think about how this non-linear form of reading and writing may shape children's perceptions of their own writing development with regard to literacy and technology. Questions about literacy growth and development hinge on how the learners' perceptions are shaped by what counts as knowledge, whether they believe knowledge is discovered or created, and where this knowledge is located relative to themselves. These epistemological lenses can be used to look at literacy development and how technology may or may not play into this development. Semiotics fits into the equation of understanding literacy development because it recognizes that all meaning making is contextual and that

many systems of meaning transact with one another (Berghoff, 1994). Sign systems can be used in flexible ways to learn and to communicate as one layer for gaining a deeper understanding of how literacy development is defined by epistemological perceptions of the learner.

Defining Literacy

With the push to include a computer in every classroom and web access in those classrooms by the year 2000, those interested in literacy education are at a crossroads to gain a greater understanding of how hypertextual reading and writing has reinvented literacy and changed the way one writes, reads and sees the world (Bork, 1981). Reinventing literacy or new ways to think about literacy needs to begin by clearly exploring what is meant by literacy in the linear sense and then by exploring changes to that definition.

The Changing Definitions of Literacy

According to Reinking (1998) traditional views of literacy have centered around the notion that reading and writing are typographic and fixed for learners. Literate behavior has centered on the processes of reading and writing for the purposes of communication and learning (Smith, 1994). We now know that literacy encompasses so much more than simply reading and writing. It has broadened to include understanding, listening, speaking, representing ideas in multiple ways, and being able to learn from others' cultural perspectives (Tierney, Kieffer, Stowell, Desai, Whalin, & Moss, 1992). This intersects with the ideas of intertexuality and epistemological perceptions of literacy development that fit into the use of hypertext. In thinking about new definitions of what literacy means, one could say that the

processes of expressing oneself through reading, writing, and thinking in multiple discourses are precursors to a more global definition of literacy. This new definition of literacy encompasses more of the sociocultural and cognitive aspects of learning and what Bolter (1998) refers to as hypertextual literacy. Literacy can then be understood in terms of the use of hypertext environments as opposed to strictly linear text. This is driven by the idea that the nature of literacy and learning are being redefined by the digital technologies that are quickly becoming a part of the current information age.

Broader Definitions of Literacy

Technology and computer use have played into this broadening definition of literacy because one is able to now represent text, learning, and ideas in multiple ways, such as with buttons, scrolling bars, text, graphics, and images (Reinking, 1998). Technology in a broad sense can be defined as any tool that moves one toward being more literate, such as a calculator or a computer. For this study, notions of technology center around the use of computers, specifically hypertextual environments that use non-linear text to convey ideas and meanings. Reinking (1998) and Bolter (1998) refer to this new term that defines a new literacy as hypertextual literacy. Hypertextual literacy is the marriage of hypermedia and hypertext into new ways of thinking, reading, and writing that moves learners away from alphabetic code and toward a wider range of symbolic elements. This new definition poses questions that ask: What is considered to be text? What elements comprise text? How are texts appropriately structured? These questions help to frame how our definitions of literacy are changing and will continue to evolve as our understanding of

technological transformations of literacy move into a post-typographic world (Lemke, 1998; Reinking, 1998).

Looking at other new definitions of literacy and technology hypertext, or non-linear text, provides us with new production skills not used before. The production skills are learning how to make effective choices in framing, point of view and style, learning how to use visual and auditory symbolism, and learning how to manipulate time and space through editing (Flood & Lapp, 1995). Eisner (1994) sums up the ideas best when he describes a conceptualization of literacy as one that allows for multiple forms of representation. Multiple forms of representation include visual literacy and media literacy. Visual literacy is described as art, drama, television, film, and media literacy is defined as the understanding and production of messages through physical devices (Flood & Lapp, 1994). And to broaden this definition of literacy further, Lemke (1998) adds that we can define literacy as a set of cultural competencies for making socially recognizable meanings by the use of particular material technologies and by the use of particular material artifacts that mediate the process. All of the definitions of literacy have some common elements that are reflected in the current research (Reinking, 1998). Tierney and Damarin (1998) describe the common elements as multiple ways of knowing, semiotics, and the confluence of perspectives that can be built from cultural differences. Literacy and technology are terms that are now linked together in the question of: What is literacy? (Bruce, 1997). Ong (1982) states that the materials and processes of creating texts have linked the two ideas together in a way that one can not be realized without the

other. The explanation of definitions of what literacy is have evolved to reflect the communicative aspects of reading and writing but also the effects of technology.

Strands to Conceptualize Literacy and Technology Learning

Studies that focus on these ideas of literacy learning and technology help to explain the different lenses through which one can look at children's perceptions of literacy development as they author in hypertext. These studies contain the lenses of multiple ways of knowing, semiotics, intertextuality, and the creation of literacy learning spaces. Lemke (1998) described this type of learning as similar to the paradigm used by libraries and research institutions. The paradigm placed learners as masters of their own learning in setting their own purpose and direction for research. He further stated that learners created and interpreted differences of degree as well as differences of kind. It was the belief that multimedia technologies help to solve the problem of learning that in the past has only emphasized conceptual categories and semantic distinctions.

Current research (Bergeron & Bailin, 1997; Eagleton, 1999; Hailey & Hailey, 1998) in the area of literacy education and technology is varied in its approach to use literacy and technology as a tool to mediate thinking. The research includes the use of multimedia programs, the use of the web as a resource to search for information, the use of computers as writing partners who provide feedback, the use of programs written to act as reading partners, and the use of the computer to make links between content learning and personal relevance. Although these studies are vastly different in their approach and their general goals, they have a common thread that links them together and that is the use of technology as a tool for mediated thinking. Technology

can be tied to writing in that technology as a tool for thinking can parallel writing as a tool for thinking. The two tools together, literacy and technology, help the learner gain a greater sense of being literate.

Several studies helped frame different strands explored in this research. The strands explored were semiotics as a tool used with hypermedia to architecture writing spaces, multiple ways of knowing and intertextuality, the critical collaborative learning community and reader-response (Rosenblatt, 1978).

Semiotics as a Tool

The first strand that informed the research was supported by the research done by Labbo (1996). She studied kindergarten children's writing in their classroom computer center. She found that learners used five screen metaphors as semiotic patterns with which to write. Examples of this included the use of symbols above the number keys on a keyboard in a mixed string to convey words or phrases. The children used the symbolism present in the mediated tool along with typographic symbols to represent complex ideas in their writing. Their engagement in symbol use to communicate with others in their environment was an example of the children's literacy processes at work and the purposeful explorations of the literate environment. Findings also suggested that children were able to determine what symbol was appropriate to use in the writing context and when it was appropriate. In using a computer the children were able to put into play their knowledge about the language arts processes along with processes related to the fine arts and multimedia arts. This supported multiple ways of knowing in their thinking.

Multiple Ways of Knowing

A second strand of support for the present study was the idea of architecturing writing spaces for communicational purposes. Cummins and Sayers (1997) described the use of electronic conversations through the Internet between two classrooms, one in Maine and the other in Quebec. The students from Maine corresponded with their Canadian friends in French and the students in Quebec corresponded in English. Both groups engaged in reading and writing with native speakers of their second language without the added burden of having to respond immediately to the conversation. The electronic conversation afforded the learners in both locations time to reflect on the responses before replying. These global language exchanges also afforded the learners the opportunity to understand the second language they were learning from a native speaker who assisted in enhancing their perspective of the second language from a cultural perspective.

Critical Inquiry Collaborations

Critical inquiry collaborations have utilized technology via the Internet to connect classrooms for joint projects. These projects, such as the De Orilla a Orilla, (Cummins & Sayers, 1997) harnessed the power of E-mail conversations and computer-based conferencing for the purposes of connecting classes to effect social change. Teachers and students globally participated in projects that dealt with antiracist education, linguistic human rights, and their own community traditions. Students shared information and used a common web site to post their assignments for all in the global village to read. Feedback for the students enhanced their

understanding of collaboration in planning assignments with those around the world, and also an appreciation in critically understanding social issues from others' perspectives (Cummins & Sayers, 1997).

Intertextuality

The fourth strand, intertextuality, is supported by the research done by McKillop (1996). In this study, seventh grade students authored hypermedia projects that juxtaposed, linked, and sequenced multiple representations within the context of social studies topics while also adding text to explain how their ideas posed a question from a critical literacy perspective. The hypermedia tool was used to bring all the ideas of the author together in an electronic space so that the writer might generate the connections as a basis for critical literacy. From an overall literacy perspective, the learners transformed their role as meaning makers from the reception of the teacher's meaning to the production of their own knowledge about the topic. This was a shift in classroom writing from production to process that was more interactive in nature.

Research Rationales

The strands of reader-response, intertextuality and multiple ways of knowing, critical collaboration, and semiotics frame the purpose of this study which was to gain new understanding from children's perceptions of their writing development as they authored in hypermedia environments. It was important to investigate children's perceptions of what counts as literacy learning knowledge and if or how technology contributed to their perceptions of their own literacy learning because of the increased emphasis of technology used in the global society and in our schools. The changing

definition of literacy and technology also contributed to a need to better understand how we have shifted from traditional ways of thinking about reading and writing into literacy and technology as the ability to communicate in multiple discourses. We often hear children working on a computer express that the writing or learning they are doing is not work in the school sense. They seem to see the technology and literacy as intertwined but the reading and writing that occur on the computer are not always considered by to be "doing school " (Allington & Cunningham, 1995). Children seem to see a very clear line between what schools have traditionally called reading and writing instruction, and they view technology and literacy acts as closer to authentic activities in which adults engage (Allington & Cunningham, 1995).

Defining the Research Questions

New Technology and Old Paradigms

Many schools are using the Internet to link children with information for researching in a bookshelf metaphor type of way. Students have been taught to use the Internet as if it were a library and to pull documents or web pages from search engines without going into documents and exploring the extended text. Very few classrooms are harnessing the power that digital technologies offer in terms of writing and demonstrating knowledge in multiple ways (Eagleton, 1999). Because there is so little research in this field of literacy and technology, it is important to investigate it and begin to understand how children view it in terms of their own literacy learning and development. The present study contributed to the field of literacy and technology not just because of the lack of research, but more in the way of extending our understanding of the processes of reading and writing within the realm of

technology, and in how children viewed the tool of technology when they begin to think about what counts as literacy learning. The research questions sought to uncover why children view technology and literacy learning as different from other ways of learning with printed texts or linear texts. The field of technology is so rapidly changing that new research efforts need not focus on technology integration into learning, but more on what is delivered from the technology and how that literacy learning is perceived by the learner. The learners' tool use and how this tool use mediated their thinking in terms of their perceived literacy development was the salient point of the research.

Developing New Paradigms for Literacy and Technology Learning

The questions asked have to frame literacy and technology learning in new ways in order for the research to develop its own unique paradigm. The overarching questions in this study asked: What were children's literacy perceptions as they authored with hypermedia? And what were children's perceptions of their literacy learning growth as they authored with hypermedia? Underlying questions embedded in the research included: What is literacy according to the child? How do children perceive that literacy knowledge is created and where is it located? And, how does the hypermedia tool mediate their thinking within a literacy framework? Paulo Freire (1998) spoke of critical reflection and a need for it as a requirement between theory and practice. Understanding literacy theory is not enough to be a successful teacher; one needs to think and act theoretically so as not to transfer knowledge but to act in ways that it creates possibilities for the production and construction of knowledge. Freire also stated that there is no teaching without learning. "The more critically one

exercises one's capacity for learning, the greater is one's capacity for constructing and developing epistemological curiosity (Freire, 1998, p. 32)." It is this "epistemological curiosity" that moves children to understand their own literacy development and to critically question until there is a revelation of something that has been hidden. This curiosity allows them to suspend rationale thought and balance this thought with technology to explore critical notions of who they are in relationship to larger concepts in the text and how these concepts also seek to define them. Examples of this might be the notion of conformity and, when explored through text, conformity may look very different or be judged as good and evil. The good of conformity might be the blending in of ethnic groups just as the Jews tried to conform to look like Germans during the Holocaust. The evil of conformity might be the sameness experienced by people as a way to lose one's personal thoughts and self to succeed in a racist world. It is these broad notions through text that can be explored with "epistemological curiosity" to extend thinking and the juxtaposing of texts allows the learner to look through multiple lenses in constructing their own meaning.

Theoretical Framework

Introduction

The present research was grounded in sociocultural literacy learning theory. Dialogue and collaboration surrounded much of learning in this study. Literacy and technology combined were the vehicle for learners to achieve new learning within the social collaborations. The children authored collaboratively and social interaction was a large factor in shaping how they responded. The social collaboration of literacy and technology learning was the central place where learning, talk, and the

trying on of others' ideas were experienced. Semiotics was also important to the topic because of the way writing could be constructed in HTML environments, unlike how it is constructed in linear text. The roles of stance and intertextuality also supported and helped to examine the research in that stance and intertextuality notions helped to illuminate understanding for multiple ways of knowing.

Transformative Learning

Writing is a tool for thinking and the role of multiple ways to express writing enhances this thinking. Writing and reading in multi-linear formats is transformative for thinking and serves to shape literacy development from an epistemological perspective. Cummins and Sayers (1997) describe transformative in a way that clarifies the theoretical stance of this study. Transformative learning is linked "to critical inquiry to relate curricular content to students' individual and collective experience and to analyze broader social issues relevant to their lives" (p. 153). In this study the focus was on writing in multi-linear ways within the context of collaboration to promote intertextuality and multiple ways of knowing, reader-response, semiotics, and critical collaboration. These frameworks were used to explore the notions of what counts as text and how learners' perceptions of their literacy learning had changed. The data provided new theory related to how children learned to move themselves along a growth continuum in writing within the realm of multi-linear text and critical literacy.

Learning Through Intertextuality

Intertextuality and the role of stance anchored the study to multiple ways of knowing. Intertextuality was an integral part for the children in developing their

vision of what multi-linear text and authoring might look like. It was from intertextual links of the curriculum that the learner constructed thinking in multiple ways with literacy and technology as the vehicle to grow as a reader and writer. Stance also was important to consider because the learner needed to think about who the audience was and was not in the writing process and also in reading multi-linear text. Lastly, reader-response (Rosenblatt, 1978) was a pertinent theoretical consideration because much of the writing generated by the children came from the novels read in their classroom. The three novels, *The Giver, Number the Stars, and Roll of Thunder, Hear My Cry,* were linked intertextually and transactions of meaning were seen in the responses the children created with hypermedia (Lowry, 1991; 1989; Taylor, 1976).

Technology Related Learning Theory

The theoretical stance was also actualized from Perkin's (1985) theory of the fingertip effect and cognitive flexibility theory (Spiro, Coulson, Feltovich & Anderson, 1994). Cognitive flexibility theory and the fingertip effect contributed to a better understanding of learning within the realm of literacy and technology because they directly addressed how learning took place in hypertextual environments.

In his theory of the fingertip effects, Perkins (1985) makes a distinction between first order and second order effects. He describes first order effects as technology that makes our lives easier. It is also the difference that an innovation makes. The ease of using technology is also reflected in a pragmatic sense to first order effects that seek to change the way people do things but without much cognitive effort required for the change.

In contrast to this second order, fingertip effect involves technology that helps us to think in multiple ways and gives us a multitude of choices at our fingertips. High-level thinking is not just fueled by the printed word but employs writing as a vehicle in which to think. The written word has extended the reach of thought by making possible the freeing up of low-level thoughts in writing to the focus on higher level thinking that is mediated by the technology tool. Consequently, technology puts at our fingertips opportunities for better thinking and learning.

The differences between low level thinking and more advanced thinking are salient in understanding cognitive flexibility theory (Spiro et al., 1994). Cognitive flexibility theory seeks to understand higher level thinking and advanced knowledge acquisition in ill-structured domains, the ill-structured domains being represented as hypertextual environments. The lower level learning can be described as general knowledge recognition and recall, whereas, advanced knowledge acquisition promotes the understanding of multiple sign systems, linkages among knowledge, schema assembly, participatory learning, and the understanding of cases of application which are used as a vehicle for conceptual understanding. Ill-structured domains are described as those that use many concepts that interact contextually to form meaning; however, the combinations of these concepts can be inconsistent across application as is true with the use of hypertexual authoring.

Cognitive flexibility theory can be applied to hypertextual domains to explain how learning takes place within a flexible approach to learning and instruction. Learners criss-cross ideas, interpretations, talk, and writing to understand concepts at a deeper level. Ill-structured domains, like hypertext, naturally foster flexible types of learning

by allowing learners to develop mental and visual representations. They also develop multiple ways of knowing, multidirectional and multiperspectival cases of concepts, and the ability to assemble these diverse knowledge bases to fit the needs of the learner in a particular application system. Hypertextual environments encompass all the demands of this theory and help to explain how learning moves to deeper levels of understanding by criss-crossing these ideas to produce advanced knowledge acquisition (Sprio et al., 1994).

Learning theory is an important component for understanding and exploring why learners act in certain ways to achieve learning goals. However, it is also important to understand children's epistemological perspectives because their perspectives frame their beliefs about how they see knowledge as being created or discovered and where it may be located relative to themselves. Epistemological perspectives are especially notable when there are discussions with children regarding their personal definitions of literacy, language, and learning. The epistemological questions help researchers begin to understand how children define knowledge in terms of what literacy might be and how literacy may act and influence their lives. Epistemological perspectives of the study related to understanding learning are framed by notions of dissonance in writing and the idea that language is intertextual. Cunningham and Fitzgerald (1996) explain that from a poststructural stance knowledge is located in many different sites. Knowledge is social and cultural and it does not exist outside the individuals and communities who know it. Therefore, how one learns is held to be perspective rather than fact and learning is entirely sociocultural. The theoretical framework of the study reflected children's

perspectives of how knowledge was created as they authored with hypermedia and where this knowledge was located relative to themselves. The question of how knowledge increases was explored through the children's perspectives of their own writing development.

Sociocultural learning, intertextuality, semiotics, critical collaboration and reader-response all contributed to the theoretical framing of the study through the ways that they were linked together to explore literacy learning. Each of the frameworks overlapped to explain different types of learning that were all realized with hypermedia writing tools. These frameworks also shed light on how the theoretical proposition of the study was derived.

Sociocultural Learning

To gain a better understanding of how learning is influenced by technology and literacy it is appropriate to explore learning in the sociocultural realm. Sociocultural learning has grown out of the work done by Vygotsky, Leont'ev, Bruner, Piaget, Cole, and Wertsch. The roots of sociocultural learning support learning which is embedded in the context of social relationships (Rogoff, 1990). Newman, Griffin, and Cole (1993) interpret sociocultural learning as development that is interrelated learning from the child's very first day of life. Vygotsky (1978) hypothesized that children have two levels from which they learn; the actual developmental level and the level of potential development. When children are engaged in a problem solving task at either level learning has occurred or will occur. This space between these levels of learning is referred to as the zone of proximal development. It is now understood that learning and development are interrelated for children, and children

learn best when working in their zone of proximal development (ZPD). This zone can be a place that the learner can function at a slightly higher level when the learning is scaffolded by a more capable other. The child can reach to higher levels of understanding as development trails along. Maximum benefit in learning takes place when this ZPD is embedded culturally. A good example of this is the interaction that took place between a third grade boy and his teacher as they wrote super hero story webs together. Sammy wrote qualitatively more each time his teacher scaffolded the story webs than when he wrote alone. The teacher was able to extend his writing fluency through the use of talk and repeated patterns suggested. Because the teacher scaffolded the writing around a very familiar topic and she knew he had many vocabularies to draw from, she helped to situate the learning in his ZPD. With repeated learning in this situation Sammy grew as a writer and eventually began to do the webs on his own (Dyson, 1997).

The zone of proximal development is one of the central tenets of Vygotskian learning theory; however, there are other important ideas in sociocultural learning that need to be explored to gain a greater understanding of a child's ZPD. These ideas are mediational means such as tools and language. Vygotsky (1978) referred to tools as psychological tools and categorized them into groups based on how they might be used within a cultural group. Vygotsky hypothesized that similar tools might be used by different groups but the tool use could be different because of cultural differences. Suggested tools to mediate action might be writing, art, diagrams, maps, conventional signs, language, counting systems, and mnemonic devices. These mediational means help shape the action of learning in essential ways according to Wertsch (1991).

Related ideas of sociocultural theory include: the more capable other, the internalization of learning, learning through participation, the role of voice, and appropriation. First, the discussion of the more capable other is appropriate to begin with since the ZPD had been initially defined. According to Wells (1986), initial interpretations of the term "more capable other" included parents and teachers who were older and better able to assist a child in learning. Although parents and teachers are important givers of guidance, Vygotsky (1978) suggested that peers could function as capable others also. And even when a group is trying to solve a problem and no one seems to appear as the leading expert, the whole of the group can act as the more capable other scaffolding for each other. This is prevalent in classrooms that use cooperative learning as a teaching practice. It is with this notion of cooperative learning that we realize that a capable other need not be present, but the group as a whole must participate together in the learning to learn with and from each other.

This learning through participation is necessary for children if they are to achieve the learning goal while engaging in the procedure. Internalization can take place when both the goal and procedure are learned simultaneously. Newman et al. (1993) found this to be true when they worked with groups of children who had to problem solve with a strategy and then appropriately group pairs of items. The children were able to use the strategy suggested by the scaffolder while also learning to group the pairs of items.

Along with participatory learning is the role of voice and dialogue as a necessary element for learning to take place. When new thoughts are generated from

participatory conversation or planning, the social interaction consists of a voice that is the individual's speaking personality. There is a blending of voices that ultimately forms the individual's unique voice and shades of the groups' voices can be heard in the newly revised ideas of the speaker (Bakhtin, 1981). Bahktin referred to this process as dialogic overtones and he also stated that as the child's voice begins to change, so does his or her way of viewing the world. The voice constantly has new intentions and meanings added to it. Kamberelis and McGinley (1992) described this phenomenon as the double-voiced discourse and these are the ways a voice can be directed in utterances of a speaker. Vygotsky (1978) strongly suggested that if speech was not permitted problem solving could be hampered and fail to occur in most cases. Further, Vygotsky stressed that speech played a critical role for learning in the ZPD; however, to neglect how other mediational means interacted in the process would limit understanding of the ZPD. One has to explore semiotic means to gain a greater understanding of the variety of ways in which learning in the ZPD is facilitated (Smagorinsky, 1995).

Semiotics and Intertextuality as a Framework for Understanding

According to Wells (1986) semiotic means is a way for learners to engage in learning other than through direct face-to-face contact. The use of semiotic means implies that appropriation has taken place, but this is not the end of the learning that is further down the line. When the learner makes use of the new functions then some telos or endpoint can said to have been reached (Smagorinsky, 1995). Making use of new learning is expressed as the telos because the endpoint of the learning also marks the beginning of new learning.

Harste, Woodward and Burke (1984) assert that semiotics is used to communicate and that meaning is actually assigned from personal and cultural knowledge. Dyson's (1990) notion of symbol weaving where children intertwine reading, writing, and drawing to make meaning on paper has some parallels to literacy learning in the hypermedia context. Although this example was from linear types of text when children were using traditional writing tools, it may happen during literacy learning within multimedia environments. The intertwining of the media helps to mediate thinking and multiple ways of knowing can be realized. Labbo (1996) found this to be true in her study of kindergarten children using Kid Pix (Broderbund, 1998) to read and write. Children naturally will focus on all components of symbol weaving process and this was seen in the Labbo's (1996) study. The features of the software in Kid Pix encouraged children to dialogue while writing and this was consistent with Dyson's (1990) notion that talk is a valued part in writing text.

Dyson's metaphor of symbol weaving is consistent with Hartman's (1994) metaphor of the intertextual mosaic that is created by readers and writers and realized through intertextuality. This metaphor is based on the readers and writers transposing of one text into other texts to build a mosaic of intersecting texts. The texts are conceived as signs much like semiotics uses signs. Hartman (1994) further describes the literacy learning process as the generation of interconnected ideas or the making of links between texts, resulting in a web of meaning. Although he is speaking of texts in the printed form, the generalization to multi-linear text reading and writing may be connected to the notion of linear linked text for meaning given the way he described the process as linked and webbed. The intertextual metaphor serves as a

model for what good readers do: connect previous reading experiences over time to make meaning. The end result is that readers' and writers' understanding is greater than any single passage read or written. Readers make intertexual links by forming what Hartman (1994) refers to as the Reader's databank. This databank becomes a multidimensional, heterarchical network of textual resources. New readings are brought into the intertexual loop and as meaning is composed by the reader, old text meanings are acted upon with reinvented and revised perceptions. These new perceptions of inner text then loop revised perceptions back to understanding the current text.

These definitions of intertextuality are best illustrated by several studies that utilize intertexual links as heuristic devices for making meaning. Saunders (1997) found that texts became interwoven by learners as they revisited old texts which were written as dialogue and read response journals. Intertexual tying of novels read was broad and included aspects of both visual, aural, and multiple interpretations created to invent new texts by the learners. Chi (1995) also found that intertextuality could be used as a heuristic device to create meaning as she studied Taiwanese college students who learned English through literature. The students continually relied on the linking of current texts to past texts to make meaning by employing this heuristic device of intertextuality to storytelling, evaluating, and integrating. The intertexual link helped the learners not only to understand the text but also to better understand English.

Hartman and Allison (1996) also studied the use of intertexuality as a heuristic device to understand and found that teachers in their study often positioned

intertexuality through the use of dialogic texts and synoptic texts. Dialogic texts presented a dialogue about one topic over a series of books. These books contained some of the same characters, issues, and events that reappeared. The continuity of characters among books provided students with ongoing textual conversations, or dialogue. This dialogic arrangement of texts was an example of an intertextual heuristic device utilized to promote connections across texts. Synoptic texts were used as variations of a single story across multiple texts. For example, texts about social repression represented viewpoints that were linked to the Holocaust, the Underground Railroad, or the Civil Rights Movement. Synoptic texts represented a variety of viewpoints on a single event or theme that crossed events. As students read differing viewpoints related to similar issues they began to employ intertextualiy to make connections to similarities and differences between authors' perspectives.

The ability to employ intertextuality as a heuristic device to gain greater meaning construction can be seen as a precursor to reading and writing in hypertextual environments. Hypertext is based on the meshing of multiple ideas and links to fulfill the purpose of the reader in directing the reading for purposes not directed by the author. Readers must know how to choose links that logically connect their meaning construction and knowledge of intertextuality and the ability to apply it is essential for understanding to occur. At the heart of defining links and tying intertextual themes is social activity. Social activity and specifically talk about books scaffolds learning and makes intertextual understanding possible. To acquire the practice of defining connections readers engage in everyday conversations that require them to recall and retell related experiences or texts, and ideas pertinent to the topic. (Beach,

Appleman, & Dorsey, 1994; Vygotsky, 1978). These social recollections are often driven by knowledge of genres and discourse practices (Kamberelis & Bovino, 1999).

Language Learning, Talk and Collaboration

Language is a dynamic social activity that serves to meet the needs of a learner's purposes (Barton, 1994). Literacy learning is built upon a theory of language that is constructed as language is used. The result of different forms of language is the use of discourses. Discourses are the different ways of using language. Language is reorganized to include vocabulary that signifies a certain group and readers and writers reorganize existing components of language to function in new discourses. Ways of using language are also ways of structuring knowledge and relationships. One needs to understand not only the appropriate language used in a discourse, but also the appropriate behavior in the appropriate setting. Gee (1990) refers to this as language that is situated in the social context with and understanding of the ways of being. This fits well with the previous definition of how literacy is reinvented by technology because technology and literacy together function as a discourse that mediates thinking when authoring in hypertext environments. Socially constructed texts from discourses grow from the intertextual links, reading, and experiences that shape new knowledge.

The ability to function in new discourses with language is heavily related to the notion of intertextuality. Intertextual conceptions assume that the reader derives meaning from the text in the transaction with the text and then readers apply their knowledge of literacy and social conventions to that text (Beach, 1985; Rosenblatt, 1978). Literacy learning in this way describes how readers and writers construct

knowledge with hypertext. Hypertext requires the reader and writer to make intertextual links and the links can be defined as the meshing of categories of information to create new unique categories or ideas as defined by the discourse in which the reader or writer is functioning. To apply this intertextual knowledge, readers and writers draw upon knowledge of scripts, genres, social relationships, and practices. The elements all contribute to how texts are socially constructed within discourses to assert one's ideas (Beach et al., 1994). Barton (1994) asserts that all texts depend on earlier texts. This assertion assumes that within a text lies the potential for new text and this also brings to light how language and text are closely linked by Bahktin's (1981) notion of double-voicedness.

Literacy learning allows the learner to engage in these processes from a transactional theoretical underpinning (Rosenblatt, 1978). Multiple ways of knowing can further be realized by the use of semiotics by the learner. Semiotics in the HTML environment allows the writer to bring knowledge to the writing by the use of signs and symbols. Berghoff (1994) explains that literacy learning is the transaction of three dimensions and this forms a complex network that influences and carries meaning. These dimensions are: inquiry (reading, authoring, transmediation, conversation, and reflection), sign systems (language, art, music, graphics, movement, and mathematics), and conceptual frameworks (myths, disciplines and models). It is further explained that this triad is used as a lens to see a larger framework for literacy learning which may help to understand how the learner conceptualizes their own literacy learning.

The triad which helps to conceptualize literacy learning does not take place in a vacuum, but is situated in a social context of collaborative talk (Jones & Pellegrini, 1996). Collaborative talk is at the center of learning and technology has the capability to enhance this. Pea (1994) describes a type of learning that gets to the heart of the questions being posed with regard to literacy learning and non-linear text. He calls this type of learning computer supported collaborative learning with the central activity of learning being the construction and refinement by learners of documents and problem interpretations. Seeing what the learners build is a central goal in learning. This type of learning and communication is transformative and takes into account the social and cultural messages that learners bring to the learning. The blending of learners and the effects of technology helps to create a unique voice and space that can be constantly changing or added to with regard to hypertext. Wertsch (1991) interprets Vygotsky's notion of unique voice to include all the interactions of learners that help a learner to form a new idea. The voice evolves from social interaction, collaboration and or tools. At the center of this new voice are the ongoing conversations that are the basis for the learning, whether it is with a teacher or peer, or peer in collaboration with a computer. This two-way or multiple-way transformative communication leads to meaning being constructed through negotiation and appropriation. Meaning is constructed through the successive taking of turns to talk, and between turns meaning is negotiated. When thinking about this in the context of hypertext, chat environments, or even two learners working side by side at a computer with a program such as Hyperstudio (Wagner, 1993) the notion of appropriation seems to explain how this learning may take place.

All of these environments have what Newman et al. (1993) refer to as a "looseness." It is this looseness that allows spaces and voices to be created in unique ways. Learners can pull in information from their cultural backgrounds when constructing meaning and the tools in the hypertext environment might look like graphics, buttons, bars, or text. Appropriation is also present when learners work in the zone of proximal development with more capable others and experience tool use from the scaffolder's perspective. Cognitive change may result from the differences while working in the ZPD and it seems that the looseness between learners is the essential element for this to occur. Web authoring supports appropriation and looseness because of the phenomenon of architecturing spaces that is a consequence from the writing.

Creating literacy learning spaces provides a means for expressing oneself in ways that reflect more directly the complexity of our thinking and the interrelatedness of ideas (Reinking, 1995). As children create texts, they develop spaces for themselves and others just as an architect designs a space in a building. These spaces hold the potential not only for meaning, but also for an opportunity to understand a child's literacy development with a different type of lens. The architecture or engagement of these spaces provides for a juxtaposing of multiple texts that may achieve powerful ways of knowing and learning complex knowledge. According to Sprio et al. (1994), the multimedia nature of these forms of text being juxtaposed may afford a kind of semiotic engagement that provides students access to multiple symbol systems. Students might also be afforded ways of knowing that are metaphorical or through analogies. Labbo (1996) discusses a similar phenomenon in exploring young

students' involvement with multiple forms of representations with computers and their relationship to literacy develop in her research with the screenland metaphor.

Reader-Response as a Tool to Interweave Theoretical Considerations

Texts can be woven to include the use of semiotics, intertextuality and multiple ways of knowing, along with sociocultural and technology learning theory. The catalyst to achieving this in classrooms is the use of Rosenblatt's (1978) reader-response theory situated in the context of Reader's Workshop (Atwell, 1994).

Reader-response theory (Rosenblatt, 1978) is predicated on the idea that each reader comes to a piece of literature with a rich background of worldly experience and a broad knowledge base in different subjects. The text's meaning is considered to reside in the "transaction" between the reader and the text, not from the text alone. Readers also act on the text with either an efferent or aesthetic stance. The efferent stance positions the reader's meaning making to solicit from the text referential, factual, analytic and logical aspects of meaning. The aesthetic stance queries the reader to focus on feelings, images, sensations, and to essentially live the text as it is read. According to Rosenblatt (1994) readers toggle between stances as they read a piece of literature and this toggling is based on the amount of background knowledge they are able to draw into the reading "transaction". How much toggling between stances takes place during any given reading can be likened to what Bates (1979, pp. 65-66) refers to as the "iceberg metaphor." Like an iceberg, readers use both information above the water, public meanings, and information below the water, private meanings, to construct their total meaning. The evocation of stance dictates whether a reader will use a mix of both pubic and private information to construct

meaning. Language is the common element that can appear in both public and private forums to construct meaning because language is part a larger sign system that takes into account differences of personal, cultural, and social contexts.

Peirce's (1933) triadic model uses language to ground the transactions that readers and writers make to construct meaning. The triadic model uses an object, a sign and an interpretant to construct semiotic meaning from text (Deely, 1990). This expresses how Rosenblatt ties the transaction of text to meaning making with the selection of stance. Hypertext authoring and reading utilizes this theoretical underpinning to connect texts (a sign) to the computer and hypertext environment (the object) to the meaning maker (the interpretant). The computer or hypertext environment created on the computer supports what Pierce (1933) refers to as virtual thirdness. Virtual thirdness anticipates changes in states of thinking and reacts according to how the interpretant chooses to read or write. This thirdness is realized as readers act on hypertext depending on their reading stance, either aesthetic or efferent, and also depending on the amount of public and private information they draw from. If a reader is reading a web page efferently and then is called to understand a concept presented by viewing a quick-time movie, virtual thirdness, their stance may shift to an aesthetic level. The same can be true as writers author with HTML. They may try to anticipate virtual thirdness in how they plan their writing. Examples of this are often seen in the different versions of web documents written for the anticipated browsers being utilized. Writers may author one version with frames for Netscape users and another version an icon away without frames for Mosaic browers.

Rosenblatt (1994) extends her theory to include writing as a meaning making process very similar to reading. Writers also face the problem of stance but they respond as readers as they compose text. Rosenblatt suggests that this type of writing engages the writer in authorial reading. Authorial reading is the act of reading one's own written text to evaluate stance and the transactions that may be anticipated by potential readers. Writers engage in two types of authorial reading: expression oriented and reception oriented. Expression oriented reading is utilized by the writer to evaluate meaning transactions and often leads to revision if the writer believes the symbolism may confuse the reader. Reception oriented reading allows the writer to disassociate from their writing and read from a stance to judge the meaning potential readers might draw from the text. Essentially, the first type (expression oriented) of reading is necessary to enact reception oriented reading. The two processes interact together as writers transact with their own text.

Hypertext authoring and reading brings into play transactional reading and writing through the process of interpretation. Hypertexts are malleable things and in certain respects a hypertext can be reauthored each time someone enters it. The implication is that we must rethink our conceptions of reader and writer. Our notions of what literacy is must be broadened because technological developments are affecting the nature, processes and uses of literacy (Teale, 1997). Transactional reading theory is broad enough to include these new definitions; however, types of interpretation may change as a result of the ways readers and writers select stance.

Chase and Hynd (1987) list five possible perspectives that children must consider as they author: the teacher, other classmates, their own, a critics, and other children

outside their classroom. Almasi (1995) suggests that there is actually a sixth interpretant: the changing interpretation within one reader when faced with challenges to their interpretation from the text or from others. Hypertext has the ability to engage readers and writers in the sixth level of interpretation because it is dynamic, often reflective and introspective. There are multiple interpretations with hypertext and readers must have tolerance for and even an expectation of ambiguity, which may cause them to rethink initial responses. The hypertext is viewed not as static but as dynamic and changing and readers learn to understand that a flexible use of stance is a necessary element in considering alternative meanings (McKeon, 1999). Flood and Lapp (1994) suggest that we need to expand our notions of reader-response to include the communicative arts, which includes computer technology. Rosenblatt's explanation of how reader-response theory also supports writers is clearly flexible enough to accommodate these new definitions of literacy, which encompass hypertext authoring.

Exploration of Research Questions

Hypertextual writing processes and children's perceptions of their literacy development while engaged in these digital processes anticipates new perceptions of the writing process by children. How these digital tools influence children's perceptions of their literacy growth and the extent to which technology contributes to their literacy growth over a period of time is a salient point to the study. Embedded within these child perceptions are the notions that new theory related to literacy learning as children author with hypermedia might emerge framed by the theoretical lenses espoused in the preceding section. The questions in this study asked: What

were children's literacy perceptions as they authored with hypermedia? and What were their perceptions of their writing growth as they authored with hypermedia?

The research questions of the study were considered over a period of five months in a fifth-grade classroom. Focal children were randomly selected to participate in the study along with the class. The children authored two hypermedia projects while participating in reader's workshop in their classroom. The children were paired by the teacher to author collaboratively throughout both hypermedia projects.

The first project involved the children in authoring with Hyperstudio (Wagner, 1993). Hyperstudio is a multimedia tool that allows users to blend text, graphics, sound, and video into a stack-like presentation. This tool was utilized while the children read *The Giver* (Lowry, 1991). Each of the ten dyads collaboratively authored a presentation related to the novel. The second project for the students utilized Pagemill (Adobe, 1997) as an authoring tool. This tool is an HTML editor that allows authors to write web documents with little knowledge of HTML authoring code. The students continued to use their reading response from reader's workshop as a way to express their ideas from the novels being read in class. Novels were intertextually linked by central social themes selected during class discussion of the books. The three novels, *The Giver*, *Number the Stars* (Lowry, 1991; 1989), and *Roll of Thunder, Hear My Cry* (Taylor, 1976) formed the basis of the literature response written within Pagemill. Each dyad explored a social theme that cut across all three novels and they used this social theme as a conceptualizing point of their writing. Examples of the social themes, generated by the class during reader's

workshop, included: conformity, racism, hate, family, freedom, and choice. Writers used their theme to intertextually link the three novels within the website.

Interviews of the focal children were conducted three times during the five month period to gain an understanding of their literacy perceptions as they authored with hypermedia. Additional data sources included field notes, screen changes as children authored, and prewriting documents. Final projects were presented to the class and critiqued by the collaborative community.

Chapter Two: Literature Review

Introduction

Research on literacy and technology falls into three broad categories: (a) literacy research that incorporates technology, (b) literacy research that utilizes technology as a scaffolding tool for learning, and (c) literacy and technology research that is transformative for the learner. The first two areas of research were situated in a curricular paradigm. The curriculum paradigm was first studied by a small core of educators whose interest was in technology for word processing as a new tool for writing and new instructional options offered for teaching conventional reading and writing skills (Reinking & Bridwell-Bowles, 1991). Consequently, an abundance of research that dealt with writing and technology as it relates to word processing resulted. The next group of studies that used technology as a tool to enhance literacy learning was situated in utilizing technology to enhance traditional reading and writing skills. It was more unique than the writing studies and requires some explanation about how the studies are situated and differ. The third category encompassed the most recent research in the field and sought to understand the two disciplines of literacy and technology together. According to Lemke (1998), this third category of research, which is situated in the interactive paradigm, is described as changing literacy and technology through using technology as a tool to mediate the literacy learning process. The most recent research encompasses literacy and technology from an interactive and transformative stance.

The Two Paradigms of Literacy and Technology Research

Curricular Paradigm: Literacy Research that Incorporates Technology

Word Processing

Early word processing studies conducted during the 1980's looked at how word processing might or might not transform the writing process. It was hypothesized that word processing would make writing easier for students and editing would be more thoughtful. The entire writing process was to be transformed, and it was thought that students would progress in overall writing processes from using computers. Newman (1984) cautioned that software available 10 years ago actually restricted editing or revision options available to students because the options were difficult to use and embedded in programs as function keys and shifts of function keys. Users had to have a thorough understanding of where editing options were located; thus, user friendliness was greatly reduced by the program and hampered the overall use of editing processes.

Ten years later word processing studies made a resurgence in the field of literacy learning because better word processing programs became available and they were within windows-based environments which were easier for children to utilize. Olson (1994) conducted case studies of first-grade children's writing with traditional versus electronic tools and reported that composing at the computer resulted in more revisions. The revisions, he cautioned, tended to be at the surface level and frequently arose from difficulty children encountered with using the computer. Although children tended to spend more time writing with the computer than they did

in using traditional tools, there was little difference in the quality and length of texts produced with either pencil and paper or with the computer.

Seawel (1994) and Shaw (1994) conducted parallel studies that looked at the processes of handwriting and word-processing within third and fourth grade classrooms. They also found that students spent much more time revising with computers but that revisions were of the same quality or less in quality than the handwritten drafts. Students who tended to write handwritten drafts had longer essays and the content of the writing was at a deeper level. They attributed some of these effects with using the word-processor to poor typing ability.

These studies suggested that word processing as a tool did not add to the writing process; however, there were other studies that suggested the opposite view (Dalton & Hannafin, 1987; Hawisher & Fortune, 1989). Cirello (1986) concluded that word-processing had a significant positive effect on writing. In trying to come to some conclusion about the effects of word processing and writing, Cochran-Smith (1991) summarized the literature as sending mixed messages because of a number of factors researchers have not taken into account with regard to word-processing studies and literacy development.

Cochran-Smith (1991) asked the question of whether word processing helped students write better and her answer suggested that "it depends." It depends on the writer's preferred writing and revising strategies, keyboarding skill, prior computer experiences, the social organization of learning in the classroom, design of the research, and the school and community culture. These constituted the factors that researchers have not taken into account in the area of this research.

Bangert-Drowns (1993) conducted a meta-analysis of 32 studies that involved one group using word processing compared to another group not using word processing while writing. Within these 32 studies, two-thirds concluded that word processing contributed to the students' writing processes by making revision a more thoughtful process that writers tended to utilize to a greater degree along with writing longer pieces of text. When studies focused on word processing as a tool or as a cognitive technology (Pea, 1994), more positive effects were realized than when word processing was used in more of tutorial metaphor.

These studies suggested that word processing as a new technology tool had some effect on literacy processes. However, changes in the tool as more sophisticated versions became available were not considered in relationship to how the tool changes may have affected literacy learning. Researchers attempted to take new technologies and use them in older more familiar ways instead of realizing that word processing was a very different type of tool than traditional ways to write. Traditional ways to write and the learning processes involved with them were only reinterpreted but in the same ways with a different tool. Writing processes were examined in light of the technology tools; however, researchers failed to see differences related to tool use as affecting writing processes.

Researchers began to see that technology had other potentials related to literacy learning and they began to focus the technology use toward supporting traditional reading and writing skills. These skills were related to the introduction of computer-based instructional activities for drill types of reading and writing practice.

Technology as a Scaffolding Tool

The next group of studies examined literacy and technology in terms of technology as a scaffold in both reading and writing processes. Salomon, Perkins and Gloverson (1991) made the distinction between the first type of research discussed as the effects with technology, such as word-processing to aid the writing process overall. They further described the effects of technology as a partnership between the computer and the learner that resulted in the learner gaining new knowledge. The learner was able to take this knowledge and use the spin-off effect in other areas; consequently, the new learning had application to other contexts.

Early scaffolding attempts by a computer were reflected in computer-assisted instruction studies that were intended to teach a reading skill that could be extended to real reading contexts. In a study done by Weber and Henderson (1989), children were taught to recognize new words in isolation and on the computer. Flash recognition of the words and oral reading of timed passages were seen to improve on the computer. However, long-term effects of the gains were not reported, nor was the use of new words in other contexts.

The skill and drill programs of early study were an attempt to look at the computer as a scaffold. As research progressed, the notion of the computer as scaffolder increased to include studies that helped to explain issues of cognitive residue or spin-off effects gained by the learner (Pea 1994).

A spin-off effect of learning was investigated by Reitsma (1988) in a study conducted using computer-based speech feedback. This study selected 133 children that were divided into three groups. The first group participated in teacher-led guided

reading; the second group read while listening to a taped story; and the third group read the story on the computer with computer-aided speech feedback. The computer feedback group also received cues from the computer if they had difficulty in reading the text. These reading cues consisted of words or phrases that helped the learner maintain fluency.

Each of the three groups had its number of reading miscues calculated from a pretest and posttest. The reading along group performed the poorest during the evaluation and the computer-aided group performed only slightly higher than the guided reading group. The study suggested that computer-aided feedback was a promising way for students to gain fluency in reading; however, more research would need to be done regarding the level of understanding the students attained from the readings. The repeated readings in the computer-aided feedback group could prove to be a promising tool for emergent readers.

Reinking and Schreiner (1985) conducted a similar study but used text passages with middle grade readers in four different formats to determine if this aided the learner's comprehension. The 104 fifth and sixth grade students were assigned to four conditions. The reading consisted of six expository passages followed by six comprehension questions. If subjects incorrectly answered questions, they were encouraged to restudy the passage before again attempting to meet the criterion score. Three of the passages were considered low difficulty and three of the passages were considered high difficulty.

Findings from the study indicated that comprehension could be affected by providing textual manipulations mediated by the computer. The all-options group

scored significantly higher than the other three groups in the study. Notably, the select-options group scored lower overall than the off-line group. The authors hypothesized that computer mediated text that allows for only certain text manipulations may interfere with the comprehension process for poor readers. More research would be needed to explore whether the use of the program in the all-options mode was beneficial for only difficult text and whether this reading management was related to metacognitive theory.

Research progressed in studying the uses of technology to enhance literacy learning with attention moving away from computers for instructional skill and drill to seeing the technology as providing support for the learner's understanding. Understanding of how to best use technology was still undergoing a process of discovery by educators. Researchers continued to push the field forward based on new understandings of sociocultural learning and the impact that this had on technology and literacy learning. Sociocultural learning theory provided a new lens for not only using the technology but also for thinking about the implications of it.

The use of the computer as a scaffolding tool for reading-related metacognition was further studied by Salomon, Gloverson and Guterman (1989). They authored and field tested the Reading Partner. This study and software were similar to the preceding study because the software used reading passages and cues from the computer to enhance comprehension. However, the authors hypothesized that learners using the Reading Partner would be reading in their zone of proximal development (Vygotsky, 1978) and that they would develop competencies through internalization. The authors further hypothesized that because the learners were

engaged in this social activity with the computer the result of this thinking would become internalized. This thinking that would be internalized was considered to be cognitive residue that could then be applied to reading in other contexts by the learner.

The authors then used this idea to assert that while working with the more capable other, the Reading Partner, this might provide the reader with three basic elements from the social interaction that could lead to better performance. It was hypothesized that the reader would gain improved mastery of cognitive skills while working with an explicit model of a more capable other. Consequently, the activation of operations that the learner would have difficulty using without the partnership could be realized and appropriate metacognitive guidance given.

A group of 25 seventh graders used the program, the Reading Partner, designed by Salomon, Gloverson and Guterman (1989) to read 11 passages over the period of three reading sessions. The Reading Partner was used as a tool with three elements that the learner could choose from before, during and after reading. Before reading, the Reading Partner suggested three guiding questions that asked the learner to think about what thoughts, messages, and images the reading brought to mind. During the reading, the Reading Partner introduced inferences and modeled how to use inferences in the reading. The third component entailed repeated presentation of externalized, metacognitive-like questions related to the first two sets of questions. This constituted the fully developed Reading Partner program.

A reading comprehension test was given after all the treatments had been administered. Results indicated that the experimental group scored significantly

higher than the other two groups on all the reading comprehension measures. To further investigate whether this carried over into writing, one month later, the learners were all given a writing assessment that was holistically scored. Again, the experimental group scored higher than the other two groups. The authors concluded that the computer could serve as a more capable other that provides reading-related metacognitive guidance and that this guidance leads to internalization and is able to transfer over to writing ability.

The use of the computer as a scaffolding tool was further investigated in two different studies done by Reinking (1988) and Reinking and Rickman (1990). Both of these studies were couched in the notion of whether computer displayed texts were better than conventional texts in helping the reader with comprehension. Reinking (1988) investigated reader preference and the amount of reading time that influenced comprehension for text that was present on the computer and then studied the use of vocabulary cues to enhance comprehension and word knowledge (Reinking & Rickman, 1990).

Reinking's (1988) initial study of 33 good and poor readers sought to understand whether text presentation had an effect on comprehension, the amount of time spent reading, and estimation of the learner's own learning. The subjects were divided into two groups. The first group read the three text passages on printed pages while the other group read the three passages on the computer that gave textual cues to the readers. Both groups then took a six-item multiple choice test after reading each of the three passages.

Findings suggested that the text cue group reading on the computer gained more in comprehension than the printed text group. The computer text group also spent more time reading and expressed in interviews that they felt they had learned more. Since this control of the reader's processing of text showed promise in enhancing comprehension, Reinking decided to replicate the study and add in further elements.

Reinking and Rickman (1990) hypothesized that computers could enhance overall comprehension but they were also interested in finding out if text manipulations added to this comprehension. Their study participants of 60 intermediate-grade students were divided into four groups. Two groups read informational passages that contained target words, which were deemed difficult to understand. In two of the treatment groups subjects read the two passages on printed pages and had access to either a dictionary or glossary to use as needed with the difficult target words. The other two treatment groups read the two text passages on a computer but were given either choice of reference materials or mandatory word cues for definitions related to the target words.

Subjects in the second two groups outperformed the first two groups on a 32 item vocabulary test. The fourth group who had utilized mandatory cues outperformed the third group. The mandatory cue group learned more of the target word definitions than the other three treatment groups. Subjects were also asked to respond to five comprehension questions that were text explicit after reading passage number one and then to respond to five comprehension questions that were text implicit in passage number two. Again, the mandatory cues group significantly outperformed the other

three groups. Findings suggested that computer aided support for difficult words may have enhanced overall comprehension of learners.

Curricular Paradigm: Summary

The use of the curricular paradigm to characterize word processing studies and studies that began to use technology as a tool to enhance literacy learning indicated a shift in understanding by researchers regarding how literacy learning theory was connected to literacy and technology use. The word processing studies' meta-analysis done by Bangert-Drowns (1996) indicated that the ways research was determining results varied greatly and implications for practice were difficult to make. Cochran-Smith (1991) suggested that the wrong questions were being asked with regard to literacy learning. This was couched in the notion researchers had attempted to use new technologies in old ways and this positioning yielded little in the way of understanding what technology contributed to literacy learning.

Different theoretical considerations were introduced, such as sociocultural learning, and the theory base change refocused the research to see technology as a scaffold to broaden and deepen literacy understanding (Salomon, Gloverson & Guterman, 1989). Computers also became utilized not just as skill and drill tools (Weber & Henderson, 1989) but as a way to extend the understanding of the learner (Reinking & Schreiner, 1985; Reitsma, 1988;). These new ways to study literacy and technology, brought about by expanding theoretical bases, included considerations of not only sociocultural learning but also other ways to conceptualize learning. These theoretical bases that broadened understanding of technology as a tool also began to impact the type of research taking place. The interdisciplinary focus of semiotics,

transactional reading theory (Rosenblattt, 1978), cognitive flexibility theory (Spiro et al., 1994), open-ended learning environments (Land & Hannafin, 1996), intertextuality (Hartman, 1994) and visual literacy (Flood & Lapp, 1995) conceptualized new ways to use technology as tool to mediate literacy learning.

Interactive Paradigm: Transformative Literacy and Technology Research

The interactive paradigm is unlike the curriculum paradigm because the learner exclusively decides learning. Most schools have functioned and are still functioning under the curriculum paradigm. However, with more literacy and technology research being done, some schools are beginning to look at the interactive paradigm which is the central learning paradigm of libraries and research institutions (Lemke, 1998). This paradigm allows the learner to control the learning and guide the purposes. Lemke also stressed that differences between the two paradigms can be further illustrated by the use of a logocentric tradition that emphasized conceptual categories and semantic distinctions. Students have been neglected in their education of topological principles of making meaning by creating and interpreting differences of degree as well as differences of kind. He further believed that multimedia technologies helped to solve this problem. It was this movement into seeing learning as part of an interactive paradigm that shifted the research focus with literacy and technology to a new and different level. The interactive paradigm of learning asked learners to become critical and collaborative in their learning along with the utilization of technology as tool to mediate thinking.

Current research in the area of literacy education and technology is varied in its approach to use literacy and technology as a tool to mediate thinking. The research

includes the use of multimedia programs, the use of the web as a resource to search for information, the use of computers as writing partners who provide feedback, the use of programs written to act as reading partners, and the use of the computer to make links between content learning and personal relevance. Although these studies are vastly different in their approach and their general goals, they have a common thread that links them together and that is the use of technology as a tool to mediate thinking. This can be tied to writing, in that technology as a tool for thinking can parallel writing as a tool for thinking. The two tools together, literacy and technology, help the learner gain a greater sense of being literate.

New uses of technology as a tool have considered the role that semiotics plays in understanding how technology meditates thinking especially in the construction of meaning by learners. The consideration of semiotics broadens definitions of what has traditionally been considered as text and expands definitions of literacy to include graphics, icons, audio and video. These semiotic textual additions expand meaning construction potentials exponentially for learners not only in making meaning as a reader but also in making meaning as a writer.

Semiotic Tool Use

Semiotics can be defined as a general philosophy of communication. This philosophy studies the use of linguistics to understand how individuals mean through their use of sign systems. The use of sign systems to mean is culturally embedded for the users and employs shared meaning as the basis for all understanding (Deely, 1990). Some may view semiotics as a point of view or a method for understanding

shared cultural meaning; however, according to Deely (1990) there is some point of view inherent in most methods.

Semiotic sign systems are built from triadic frameworks (Peirce, 1933). The triadic frameworks of sign, object, and interpretant act together to culturally give meaning to an experience. An example of this related to technology is Email. The Email shows up in the user's inbox (sign), the writer has written and sent the mail (object), and the computer (interpretant) decodes the author's message so that readers may understand it. The framework functions together to create a sign of communication that electronically displayed. Electronic texts employ many sign systems which may or many not include standard text. Labbo (1996) explored the use of alternative sign systems to mean in her kindergarten study.

Labbo (1996) looked at the literacy learning of 18 kindergarten children in the classroom computer center from an ethnographic methodology. The children were from a lower and middle-class socioeconomic area in the eastern part of the United States. Over the course of one academic year Labbo and her two research assistants collected bi-weekly participant observations of the computer-related activities that occurred in the classroom. Data collection also consisted of ethnographic field notes and video taping.

Data were analyzed using a constant-comparative method (Glaser & Straus, 1967) and Labbo also employed a form of semiotic analysis to gain an understanding of how the children used the mediated tools. The data analysis also utilized the uncovering of semiotic patterns that dealt with metaphors and patterns of behavior reflected from different cultural contexts. Learners used five main metaphors to

characterize the computer screen use. These metaphors were: the screen as landscape, playground, stage, canvas, and as paper. The learning was divided into three categories by the children: playing, creating art, and writing. The researchers also tried to uncover the modes of symbolism that children used which ranged from graphic images to represent ideas, to the use of graphic symbols as placeholders, and typographic symbols and multiple symbols used together to represent complex ideas.

Findings from this study indicated that children used computers as a tool for making meaning even at the emergent literacy level. Their engagement in symbol use to communicate with others in their environment was an example of the children's literacy processes at work and the purposeful explorations of the literate environment. Findings also suggested that children were able to determine what symbol was appropriate to use in the writing context and when it was appropriate. In using a computer the children were able to put into play their knowledge about the language arts processes along with processes related to the fine arts and multimedia arts. This supported multiple ways of knowing in their thinking.

Additional data from Labbo's (1996) study were collected to look at how the teacher incorporated the computer into the culture of her classroom. Labbo, Reinking and McKenna (1995) wanted to find out how the teacher's emergent literacy philosophy meshed with the computer-related instructional activities. The methodology used was the case study approach within the original ethnographic study conducted previously by Labbo (1996).

Findings indicated that the teacher moved through six chronological stages to incorporate computer use within her emergent literacy teaching framework. She

moved from preparing herself to teach using the computer, to introducing computer use to the children, to offering invitations to try, to allowing explorations, to making curricular connections, to student transformation in gaining ownership of their own writing in which they set their own purpose and generated unique computer-related work. The authors found that the teacher's use of the computer was very much tied to her knowledge and philosophy of how young children learn to navigate literacy. The study also gave insights into how children internalized literacy knowledge while interacting with an adult. Procedural knowledge was also gained by the children from this process with regard to computer literacy.

Labbo and Kuhn (1998) hypothesized that the screenland metaphor used by the children also taught them how to take multiple stances in their writing. The teacher modeled this and then the children realized these stances as they worked in the computer center. Each of the stances allowed the children to construct concepts about the computer as a symbol-making tool. The stances realized were: the computer to accomplish personal goals, to compose and publish, to create works of art; the computer as a storehouse of symbols and symbol-making tools; and the computer to store and retrieve their work. Although the students were using computers to experience they got an added benefit in that their ability to communicate was enhanced. This relates to literacy learning because non-conventional forms of writing were generated while talk surrounded their production. The learners gained conceptual insights related to the communicative purposes of text.

Communicative processes of talking and sharing ideas are necessary in producing written texts (Werstch, 1991). This has often been observed in classrooms that utilize

writing workshop (Atwell, 1987) as an instructional model for teaching writing. Talk is important for producing new ideas for text. And to support this learners use the backdrop of their cultural knowledge to frame all that they write (Dyson, 1994). Dyson (1994) explains that "while written language is a means of interaction for producers and recipients-in a sense, a way of talking, it also yields tangible products that can be talked about easily" (p. 300). Computer mediated communication employs both talk and writing simultaneously which is supported through literacy learning research with technology that is transformative.

Computer Mediated Communication

Communicational purposes was the central tenet of the Beach and Lundell (1998) study that investigated early adolescents' use of computer-mediated communication (CMC) to learn about reading and writing as social strategies. CMC in this study was described as computer-mediated communication, which was synchronous while using an electronic network for interaction approach. Characteristics of CMC included chat exchanges similar to reading, writing and oral conversations. The authors also used the example of note-passing and dialogue journals as similar discourses to CMC.

In their study they hypothesized that CMC chat exchanges served to transform reading and writing practices. This assumed that reading and writing in CMC differed from reading and writing with nonelectronic texts. The primary difference cited related to societal or rhetorical context created by the CMC context. The participants were required to read and write in a unique social context that asked them to actively employ reading and writing strategies, infer underlying points of view from a string of messages, and formulate messages based on the inferences that were

relevant to the point. It was different from regular dialogue in that learners don't have to just get the "gist" of the conversation, they had to read into the social context of the messages. Then the learners had to respond quickly enough so that their response meshed with the train of thought currently on the screen. All the time the learners had to anticipate the immediate reaction of what others are saying. The authors' theoretical stance was reflected in Baktin's (1981) notion of answerability. Answerability suggests that every utterance contains the potential of future reactions and answers. And as Bakhtin (1981) noted, "the word in living conversation is directly, blatantly, oriented toward a future answer word. It provokes an answer, anticipates it and structures itself in the answer's direction" (p. 280).

The CMC study was clearly different from the first two groups of studies because of how it was situated in sociocultural learning. The addition of sociocultural theory as a framework also helped to illuminate why it was within an interactive paradigm and not within a curricular paradigm. The study was conducted under the sociocultural theoretical notion with a group of four, seventh-grade girls who each participated in a computer lab at separate stations. The chat sessions were bi-weekly over a period of two months. Interviews and analyses of the chat were analyzed.

Patterns revealed that students were more comfortable talking and expressing opinions in the CMC environment than in the face to face contact. They also felt that there was a reduced sense of intimidation and everyone was able to talk; consequently, greater equity was established. The results also suggested that CMC exchanges could foster disagreements within a safe context and this allowed the

students to formulate positions that were more provocative than in face to face conversations.

Writing in the CMC exchanges tended to be shorter in order to maintain one's position in the rapid pace of the conversation. The conversations tended to unfold and this was unlike the traditional essay writing in schools, which sought to end in a product. The conversations were also more exploratory, in that, possibilities and not certainties were understood in the text.

The taking of different stances was also part of the process in this type of reading and writing. The learner was asked to shift stances based on the social context they were writing within. Their writing stance reflected the social context and mood of other responses during the chat. Oppositional stance was also seen in the dialogue depending on how the learners aligned themselves with the topic or the group being discussed. Some learners would respond similarly to how the group was responding for a period of time and then they would change to an opposite response or alignment in the conversation as a way of manipulating their audience. A unique finding was the use of double-voice (Bahktin, 1981) during the conversations. The learners could talk about a topic and respond to icons, symbols, or blinking text within the context of the topic talk. This led the authors of the study to hypothesize that the writers could use different conceptualizing strategies in their writing. The learners could not only participate in the on-going conversation, but also participate in the semiotic conversation represented by symbols, icons, or blinking text. Examples of this were ☺, :~), O~, or YELLING with all capitol letters. These writing strategies included sizing up and defining context, defining relevancy and significance in context,

detecting signs of dishonesty and deception in context, discerning appropriate behavior, managing conflict, establishing one's own authority or status, and determining one's own and others' beliefs and values. All of these stances were used to frame their writing in ways that might not be utilized in traditional texts. The inferential strategies were also learned in the social context of the online chat, and as a result of the context the learning held relevant meaning for the learners.

In two other similar studies using CMC environments done by Fey (1994; 1997) she explored the use of CMC environments with students to consider how the computer networking culture contributed to literacy development. In Fey's 1994 study 14 adult students used the CMC environment exclusively to discuss topics in the course and also readings. The class did not meet face to face until the last week of the course. This study was done as ethnography and the CMC conversations were analyzed with feminist perspectives in mind. It was noteworthy that this group of all females had some of the same experiences as the young girls in the Beach and Lundell (1998) study. Both groups of females in both studies experienced a sense of power and presence within the CMC community. They all acknowledged that the collaborative nature of CMC contributed to an acceptance of new ideas and the females felt more powerful with this risk-taking in their new learning. Fey (1994) also found that the computer networking along with the reader- response (Rosenblatt, 1978) played a role in transforming the literacy classroom into a communal act. The dialogue introduced new points of view and multiple ways of thinking about one idea in the text. Positive results were found in the area of knowledge development, the development of clarity of expression and the development of women's voices.

The feminist perspective results led Fey (1997) to conduct a similar study utilizing CMC with adult learners and secondary students. The study sought to understand to what extent reading and writing through CMC afforded a safe space for women's development. Transcripts were collected from the teacher-researcher group. The data looked at the discussion that took place between the adult learners and the secondary students. The role of conflict in the literacy classroom was studied within the framework of the CMC environment. Three main themes emerged from the data: a hierarchy in masculine discourse, explanatory language in female discourse, and expression or silencing of voice in women. These findings suggested that CMC collaborative dialogue was much like mixed gender dialogue in face to face contexts. Though CMC was transformative in single sex conversations it was not as helpful for female students as previously thought in the first study (Fey, 1994).

The transformative paradigm group of studies harnessed the power of CMC and when multimedia was added to knowledge and literacy development, learners continued to explore critical literacy aspects of learning. Critical literacy stances positioned learners to question their role relative to those involved with the chat, to question the validity of responses based on the gender the speaker was acting in and to think deeper about how the use of multimedia technologies positioned them into a response. The stance taken within a response was manipulated by the group because of the social dynamics that were perceived and those that were not perceived but inferred by the participants (Luke, 1994). Examples of this in the CMC environment abound as one person takes on different genders and personalities in response to the

discourse. The learner must read the dialogue critically and quickly judge their response and opinion of the emerging talk.

The power of collaboration serves to enhance talk and expand understanding. New ways to talk and write simultaneously add to definitions of literacy that has never included hypermedia types of texts. Exploring new types of texts in a different way separates transformative studies from the initial group. The multimedia and transformative studies ask different questions of the literacy processes and situate the technology as not only a tool to support learning but also as a way to mean. Ways to mean with multiples texts, such as graphics, video and audio can only be realized through the hypermedia approach to writing. Multimedia approaches to writing are multi-layered and utilize writing conventions unique to the medium. Because it is different in its' use of writing conventions linear conventions can not be used a sole means to write with. Even in the context of straight text on a web page one must still use a scrolling bar to read forward. It is virtually impossible to find text in a hypermedia writing environment that was created with only linear writing conventions. Hypermedia studies have served to support the idea that linear and non-linear authoring is qualitatively different. Hypermedia studies also support understanding for how this type of authoring is different from linear authoring.

Hypermedia Studies

Hypermedia interactive studies have centered around three concepts: the role of stance for the reader/writer, semiotics, and multiple ways of knowing. All three of these ideas were present in a study done by McKillop (1996). Further analysis was done by Myers, Hammett, and McKillop (1998) from the same data. The seventh

grade students authored hypermedia projects along with a group of undergraduate students. The seventh graders' projects juxtaposed, linked, and sequenced multiple representations within the context of social studies topics while also adding text to explain how their ideas posed a question from a critical literacy perspective.

Examples of the type of project involved using hypermedia authoring tools to juxtapose the notion of privilege described in a speech given by Roosevelt with images of children and war, and the text from *To Kill a Mockingbird* (Lee, 1960). The children then posed critical questions to deconstruct the notion of how war might not be a privilege and how the notion of war and privilege had changed through history. Symbolic signs were used to generate multiple meanings for the text. These critical literacy practices sought to help the author make explicit the underlying ideological interpretations of a sign by juxtaposing images and linking this with questions in the student written text.

The authors of the study hypothesized that children could realize critical literacy and that they could learn to resist representations, question power and privilege, and empower and emancipate oneself within a community. The community was defined as the groups working on the projects together, and also, their local community. They further stated that the learner gained new insights into reading, since the hypermedia asked the learner to think about contradictory notions within text and experiences. The program Story Space used in the study positioned the reading in a way that made it hard for the reader to ignore or not think about the critical literacy aspects of the topic.

The hypermedia tool was used to bring all the ideas of the author together in an electronic space so that the writer generated the connections as a basis for critical literacy. From an overall literacy perspective the learners transformed their roles as meaning makers from the reception of the teacher's meaning to the production of their own knowledge about the topic. This shift in classroom writing from production to process was forward thinking and interactive in nature.

Studies that specifically focused on hypertext reading and writing have emerged over the previous five years to support new theoretical frameworks that consider literacy theory to be an integral piece of any new literacy and technology theory. Hypertext authoring, the use of open-ended learning environments and on-line bookmaking all support the notion of technology as a tool to mediate thinking and move learners forward in their literacy learning.

The use of "mindtools" (Jonassen, 1996) characterizes Eagleton's (1999) study of seventh and eighth grade students who authored their own web pages. Eagleton questioned what students perceived to be the purpose of creating websites and also what benefits were specific to the language arts. The study reflected a semiotic-sociocultural stance on the nature of literacy and learning. Significant themes from the study indicated that students wanted to author within the medium to have a voice and to create their own unique space on the web as a way to express who they were technologically. Pedagogical implications from the study indicated that students felt a sense of empowerment and consequently they felt that they had gained knowledge as writers. Collaboration and learning to collaborate was cited as a positive outcome of web authoring by the students. The students also learned to assume roles that were

a learning strength to scaffold others' in the collaboration. With regard to language arts process, the study contributed not only to "traditional language arts" but also to critical thinking and problem solving.

Kinzer and Leu (1997) also found these language arts processes that included problem solving and critical thinking were positive outcomes of their Reporter Project study conducted with sixth grade students. Students authored hypermedia versions of news reports for on-line reading. Additional support for writing was achieved as writers collaboratively worked in groups on their writing and also viewed on-line video clips of anchored instruction that described the type of writing they were working toward. Students focused their writing processes on understanding who their audience was and the writing goals of the genre. The researchers also noted that instead of students compartmentalizing their knowledge of audience awareness, point of view and the use of relevant facts learners utilized these strategies in a more authentic way because of the real world audience the web provided.

On-line book making and sequencing that utilized visual supports in the form of video added to the comprehension of second grade students as they used hypermedia to retell stories. Sharp, Bransford, Goldman, Risko, Kinzer, and Vye (1995) found that language arts processes were enhanced by using hypertext as a tool in much the same way as the previous two studies. After viewing a video-anchor story, children sequenced and retold the multimedia story. Later, they used their retelling as a basis for writing, illustrating, and adding music to a story. The capability of adding music to stories provided a vehicle for discussing setting, and other elements of mood as reflected by the music chosen. Students wrote and read related stories, and published

them in their classroom computer center for access by others. Sharp et al. (1995) concluded that multimedia environments with dynamic visual supports facilitated language comprehension and provided a framework for understanding and remembering linguistic information.

The hypermedia design project (Leu & Hillinger, 1994) also found that comprehension was enhanced for low prior knowledge readers and writers as they interacted with on-line reading and problem-solving models to learn new skills related to repairing jet engines. Air force mechanics unfamiliar with the hot section of a jet engine used on-line reading to seek out information to help fill in the gaps that prior knowledge would normally facilitate. The mechanics could click on information related visually to a model and read or make notes on-line to enhance their understanding. Although these were adults in the study, the implications were useful for all readers and writers who encountered informationally dense passages where many items are unfamiliar. The hypertext environment scaffolded the low prior knowledge and helped the learner compensate.

A student using a hypermedia environment such as those described might develop different ways of knowing, using different media sources, and depending upon which resource was most helpful in clarifying a particular concept. It is also likely that constructing meaning from multiple perspectives, using multiple media sources, provides a richer understanding of complex information especially if one lacks prior knowledge of a topic (Spiro et al., 1992; Kinzer & Leu, 1997).

The use of multiple media sources and texts served to extend the writer's understanding of text in three similar studies conducted by McKillop (1996),

Bergeron & Bailin (1997) and Jones and Pellegrini (1996). In all three studies writers used hypertext to reinforce the working context of a word, phrase or concept. Although the authoring was somewhat constrained by structure and visual design by the evolving capabilities of authoring tools, browsers, and the authors' general computer literacy consistency of content was under their control. In each of studies the hypertext paradigm supported collaborative writing. Learners often organized collaboration through expert roles and also acted as scaffolders for others in the collaboration.

Unlike content authoring in text, link authoring in these studies created a conceptual structure for the authors that was multi-layered and allowed the writers to present information to the reader in a way that reflects multiple uses (Bergeron & Bailin, 1997; Jones & Pellegrini, 1996; McKillop, 1996). Participants in the studies used several types of linking: word-level, paragraphs, icons, pictures, pages, documents and entire databases. This type of link authoring called into question current definitions of literacy in terms of copyright and general intellectual property rights. If writers intentionally linked whole pieces of text to illuminate or add to their writing then the writing process in general had been re-framed or transformed by the hypertext medium. Writers in these three studies not only learned how to map their writing conceptually, but they also gave great consideration to anticipating how readers might retrieve or read the information. This was consistent with Rosenblatt's (1994) transactional theory of writing that posits that writers also act as readers who engage in expression-oriented and reception-oriented authorial reading.

In stark contrast to these hypertext authoring studies Hailey and Hailey (1998) concur with Clark (1993) that hypermedia authoring and technology in general contribute little if nothing to overall learning. Hailey and Hailey (1998) conducted five studies that used seven different instructional modules, which utilized hypertext and multimedia environments to help learners understand new concepts in a college level machining skills course. They found that in some environments hypermedia and hypertext had been ineffective as instructional media particularly where learners were struggling with the subject matter. Hypermedia was a less effective heuristic and students tended to misunderstand more concepts in the hypermedia environment than in the traditional text environment. One reason for this may have been the multitude of choices that hypermedia offered and the lack of prior knowledge required to make good choices in learning. Hypermedia also brought with it a level of confusion and learners already struggling with content found the confusion difficult to cope with. Lastly, they found that average learners struggled more when reading and writing in hypermedia environments.

The struggle to read and write suggested by the hypermedia studies and the true ways we think may not be as close to our thought processes as originally hypothesized by Morrison, Ross and Odelll (1992) in their studies of learner control research. This assumed that students learned best when mapping their own paths through a given instructional path. Once again, there was a contradiction between the uses of hypermedia and hypertext as effective learning tools, and again a similar parallel is seen in the early word processing studies and the contradiction of instructional implications. The implications were namely whether word processing

made a difference with regard to literacy learning. Interpretation in the use of hypermedia as a learning tool is clouded with the use of hypermedia to construct meaning. Those arguing against hypermedia as tool for learning did not consider the outcomes for learning when hypermedia was used to create knowledge rather than take it (Clark, 1993; Hailey & Hailey, 1998). The debate is justified in how one perceives learning rather as translated or created. Unlike the early word processing studies new ideas have been suggested by Kinzer and Leu(1997) that situated the literacy learning benefits of hypertext within appropriately structured environments. Land and Hannafin's (1996) research suggested a new theory of open-ended learning environments that most closely relates to what Kinzer and Leu (1996) describe as appropriate learning environments. Exploration of open-ended learning environments was a useful link in differentiating hypertextual writing studies from word processing studies. They explored the use of simulated rollercoasters created by children to study a principle of physics. The children in the study used the hypermedia environment to create their new learning by altering it to meet the needs of the questions they had posed. Examples of this included changing the pitch of the coaster run to examine speed, noting changes in an on-line notebook, or adding cars to the coaster to give it more weight. The hypermedia learning environment was open-ended and learners constructed meaning through interaction with it. The learning environments which were closed and created for learners induced a different type of learning that did not support interaction or multiple responses in the Hailey and Hailey (1998) study.

Summary

The interactive paradigm of transformative literacy and technology research has included studies that used semiotics to understand language play (Labbo, 1996; Labbo, Reinking, & McKenna, 1995), CMC exchanges to understand the role of talk and collaboration to construct literacy understanding (Fey, 1994; 1997; Beach & Lundell, 1998), hypermedia to juxtapose texts read for understanding intertextuality (Myers, Hammett, & McKillop, 1998), and the use as of web authoring to understand how the writing conventions of hypermedia authoring differed from linear authoring (Eagleton, 1999). The justification for studying technology in this paradigm instead of the curricular paradigm was not so much in seeing what the technology could deliver to the learner, but in seeing how the technology mediated the literacy learning process for the learner.

In trying to understand children's perceptions of authoring with hypermedia it was important to look carefully at what was being studied, namely, children's perceptions of the hypermedia tool. Before research can suggest that hypermedia tools impact learning, the learners' perceptions of it must be understood and also their perceptions of their literacy and technology growth. Literacy and Technology is such a new tool that research outcomes may not recognize or may mistake new ways of thinking within this realm as "if it were a different versions of something older and more familiar" (Meyer & Rose, 1998, p. 6). The cited example by Meyer and Rose (1998) was of the first wireless telegraph better know as today's radio. When first discovered, inventors of the radio thought it was a new and improved telegraph, and they had mistaken it for a new version of something old and more familiar. Only

later, after Marconi had invented the radio did he realize that its wirelessness was the most important feature, giving it the power to broadcast messages from one user to multiple listeners.

Literacy and technology research is at a crossroads of understanding with regard to the overall impact that the technology has on literacy learning. The multilayeredness of the text authored with hypermedia utilizes not only traditional writing conventions, but also many new writing conventions, ways to mean, and ways to write as explored in the interactive paradigm of literacy and technology research.

Literacy and Technology Research Summary

Literacy and technology research has two paradigms, the curricular and the interactive, that are related to the historical aspects of how technology has developed since 1980. These paths at first continue to function under a curricular paradigm, but as more advanced computers became available, the research became transformative. The first path of literacy and technology research sought to understand how word processing contributed to literacy development and specifically writing development. Technology in these studies functioned to assist the learner but did little to extend learning. The word processing studies fail to come to any conclusion on whether the computer was useful as a tool for promoting writing development. There was strong evidence that word processing did not contribute to writing development and there was even a phenomenon referred to as the technology that does not have an affect learning phenomenon (Reinking, 1998). However, the meta-analysis on word processing studies (Bangert-Drowns, 1993) indicated that it may. Research was extremely mixed on the issue and it may be impossible to explore this idea further.

Researchers may be asking the wrong questions with regard to word processing and writing development. Research may have needed to focus on the second path of literacy and technology studies that sought to understand how technology as a tool could enhance literacy learning, mediate thinking, and afford the learner with spin-off effects that move learning forward in new contexts. The technology as a tool approach seemed promising to extend literacy learning, but it still did not allow the learner to gain multiple perspectives or utilize multiple ways of knowing which was more consistent with sociocultural learning. The third group of studies was set apart from the other two groups as a result of the inclusion of multiple theoretical frameworks.

The third group of studies moved from a curricular paradigm to an interactive paradigm. Within this group of studies literacy learning was realized in ways that promoted cognitive residue for learners, transformed thinking with multiple ways, and acknowledged that semiotics was a tool for mediated communication and thinking. However, studies had been done in multiple contexts and with varying types of media and the implications for practice were not clear. Often, the third group of studies was done with small groups or adult learners who had much knowledge about the way computers worked. There was little information about how this looked in literacy classrooms or how it impacted literacy learning. It was evident that this type of literacy could impact literacy learning, but further investigations needed to be done in classrooms that were closer to the ways teachers practiced or carried out instruction that utilized technology and literacy together for learning.

Although the research presented thus far provided some historical context for the use of technology and literacy education, the field has not functioned as a fixed entity moving through time. Word processing was first discovered and used in literacy contexts, and then electronic networks, and then hypermedia. However, the field and those working within it were always changing, thus the historical context should be used as a framework through which to tell the story of the field's research without sacrificing its complexity (Hawisher & Selfe, 1999). The conceptualization of the two paradigms, curricular and interactive, that characterized the research served to explain how the last body of research moved us away from questions such as "What are the effects of technology?" toward questions such as "What processes are occurring in the social system in which this technology participates?" It is much more important to understand how people used technologies than simply to measure their effectiveness across broad averages of use. This leads one to think of technologies as part of what we do as literate beings, rather than as isolated tools that are employed to fix problems (Bruce, 1999).

The interactive learning paradigm that utilized hypertext and hypermedia as a tool to mediate thinking was at the same risk as early word-processing studies (Bangert-Drowns, 1996) in repeating history with regard to clouding the issues of whether technology and literacy combined contributed in helping learners become more literate people (Cochran-Smith, 1991). Kozma (1991) stressed that research on the effectiveness of technology needed to be studied in new and different ways. He cautioned that if this did not take place, literacy and technology studies would run the risk of falling into the media effects debate. This debate comprised an extensive

statistical analysis against the effectiveness of computers as tools of learning that made a difference (Clark, 1993; 1994). Reinking and Bridwell-Bowles (1991) and Dillon and Gabbard (1998) assert that literacy and technology research have failed to make significant contributions toward literacy learning pedagogy and theory because of the lack of sound theoretical frameworks. Many of the studies seemed to reflect pragmatic rather than theoretical concerns. Taken as a whole, literacy and technology research was difficult to interpret; however, new theories are emerging that may have application into older studies previously done (Jacobson & Spiro, 1993).

Conclusions

Land and Hannafin (1996) suggest that learners were able to create theories-in action with open-ended learning environments (OELE). OELEs employed technology to enable learners to build and test their notions about the world. These environments also supported experiences where learners explore and build on these experiences to form their own theories. Learners are able to construct their own model or text in the case of hypertext that is progressively honed and manipulated via the writing process. OELEs assume that understanding is continuous and dynamic and evolves as learners take in observations, reflect, and experiment. Affordances of mindtools represent ways in which tools and resources of the system are designed to promote learning, not necessarily how they are actually used. And rather than provide instruction to transmit formal concepts and knowledge, OELEs provide contextually-based and experientially-rich opportunities to engage formal concepts. Essentially, OELEs provide the learner with a transitional system to help connect informal knowledge and experience with formal knowledge domains and concepts.

Tools such as Hyperstudio and Pagemill afford learners use of this type of OELE to experience new types of literacy learning.

Chapter Three: Method

Contexts of the Study

The School

This study was situated in the context of a suburban elementary school in the Southwest. The school was within blocks of a university and drew students from the surrounding neighborhoods. Students who attended the elementary school were in grades kindergarten through fifth grade. Literacy education at this site was a focal point of the entire curriculum for all students who attended the school.

The curriculum of the school was acted on by students and teachers as they participated in reflective portfolios (Courtney & Abodeeb, 1999) from kindergarten through grade five. These reflective portfolios were used as a tool for assessment, personal reflection regarding growth in literacy learning, and as a way of describing who the learner was as a literate person. Each child in the school began a literacy portfolio the fall of their kindergarten year and this portfolio grew as the child progressed through fifth grade. The portfolio contained one piece from each of the four quarters of the school year. Some of the pieces in the portfolio were selected by the student and some were student and teacher selected in conjunction with the teacher's suggestions during literacy conferences. Items that were typically in the school-wide portfolios ranged from autobiographies, fiction and non-fiction writing, lists of books read, lists of topics to write about, narrative reflections of books read, drawings, journal entries, language experience stories, tape recorded oral readings of text, prewriting documents such as webs, maps or outlines, photographs, and art. The portfolios included written reflections by the students regarding why they had

selected the particular pieces to be included. Literacy portfolios in this school had an eight year history with the first years in use described as a collection of the child's writing and then evolving into reflective portfolios that more fully encompassed who the child was as a literate person.

The school literacy philosophy assumed that all children entering school in the fall of their kindergarten year were readers and writers, whether they were emergent or fluent in their abilities. School media personnel supported the literacy philosophy by assisting the teachers in selecting books or materials for units, by teaching library and technology skills, and in generally supporting students as readers. Students selected books from the school library on a flexible schedule and students were often seen selecting or returning books before and after school. Students were also observed talking to teachers, the principal and the media specialist about a recent book they had read. The media center environment was traditional in the way it was organized; however, all books and materials were accessible to students. The school computer lab, a room within the school library, was the only area not totally accessible to the students. The library did contain three computer stations with access to the Internet.

Classroom teachers utilized other types of portfolios ranging from math portfolios to working literacy portfolios in their classrooms. Literacy instruction was varied in the methods used with some lower grade teachers using a balanced approach to literacy instruction (Tompkins, 1996) to a complete literature-based approach using only children's literature for instruction (McMahon & Raphael, 1997). This variation in approaches was based on each teachers' personal literacy philosophies and how they felt children learned to become literate. All the teachers in the building and the

building administrator participated in yearly workshops and inservices focusing on literacy learning. Teachers selected a children's author to visit the school yearly and hold workshops for themselves and the children. The teachers also selected authors of literacy learning texts to carry on inservices or workshops once each year.

Researcher's Role

My role in the study was to act as observer, interviewer and consultant to the teacher when there were questions regarding how they would use the technology with their literacy projects. I spent five months in this classroom observing the literacy instruction two mornings and one full day a week, and observing all the uses of technology in literacy learning that took place in the computer lab with regard to this class. I had many chances to interact and talk to the children regarding the books they were reading, Internet sites that they found interesting, their writing projects and their general use of computers at home. The class quickly discovered that during computer lab time I had "cultural capital" that could aid them in accomplishing their goals. This "cultural capital" was defined as my knowledge base related to technology and how this knowledge was useful to the culture of the authoring event. I tried to observe and take field notes during this time; however, children would direct me to their computer and ask questions related to use of the program, ideas regarding their projects or just to generally gauge my opinion. I feel it is important to acknowledge this relationship that took place between myself and students so as not to mislead the reader into thinking that I had no social interaction with the participants. This relationship helped me to better understand the children's perceptions as they authored with hypermedia.

Setting and Participants

The Classroom

The classroom was structured to enhance literacy learning from a physical standpoint. The children had their desks in clusters of four to maximize collaborative learning. A classroom library housed a collection of non-fiction books and a collection of fiction books with a specific emphasis on history and historical fiction. There was a bathtub with pillows in it as a comfortable place to read along with a reading loft that was elevated six feet off the floor. Three computers and a printer were together on a table and one computer was connected to the Internet. One large table was used for student-led group projects while the other round table in the classroom was used for teacher and student conferencing during reading and writing workshop (Atwell, 1991). Multiple art projects and student-authored books were suspended from the walls and ceiling. One bulletin board contained torn art pictures reflecting feelings from the novel *Number the Stars* (Lowry, 1989). Student writing was displayed in the classroom library and current themes, novels, or units being taught were directly connected to this.

Learning in this classroom was collaborative by design and structured by the teacher's constructivist, holistic approach to teaching literacy (Rosenblatt, 1978; Lane, 1993; Tompkins, 1996; Vygotsky, 1978). Daily literacy learning focused on the reading and writing workshop model (Atwell, 1991). Learners were immersed in extended amounts of time to read freely alone or with a partner. While learners were reading, small groups of children met with the teacher to conference about the books they were reading. The class also took time to read a class novel together daily and

reflected on the readings in a response journal. The response journals included writing or drawing prompt suggested by the teacher. All responses written in the literacy journal were responded to by the teacher with comments and a specific number of points. Novels and writing projects were connected to other content areas such as social studies or science. Examples of this were a unit that focused on the Civil War. Students used writing projects based on the theme to examine the career or life of a person who lived during that period of time. Writing was a central way to learn in this classroom and some varied ways to write included: making a list, webbing, detailing science observations, and writing summaries of the events that took place during the week in a journal.

Much talk surrounded the learning as the entire class engaged in daily meetings to discuss the day's learning or problems someone was experiencing. Group projects within the realm of reading and writing was the norm in contrast to individuals working in isolation on teacher selected assignments. The teacher described an assignment and during group meetings the learners refined it or made suggestions for changing it to coincide with their interests and diverse learning needs. Wrinkles in this process were worked through with the use of student and teacher led conferences during the day. Daily conferences with the teacher occurred with three to four students per day talking and reflecting on their learning with the teacher and the group. All the members of the learning group had a voice and the teacher would act as a listener to let the children direct the talk. The teacher conferenced with all the children weekly and took notes on what they were reading, ways they responded to literature in writing and listened to ideas they had for ongoing projects.

Visual literacy (Flood and Lapp, 1995) was a large part of the reading and writing processes that took place in the classroom. The teacher utilized art instruction as a way to connect meaning from what the children read into what they knew through a visual medium. Examples of this were the use of the color wheel and the scientific reason for all colors, torn art to express the hatred of how the Nazis felt toward the Jews during World War II, and flip-book illustrations of the Bill of Rights. The use of visual art to enhance meaning construction was viewed as an extended text of the novels or topics explored and was thought of as a type of transmediation. Transmediation was used in the classroom as a way to construct meaning through the use of taking one sign system and recasting it in terms of another (Siegel, 1995). The learners in this classroom utilized this type of meaning construction daily as a way to extend their learning within other sign systems.

Technology use and literacy learning were closely linked by the learners because they were already experts at employing transmediation as a learning strategy. The classroom contained three computers with one of them networked into the district Internet connection. Learners used the computers in the classroom to play learning games or to find information on the Internet. Classroom use of the computers was limited and only three to four children per day could use them. The class visited the school computer lab once or twice a week and sometimes published their writing with the available word processing program. This limited amount of time each week was due to an insufficient number of computers available for use. However, while in the computer lab there were enough computer stations to accommodate an entire class.

The Children

The setting for the study, as described previously, was a fifth grade classroom at an elementary school. The school enrollment was approximately 350 students. The classroom had 20 children of diverse learning backgrounds. The authoring setting took place both in the classroom and the school computer lab.

The participants in this study were children who were emergent fluent writers and who actively gained fluency of the writing process. Because the study focused on children's perceptions of authoring with hypermedia over a period of time, emerging fluency within the writing process helped determine the relative age and grade level of the children needed for participation in the study. This grade level selection was also based on past research that was conducted by Salomon et al., (1991) and Reinking (1998). Both of these studies used intermediate grade students as participants. Hill and Ruptic (1994) characterized the emerging fluent writer as an expanding writer who was bridging toward fluency. The young writer begins to consider audience, collaborates with peers in writing and editing, and begins to use mechanics with more ease. The fifth-grade participants were members of one classroom, and the focal children were chosen randomly from the group. The focal children were interviewed and contrasted with the entire class through field notes and observations.

The 20 class members had been divided by the teacher into dyads for the purpose of authoring throughout the two hypermedia projects. The teacher's rationale for how she selected teamed dyads was based on her knowledge of their personalities and writing strengths. She felt that certain children had great difficulty in working

together and she wanted to specifically avoid personal conflict within the dyad. She also considered the child's writing strengths and tried to pair dyads based on what each could contribute to the collaboration as a strength. The eight focal children in the study were randomly selected from the ten dyads. Four dyads participated as focal children and they were contrasted with the entire class through field notes and observations. The focal group consisted of three female students and five male students.

The focal children in authoring dyads were Sean and Allison, Sue and Angela, Bryan and Taylor, and Jack and William. Sean and Allison were both avid computer users who had computers in their homes and Sean had previously authored with HTML. Sue and Angela also had computers in their homes with Internet access and both had participated in on-line chat sessions outside of school with each other. According to the teacher, Sue and Angela were considered expert writers both in the classroom and the computer lab. They also had a strong friendship that extended into their personal lives. Bryan and Taylor often found it difficult to author together since Bryan was able to fluently type at the keyboard. They were observed during three authoring sessions in a heated discussion regarding who would type at the keyboard. Despite the differences in typing ability Bryan and Taylor chose to write together. Taylor remarked during an interview that he trusted Bryan with his writing because he knew Bryan would not make fun of his ideas. Bryan had a computer in his home with Internet access; however, Taylor did not. Taylor would often go to Bryan's house after school to use his computer. Junior and Wes were the quiet dyad. They were shy to express ideas during interviews and during writing workshop in the

classroom. They were reflective with their prewriting documents and used the writing rubric to help them design the second project with. Junior had recently gotten a computer in his home and often brought to school stories he had typed for others to read. Wes did not have computer access in his home.

Data Collection

Data collection converged on the processes of the children engaged in two authoring tasks in hypermedia authoring environments. The first writing task involved the use of Hyperstudio (Wagner, 1993) as a tool to author a critical literacy project based on a novel *The Giver* (Lowry, 1991). This program allowed the students to use multi-linear writing and it was used to introduce the students to notions of multi-linear writing before proceeding to HTML authoring. Hyperstudio also include word processing elements and the ability to add graphics, sound and animations to pieces of text. The second writing task involved the collaborative writing of an HTML document with Pagemill (Adobe, 1997). Pagemill was used as an HTML editor so that the learners could write in multiple ways while they were free from writing HTML code. The program utilized word processing along with the addition of graphics, animations, quick-time movies and sound. The use of collaborative groups for authoring supported the sociocultural theoretical underpinning that framed the entire study. It should also be noted that in both projects the children authored in dyads previously established by the teacher for the purposes of facilitating writing workshop. The second writing project was also tied to a chosen theme that incorporated three novels and a social issue selected by the children during a class discussion. Hypermedia authoring took place from mid-January through mid-May.

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the interviews with the field notes, prewriting documents, and final projects the students used throughout the authoring process supported some understanding for students' perceptions as they authored with hypermedia. The triangulation of the data also presented a larger vision into the child's perspective of how they believed that they may have grown as writers.

When parental consent and student consent had been obtained for the focal children, they were interviewed regarding their general literacy perceptions. After completing the first authoring project, a semi-structured interview was scheduled individually with each focal child. These interviews were audio taped with a small tape recorder and transcribed so that data analysis was ongoing during the study. The interviews focused on how this type of writing with hypermedia might have differed for traditional forms of writing. Additional questions arose during the interviews as a result of comments made by the child, and this was included with the data. Each interview took place during the reading workshop time in the classroom so that the child did not miss any direct instruction.

The first interview focused on initial perceptions of their literacy learning, while the second interview focused on authoring with multimedia tools and the contrast these digital tools posed within the traditional writing process. The third interview occurred at the end of the second authoring project. It focused on their perceptions of their literacy growth as they authored with hypermedia and a description of any differences described between linear and non-linear writing. These interviews examined how the learner believed that literacy was created through reading and writing with multimedia tools and where the literacy knowledge might have come

from. Information was gathered from the field notes as it related to literate activity in the classroom and computer lab. The observations became more focused as the study progressed and the themes began to emerge.

Interviews

Interviewing is the primary source of data in a grounded theory study, according to Cresswell (1998). Other data sources such as participant-observer field notes, prewriting documents, and authoring artifacts can play a secondary role in a grounded theory study because interviewing, according to Glesne and Peshkin (1992), is the only way to "get the actor's explanation" (p. 65). It is the "opportunity to learn about what you cannot see and to explore alternative explanations of what you do see that is the special strength of the interview (Glense & Peshkin, 1992, p. 65). Interviews can be used as the primary data source or in conjunction with other methods of gathering data (Bogdan & Biklen, 1992).

There are two types of interviews that can be used. The structured interview and the unstructured interview which is also referred to as the open-ended interview can be used. Structured interviews leave little latitude for the participant to tell their story in their own words and they also do not allow the participant to structure the topic. Unstructured interviews are often used when the researcher and the participant have an established rapport and the interview is more in the form of a conversation. Researcher and participant must already have an established relationship for this to be a successful tool in gathering data. Because the participants in this study were essentially strangers it was thought best to use a modified type of interview that held

some structure and also allowed the participants some latitude to tell their story (Bogdan & Biklen, 1992).

Interviews were used as the primary data source and field notes, observations and writing artifacts were used as secondary sources of data to triangulate the data and add trustworthiness to the findings.

The semistructured interviews can be contrasted with these two types of interviews. Semistructured interviews give the researcher data that is comparable across cases; however, the participant has little control to structure the topic. This method of interviewing was selected because it contained a set of questions that helped to frame the questions being asked in the study. It also allowed the participant some latitude in directing the conversation with regard to their own literacy learning and hypermedia tool use. An example of this follows to illustrate the point of the semistructured interviews:

> Researcher: What do you think the word literacy means?
>
> (structured question)
>
> Participant: I think it means the literacy club at school.
>
> Researcher: Tell me about the school literacy club.
>
> (unstructured statement employed to scaffold)
>
> Participant: Well, you read books and you talk about them with your class and sometimes you might write in your journal about them.

This example serves to illustrate that even though the second statement by me was not specifically written to be asked, it was a natural turn in the conversation for the

participant to elaborate their definition of literacy which was situated in their personal context based on their experiences. These interjected questions and statements were used as a way to help the participant connect with the researcher's questions. They were also scaffolds used by me when I sensed that the child had difficulty in understanding the question or a word within the context of the question.

Two sets of formal interview questions were written for the study. These questions were developed based on six factors described by Glesne and Peshkin (1992). The questions originated from the literature and the theoretical framework of the study. Theoretical considerations took into account the role of talk as reflected in sociocultural theory, the use of multiple sign systems derived from semiotic theory and the use of technology as a tool which was supported through cognitive flexibility theory. These questions did not form a theory but they helped to explain the phenomenon of children's perceptions of authoring with hypermedia. The questions also served to guide the inquiry, to situate the study in the milieu of the cultural setting and to draw from the backgrounds of the participant's knowledge bases. They are also based on my knowledge of this grade level from three years of teaching experience in teaching fifth grade. The first set of questions implicitly drew on literacy learning theory while the second set of questions examined technology as a tool that shaped the children's perceptions of their own literacy learning growth. The questions used in both interviews are listed in Tables one and two. Interview number one took place three weeks into the first authoring project. The post project interview questions were used twice, once at the end of the first authoring project and at the end of the second authoring project. The same set of questions was used twice as a way

to look at change within the child's perceptions of their literacy growth over a period of time.

Table 1

Interview One Questions

1. What does the word literacy mean to you?
2. What do all readers need to know about reading?
3. What do all writers need to know about writing?
4. Describe yourself as a reader?
5. Describe yourself as a writer?
6. What is the most memorable activity that you have done in school related to reading and writing?
7. What do all people need to know to be literate?
8. How do writers develop to learn more about writing? How have you developed as a writer?
9. Do you talk and share your writing with others? Why or why not?
10. Do you talk in groups about your writing? What kinds of things do you talk about in the writing group?
11. How do you feel about yourself as a writer? And reader? Is there anything you would like to change about your reading and writing?
12. What is your favorite topic to write about and why is it your favorite?
13. What is your favorite topic to read about and why is it your favorite?

Table 2

Post Project Interview Questions

1. Tell me about your authoring project. Can you describe how it compares to other kinds of writing you have done in your classroom or at home?

2. What type of things do you think writers need to know when they author with (a) Hyperstudio? (b) Pagemill?

3. Describe your experience in authoring with a partner during the project?

4. Have you grown as a writer while working on this project? If yes, in what ways; if not, why do you think you haven't grown as a writer?

5. Tell me about your use of sound, graphics, and the overall design of your project?

6. What do these additions to the text tell the reader?

7. When you are involved in the writing process with hypermedia what helps you to think and plan your writing?

8. How did you come up with your writing ideas for the hypermedia project?

Observations

Observations within grounded theory can be the sole means of data collection or function as a piece of information within a study. In either case there is a continuum which the participant-observer functions in. If the researcher studies the participants and does not interact with them, then they are said to be an observer who is at one end of the participant-observer continuum. This type of observation seeks to stay within the traditional scientific paradigm and attempts to not risk contamination to the data though interaction with the participants. Moving along the participant-observation continuum is the observer as participant. This research stance allows the researcher to engage in some interaction with the participants; however, the researcher acts primarily as an observer. At the far end of the continuum is the participant as observer who interacts at length with the participants. Glesne and Peshkin (1992) caution researchers to think about which stance on the continuum best helps them understand the phenomenon under study. They further state that "the more you function as a member of the everyday world of the researched, the more you risk losing the eye of the uninvolved outsider, and the more you participate, the greater your opportunity to learn" (p. 40). The question in where one functions on the continuum is best answered by again considering the theoretical stance of the study and also the amount of trade off the researcher is willing to extend regarding the loss of their etic perspective (Guba & Lincoln, 1992).

Learning was one of the main goals utilized with the observations and the theoretical stance of sociocultural learning supported exploration of the human

relationships mediated through the use of social relationships, tools and artifacts (Vygotsky, 1978). Consequently, my role as researcher during the observations was one of observer as participant and sometimes this would shift on the continuum to reflect more of an observer stance. This was also reflected in Labbo's (1996) study as she observed the kindergarten children during whole group literacy lessons and interacted with them as they authored on the computer. Her stance shifted from observer to learn about the classroom literacy context over to participant who sought to learn more about the children's perceptions as they authored with KidPix (Broaderbund, 1998). Observations of the daily literacy lessons in this study were in the observer stance much like Labbo's and participant-observations inside the computer lab as students authored allowed me to gain some understanding of how students used the hypermedia tools to mediate their thinking and the writing process. The children quickly discovered during the first few authoring sessions that I had cultural capitol and often called on me to help problem solve an aspect of the software. Some might consider this interaction as a loss of my outsider perspective; however, I saw it as an opportunity to understand how the tool was causing them to question their literacy processes.

Field notes were recorded in two ways for the study. They were either descriptive or analytic. When I observed the literacy context and observed direct instruction in the computer lab descriptive notes were taken that focused on capturing the moment, a description of the situation, and deep description of patterns that took place with regard to reading and writing workshop. Dialogue that was salient in understanding these descriptions was used to capture the culture of the classroom. Certain

vocabulary used by the children and the teacher in the classroom and lab setting was also noted in the dialogue (Glesne & Peshkin, 1992). Ultimately, the observations were utilized to portray the context.

Analytic field notes were also taken during the study. The analytic notes were comments of the participant-observations after interacting with the children in the computer lab. Notes of ideas or hunches were made in these observations to understand my perceptions of the children learning the hypermedia tools and utilizing them for authoring. Vignettes of situations were described from these authoring situations noting my interactions and how students responded to them. According to Smagorinsky (1995) by virtue of the researchers acting within the sociocultural setting to observe developmental processes they become part of the setting and also "mediating factors in the very learning they purport to document" (p. 201). The quote serves to explain how I supported my decision to act as observer-participant in the study. Denzin (1989) also supports the use of two types of observations as a form of triangulation to gain broader results.

Writing Artifacts

Documents as a source of data provide a contextual dimension to the observations and interviews. They expand what the researcher knows by adding to perceptions previously derived. Themes from interviewing and observations are triangulated through the use of artifacts (Glesne & Peshkin, 1992). Hodder (1992) stated that artifacts can only be understood as what they are and they are embedded within social and ideological systems. Consequently, there was a gap in understanding with the use of written texts and as more room for interpretation entered through the use of

hypertext, the gap widened and with each reading the reinterpretation widened. This caused me to question how these documents fit with a more general understanding that explores perceptions. Hodder (1992) suggested that as one studies different examples of documents one needs to make analogies between them. This is consistent with the constant-comparative (Glaser and Strauss, 1967) method of analysis in that once patterns are discovered further coding is done on the selective level to dimensionalize patterns and link them together to show relationships between them in building the theory. The data can then be patterned in unexpected ways to explain or give deeper meaning into the participant's construction of their perceptions. In order to do this the researcher must identify the contexts within which things had similar meaning. Contexts are found through showing that things are done in similar ways or that people respond in similar ways. Understanding documents as a source of data relies on interpretation to unchunk and sift through contexts to see patterns that emerge across documents.

Peirce's (1933) semiotic theory provided the analytic frame for understanding the documents in this study. Meaning within this framework is always triadic and includes a sign, object and interpretant. Myers, Hammett, and McKillop (1998) employed this type of interpretation for understanding the documents in their student authored hypermedia study. Text was characterized as iconic signs, indexical signs or as symbolic signs. Iconic signs within documents were the resemblance of other signs and an example of this was the sketch of a tree to represent the life experience of the tree. The reader had to interpret that the tree at different times during the year could represent life. Indexical signs were traces of other signs within the sign such as

a picture of boy wearing large yellow boots and carrying an umbrella as a trace sign of rain. Lastly, the symbolic sign arbitrarily stood for another sign, as is the case in language when a phrase spoken in one language rarely means the same thing in another language. Meyer et al. (1998) used the student authored documents in final form to understand how the technology and the use of sign systems helped the students to construct meaning of the texts read. The documents also provided an additional way to examine the student's ideological stances for constructing meaning when they talked about the projects in group interviews.

For this study documents were not used to look at the construction of stance but as a way to gauge how the participants used sign systems inherent within the tool to construct meaning. The sign systems in the documents were examined to understand how the students' writing changed and this was contrasted with what they said in their interview regarding their perceptions of their literacy growth using digital tools. The participants authored writing rubrics to reflect their understanding of multi-layered text and applied these rubrics as a framework for their documents. Additional writing document artifacts included prewriting cards students used to plan their writing with their partner in the classroom and final projects. Prewriting documents were used with both of the projects and cards represented pages or stacks within the hypermedia environment. Two final authoring projects were completed by the dyads with the first authored in Hyperstudio (Wagner, 1993) and the second document resulting from the use of Pagemill (Adobe, 1997). Memoing was used as a strategy to summarize the changes from prewriting documents into final projects to ultimately construct matrices as a summary. The memos were used as a way to summarize what

the writer had done with regard to all types of text. This type of memoing is referred to as operational notes. It was used for the purposes of summarizing how students operate with multiple types of text and how the changes they make in text frame their growing knowledge and understanding of the hypermedia tools.

Data Collection Procedures

Data collection for this study took place from mid-January through mid-May. During the first three weeks of the study I observed literacy lessons in the classroom three days each week and took field notes of the literacy lessons, the ways the children engaged in literacy activities and some direct literacy teaching of writing strategies being taught during writing workshop (Atwell, 1987). One day each week, usually Wednesday, I spent the entire day in the classroom observing the ways that the children utilized literacy across the curriculum. Wednesday afternoon was the designated day each week for the class to use the school computer lab for 50 minutes. On alternative weeks they authored in the computer lab on Friday afternoons for an additional 50 minutes. During this three week period of time I obtained parental permission for the children to participate in the study (see Appendix A). The eight focal children were randomly selected from the 10 dyads at this time. The second week of the study I began my role as the observer-participant during the lab authoring sessions. I began to take field notes of what was happening during the authoring sessions while also fielding questions related to software from the children. The teacher spent half of the computer lab time during the first three weeks in teaching the children about Hyperstudio (Wagner, 1993) and how they might use it. The remaining time in the lab was spent playing with Hyperstudio (1993) and

experimenting with the toolbox. Literacy lessons in the classroom these first three weeks were focused on reading the novel *The Giver* (Lowry, 1991). The children used the text as a guided reading daily and made written responses from writing prompts suggested by the teacher. They also drew illustrations in their response journals as an alternative way to answer the writing prompts. While the students were beginning to learn how to use Hyperstudio (1993) in the lab they were also working on their prewriting and planning documents in the classroom during writing workshop.

The prewriting and planning documents were large index cards and each writing dyad used six cards to plan their writing. The dyads completed their prewriting documents by the end of the third week and began to incorporate these prewriting ideas into their projects. Each week during the prewriting stage copies of the prewriting documents were made to use as an observation of changes the students made as they experienced learning and using the hypermedia tool. The beginning of February was a turning point in the study as the dyads began to spend more time authoring and less time learning the tool. The teacher had asked them to author a six card stack that focused on the novel they were reading in class. The only requirement from the teacher was that the project had to focus on the novel in some way as a reader-response. During a class discussion students made suggestions for headings or themes that they could use in structuring the stack.

The remainder of February was spent observing in the classroom and during the computer lab time. The first interview was scheduled with each of the focal children and completed by the end of February. These interviews were transcribed and coded

in early March. The second week of March the dyads finished their Hyperstudio (Wagner, 1993) projects and also created a rubric for evaluating each other. This rubric was created during two writing workshop (Atwell, 1987) sessions collaboratively by the entire class. Initial criteria included in the rubric for evaluating the projects totaled 20; however, it was then reduced to eight criteria through the process of voting by the class. Criteria included on the rubric uniquely encompassed traditional and non-traditional writing elements.

The class began reading and responding to a new novel in early March after completing their first authoring projects. Post project interviews were again scheduled with each focal child and completed by mid-March. Transcriptions of the interviews were made. The refinement of the codes continued throughout the month. Observations of the literacy lessons and new learning that took place in the computer lab continued also. *Number the Stars* (Lowry, 1989) was the current book being read during reading workshop in the classroom and learners responded in writing to the novel in their response journals. In mid-March the teacher began to teach the students how to use Pagemill (Adobe, 1997) which was a hypertext-markup language or HTML authoring tool. Essentially, the tool was a way for the dyads to author web pages without having to have knowledge of HTML coding. They again spent three weeks learning and playing with the tool. Observer-participant field notes were taken of this learning and playing time with Pagemill. At the beginning of April they began reading *Roll of Thunder, Hear My Cry* (Taylor, 1976) and they also began their prewriting and planning cards for the second authoring project.

Early in this process the dyads brainstormed 10 themes that they found that spanned the three novels. These themes across the three novels resulted from a discussion during one of the writing workshop session that focused on meaning construction and intertextuality. The teacher asked the dyads if they could think of themes that cut across all three books and as they said them they were written on pieces of paper. The dyads selected a main theme randomly and created their web page around this theme. Themes were randomly selected because the teacher felt that this was the best way to assign topics for the projects. The themes were: hatred, family, freedom, conformity, sameness, differences, choices, identity, rights, and racism. Each of the themes was defined by the dyad and intertextually linked in their web page. Prewriting and planning documents were copied each week to note changes made as the dyads added to them. Pagemill (Adobe, 1997) provided a steep learning curve for the dyads and an additional week of gathering graphics and learning the tool was required before the dyads incorporated all their prewriting notes into the process. The last week of April the web authoring projects were completed and post project interviews were scheduled. The third set of interviews was completed by second week of May.

Data Analysis

Analysis as a Sense Making Process

Researchers use various methods to analyze data and the methods are as varied as the types of qualitative research that one can choose from based on the questions they want to ask and answer. The common element in all qualitative data analysis is the need to make sense of what is learned in a systematic way. The researcher must take

the data from an information form and communicate the findings in such a way that others can find application in to their study from it. The analysis must also fit with the theoretical framework and answer the questions of the study through internal consistency. Data analysis, according to Glesne and Peshkin (1992), should also contribute to a greater understanding of the phenomenon being studied.

Multiple methods of data analysis which cross research methodologies such as grounded theory, semiotics and discourse approach have appeared in the literature as a way to creatively answer questions (Labbo, 1996; Berghoff, 1994; Fey, 1994). Miles and Huberman (1994) suggested that it is this creative stance in analyzing data that makes the data a rich bed of information and that analytic problems can be approached in many different ways. A unique approach to analytic problems with data was illustrated by a study done by Smagorinsky and O'Donnell-Allen (1998) in which they used Peirce's (1933) triadic framework to construct a two tier coding system in conjunction with coding systems used in the cited literature. Smagorinsky and O'Donnell-Allen created a multi-method approach for understanding students' visual text contrasted with the students' own words. They sought to understand how students composed meaning from literature through creating interpretive texts.

Data Analysis Clarification

Analysis of the data, including the interviews and field notes, utilized the constant-comparative method (Glaser & Strauss, 1967) for a line by line analysis. Questions from the semi-structured interviews were re-phrased to inquire about similar topics in three different ways. This re-phrasing of questions made it possible to triangulate (Miles & Huberman, 1996) the data and add internal consistency to the

interviews. Analysis of the field notes also utilized the same approach and added further triangulation to the analysis of the children's perceptions. Writing artifacts were analyzed though the use of memoing to summarize the final projects and matrices were constructed from the data based on the children's rubric they designed. The use of a matrix organized the data to draw some conclusions from the children's writing based on applying the rubric they designed to see if their described growth stated in the interviews coincided with their rubric.

All of the data were thoroughly read before open coding (Creswell, 1998) began. Initial codes were developed to characterize large themes in each of the interviews. Qualitative analysis software was used to help conceptualize the initial coding framework. Initial coding categories grew out of the questions from the interviews but were later refined and written in the children's own words based on reoccurring phrases and words in the data that the children used during the interviews. Additional coding was done to further develop axial codes and tie themes together through relationships established by the theoretical framework. The coding of the data yielded seven broad themes related to answering the two study questions and many sub-themes. These sub-themes were dimensionalized in degrees as properties or attributes of the larger main theme phenomenon and used to form relationships that linked the main themes together. Glesne and Peshkin (1992) refer to this process as "code clumping" (p. 133). Matrices of the artifacts were contrasted with final matrices from the interviews. The interview matrices intersected the main themes to build a comprehensive picture of the child's literacy perceptions of authoring with

hypermedia. The matrix from the artifacts was used to support initial findings from the interview data.

The two final projects and the prewriting documents from the data was coded using a semiotic framework to view how closely the semiotic framework was to children's developed writing rubric. The semiotic framework was based on Manning and Cullum-Swan's (1994) structured questions. The purpose according to these authors was to "place signs in context with the relevant interpretants over time" (p. 470). The semiotic framework allowed me to explore "differential meaning by demographic features such as gender, race, and class, and by personal elements, such as self, role relations, and group membership" (1994, p.470). For the purposes of the study, the differential meaning explored specifically looked at self as literate person and group membership. The questions that organized the analysis of the semiotic framework are further discussed in the coding section of the dissertation document.

Coding

Coding data is a way to make sense of the data, to sort and organize it based on some initial rudimentary system. Because all coding begins with notions of theory behind it, it is important to understand how the theoretical framework was tied to the coding system. The link from theory to the coding system consideration was important for achieving results that were theoretically dense and that held up across multiple cases. Coding is a recursive process that does not happen in a vacuum, but rather with some theory in mind. As the coding process moved forward, codes were refined based on further understanding of the phenomenon begin studied. Strauss and Corbin (1990) described coding as a process for breaking down the data and putting it

back together again. The process is the central way that theories are built. The process is also what makes coding unique as a form of data analysis. The researcher toggles between asking questions and generating comparisons between codes, hence the name the constant-comparative method (Glaser & Strauss, 1967).

All of the interviews and field notes for this study were coded as a primary way to understand children's perceptions of authoring with hypermedia and their perceptions of their literacy learning and growth based on tool use. Three sets of interviews were transcribed and initial coding schemes grew out of the data based on the theoretical framework of the study. Coding categories were refined to reflect the repeated words and phrases of the participants; however, the framework remained much the same. The uses of the children's own words to frame coding categories were used as a heuristic to further define what each code meant. Sub-themes emerged from the data and these also added to defining the codes. From this I realized that I was working with seven major categories each of which distinctly was represented in some way through the theoretical framework. The field notes were coded using the same framework; however, prewriting documents and the final projects were coded using the semiotic coding framework which is discussed below.

The following seven codes were used to code the transcripts and the field notes. They were written in the children's own words and are further described in how they are situated in the theoretical framework (see Table 3). This coding is represented in a condensed format and does not include the sub-codes.

Table 3

Coding System

Literacy is reading and writing.

Changes in what I know about my reading and writing.

Ways to Write

Working Together

Talk is Writing

Web Writing and School Writing

Readability

Coding and Theoretical Connections

Literacy is reading and writing was originally coded "literacy is and what you need to know to be literate." This code was situated in Reader-response theory (Rosenblatt, 1978) because the children described it as happening when they interacted in and with text. Transactional aspects of Rosenblatt's theory were represented in how the children saw the reading and writing processes as creating an environment. The epistemology of literacy was also part of how the readers defined the code (Cunningham & Fitzgerald, 1996). New definitions for literacy (Reinking, 1998; Ong, 1982) that included digital tools as part of being literate were also described.

Changes in what I know about my reading and writing was originally referred to as describing my literacy growth. It broadened theoretically to include Dyson's (1990) notions of symbol weaving as a writing process children recognized and also Bakhtin's (1981) notions of how learners learn to manipulate language learning to achieve growth (Dyson, 1997). Bahktin (1981) felt that learners recognize change in their own learning through the responses others make toward them as a result of their manipulation experiments. Essentially children experiment with reading and writing and watch to see how others respond to gauge their understanding.

Ways to Write also grew from Dyson's (1997) work with young children who experimented with different ways to write that included not only text but also extended texts in the form of visual literacy. Dyson hypothesized that participation in the social community organized and drove the symbolic process. Ways to write also

reflected what Wertsch (1991) referred to as multiple authorship as a necessary fact about all texts whether written, spoken or constructed from multiple media.

Working together and Talk is my writing frames how Wells (1986) described collaboration and the way talk is situated at the center of new learning. Meaning negotiation within their writing was completed through their dialogue. The dialogue became internalized and the language became a tool for thinking and then was acted out as writing.

Web Writing and School Writing were contrasted by the students in much the same way that Reinking (1998) describes new definitions of writing with hypermedia. Allington and Cunningham's (1995) descriptions of children learning how to "do school" were also reflected in how the children described traditional school writing tasks. Writing at school was framed through the lens of writer's workshop and ways to write in the traditional sense were described through activities the children had done through the writing process.

Readability or document design focused on how the children used the design of their documents to make meaning for themselves and others. Flood and Lapp (1995) refer to this as visual literacy and the meaning construction results from the intersecting of multiple kinds of texts. Myers, Hammet and McKillop (1998) found that readability had more to do with understanding texts in how they positioned the reader through their structure in HTML environments. Readability was not only a function of the level of text but also how extended texts were positioned to shape the reader's thinking. From a constructivist's point of view, readability in relationship to design is very much a philosophical consideration in which design is shaped by your

own epistemologies (Smith & Ragan, 1999). These epistemologies can guide readers who enter the text and also shape their thinking in a certain way; however, because hyperauthoring is an ill-structured domain, these readability elements have the potential to change with each new reader who interacts with the text. Consequently, epistemologies come into question because readability has to take into account a triadic framework that includes context, interpretant and sign (Deely, 1990). Semiotics studies what can be taken to be a sign and if signs are in flux within the readability framework then we can only interpret the signs based on the moment while using our culture as a reference point for constructing this epistemology.

Semiotic Coding Framework

This study sought to understand not only children's literacy perceptions of authoring with Hypermedia, but also to understand their perceptions of their literacy growth when using hypermedia. This literacy growth was defined by the children and acted out through the use of their writing rubric. Final projects were coded based on their rubric and also based on a semiotic coding framework developed by Manning and Cullum-Swan (1994). The codes are listed below (see Table 4) and were applied to each of the final projects and the prewriting documents. Matrices of these coding schemes were used as a way to capture the data in a summary format for interpretation (Miles and Huberman, 1994). This lead into understanding how the authoring documents and tool use contributed to their perceptions of their literacy learning growth.

The semiotic analysis framework was one way to understand the conventions of writing within multi-layered text. Because non-linear text is qualitatively different, it

employs not only traditional linear writing conventions but also non-linear conventions. These non-linear writing conventions encompassed the use of multiple kinds of text, therefore, the semiotic analysis framework aided in understanding how children may mean with these conventions.

Table 4

Semiotic Coding Framework

1. Defining the social field through definitions of the semiotic code; ways the pressures give meaning to the structure.

2. Organizing principles of the field or organizing structures of the tool

3. Ways the tool conveys constraint, order, and choice

4. Part/Whole contrasts in design

Limitations Inherent in the Method of Grounded Theory

Grounded theory is a methodology for developing theory that is grounded in data systematically gathered and analyzed. Theory evolves through a recursive process of analysis and data collection (Glaser & Strauss, 1967). In understanding grounded theory as a methodology it is important to also understand it's limitations in describing social science inquiry. Grounded theory can comprehensively help researchers build new theories; however, the application of the new theories are not always applicable to practice. Often a study in a new area such as literacy and technology proposes some new theory, but the aim of the theory is to continue the inquiry and not to directly put new knowledge into practice. This is especially true in trying to understand literacy and technology theory combined. Meyer and Rose (1998) exemplified this point as they stated, "It takes time to figure out how to use a new technology—to discover the valuable new uses implicit in the technology itself. At first, people tend to use new devices as if they were just different version of something older and more familiar" (p. 8). He cites the use of the wireless telegraph as an example of this and this innovation use actually turned out to be the present day radio. His point being that initial research with new technologies often has a tendency to appear as a new and improved version of the old when in fact with more research it is something quite different.

Grounded theory studies are often context bound and difficult to replicate and from this perspective they offer little in the way of extending our knowledge of how the theory might look in practice. This type of methodology employs multiple data

analyses and collection techniques and it is impossible to show cause or relationship between the study and those acting as participants. Interviewing is one of the primary ways for collecting data and if trustworthiness is not established between the interviewer and the participant then the data are useless. Worse than this is bad interview data being used and the researcher not recognizing it as such. Lastly, if the data lacks conceptual density then the research overall are at risk, thus the researcher must achieve great familiarity with the data and systematically employ analysis techniques to make sense of them (Strauss & Corbin, 1994).

Chapter Four: Findings

Children's Perceptions as They Authored with Hypermedia

Introduction

The present research is the story of eight children and their perceptions of authoring with hypermedia over a period of five months. Included in the findings are the accounts of how the children believed they grew as literate people during the time of authoring. The children's perceptions of authoring with hypermedia explored notions of what literacy was, ways to write, collaboration, and meaning construction. The children's perceptions of their literacy learning growth was also explored and the children summed their ideas in speaking of the differences between web authoring and linear authoring, ways they thought they had grown as a reader and writer, and their semiotic use of signs.

Definitions of Literacy and the Ways Hypermedia Impacts that Definition

Literacy in the study was defined by all the children as the ability to read and write. Linear writing conventions were also included as part of their definitions and they included the ability to write using punctuation, spelling, choosing the right vocabulary to mean, and handwriting. The definitions of literacy were varied with regard to conventions of writing; however, definitions of literacy that included non-linear writing conventions were consistent across all eight interviews. All of the children stated that being literate involved not only the linear ways but also non-linear ways that equated the ability to be a good writer with also being a good "techie." Those who were literate could not only manipulate text in a linear format, but also in a non-linear way that suggested expertise with hypermedia tools.

Literacy Is

Literacy definitions were described by the focal children as reading and writing in a linear sense. Descriptions of knowing how to read, writing rough drafts, writing complete sentences, understanding who your audience was, and the school literacy club were examples cited by the children as the most prevalent ways to be literate. Other examples that were talked about by two of the students included storytelling, being open minded when trying to figure out a topic to read or write about, and reading to build vocabulary.

A typical response given when asked, "What is literacy?" was cited from Sean's interviews:

> Sandee: What does the word literacy mean to you?
>
> Sean: You have to know how to read. You have to have ideas in your head, and know who your target person is when writing, whether it's kids, about kids, toddlers or grownups.
>
> Sandee: Are you describing your audience?
>
> Sean: Yeah, the audience, of your books you are writing. You have go to what they are mostly interested in, go to that sector. You can't change the mood of your writing in the middle, it confuses everyone. You can't change the whole idea from chapter to chapter, it is important to carry your ideas all the way through the story. I've had problems

with this. Changing the mood means you have to change chapters.

Sandee: Why do you do this?

Sean: You eliminate confusions if you stay with your main topic in writing, but it is hard to do this sometimes with a lot of characters.

Sean elaborated on what he thought literacy was in terms of his own writing and also his experiences as a reader. This was cited as a typical example because in trying to define an abstract concept such as literacy, the focal children described situations of reading or writing which they had engaged.

Literate People

Describing what literate people do was also a way for the children to explain what literacy meant to them. Someone who is literate reads many books and can write with writing conventions. These examples of literate people were described by the children as goals they had for themselves. There was a distinction made by all the children that described literate people as being able to read and write, but also a good writer was someone who was also an accomplished "techie." Sean was cited by the children as someone in their class who fit this description.

Hypermedia literacy

Literacy definitions by all the focal children included twice as many non-linear elements in their descriptions as linear elements. Literacy in a non-linear sense was described as being able to a navigate web pages and find the information you were reading for, writing with two hands, the ability to use the inspector in Pagemill,

knowing how to edit on the computer within each program, and grabbing graphics and animations from the web to include in your writing. The children cited those who were extremely literate as those who knew how to include video and audio clips in their writing with ease. Amanda was cited in her interview as explaining this new way to describe hypertextual literacy:

> Sandee: What do you think the word literacy means?
>
> Amanda: Well, it means to read and write, but also you also have to be able to revise your writing and learn the writing structures in the tools?
>
> Sandee: Can you describe those writing structures in the tools?
>
> Amanda: They are the graphics, animations and the music CDs you can put in your project. You also have to know how to use the inspector or tool kit for Hyperstudio and remember it. Like when we wanted to put the Titanic song in our project we had to watch Joe because he knew how, he is smart with computers. He could do this with his project, put music in from a CD and our teacher didn't know how. He is a good writer with web stuff.

Those who could function in the group as a technical consultant were also seen as highly literate individuals and their strengths were cited as part of how literacy was defined. Literacy definitions and descriptions of the "techie" did not imply that because one was an expert in a non-linear sense, one was also an expert in a linear

sense. In other words, a writer could be proficient with non-linear text and not be proficient with linear text. Six of the eight focal children expressed that one could be a poor writer in class with linear writing and be an expert at the computer and literate as a result of being able to manipulate writing with non-linear conventions.

Literate people did not need to engage in prewriting or revise documents because this took place during the writing at the computer. The children expressed that since you had to see how it looked, prewriting was not a helpful step in writing. Revision of documents created shifts to include revision as a process that utilized trying out tools or experimenting with non-linear conventions. Non-linear writing conventions were cited most often by the children as influencing how they defined what literacy was, and how these non-linear conventions shaped literate people as writers. Non-linear writing conventions differed from linear writing conventions in one distinct way, the non-linear conventions contributed to meaning construction in contrast to linear writing conventions, which usually do not (Graves, 1983).

The children cited several of the same examples of knowledge a literate person had to know to author with hypermedia. The use of navigation buttons, where to get them, how to link and place them was given as the most important thing to know when authoring in this medium. Next, general knowledge of the tool that emphasized an understanding of the Pagemill (Adobe, 1997) inspector or Hyperstudio (Wagner, 1993) toolkit was important to author. And finally, utilizing backgrounds that made writing interesting without making it hard for the reader to read was cited along with using graphics and placing text around graphics to increase the reader's meaning

process. These were all seen as a knowledge base for literate people to understand if they were to author with hypermedia tools.

Ways to Write

Ways to write were defined by the children as the media you might use to write with. Ways to write included pencil, pen, and computers. Hyperauthoring expanded their definition of ways to write to encompass not just writing tools, such as buttons and graphics, but also different types of text. These different texts included some they wrote, audio text, their own voices recorded, and links to others' writing which they acknowledged as written by someone else; however, they included it as part of their writing.

Linear Ways to Write

The tools used by the focal children when writing in their classroom were grouped into three categories: the medium to scribe with, genre or topic selected, and reading responses. Media to scribe with included pencils, markers, chalk, paint, and any other medium to use with their hands to scribe. Genres and topics selected focused on writing about ideas that the children liked or were interested in and six of the children also mentioned a specific writing genre such as fantasy or mystery writing. Reading responses were also cited by the focal children as a way to write. These were usually completed in response journals and the children responded to an open-ended question related to a novel that they were reading. Additionally, dictation was cited as a way to write before using a scribing medium by two of the eight focal children.

Using Non-linear Writing Conventions

Non-linear writing conventions were grouped into two types from the way the focal children described these conventions: non-linear conventions and tools. Non-linear writing conventions added little to the meaning of text. They only aided in making the reading more understandable for the reader. This was similar to how linear writing conventions were described (Graves, 1983). The other type of non-linear writing convention was grouped as a tool to expand meaning for the reader.

Non-linear conventions included spellcheck, editing movement, paging forward or backward, within documents, and buttons for navigation. These conventions did not add to their writing according to the focal children, but they thought the ease of the convention made them a better writer. Allison's discussion illustrated how she felt about the non-linear conventions:

> Allison: If you use spellcheck you don't have to be a good speller, so the spellcheck makes people think you can spell and no one knows. The tools that help me write aren't really different from regular writing, but they are right there and I can grab them and it makes me a better writer. I don't have to get a dictionary or ask my friend, it is just there to grab.

When the focal children were asked how the hypermedia tool differed from other ways to write all responded that it was the same and different from linear ways to write. These non-linear writing conventions could be used in linear writing; however, they were made easier to use according to the children because they were all self-contained within the program.

Non-linear Tools

Non-linear tools, according to the focal children, were inside the programs used and also on the web. The tools were described as helping make the writing more meaningful while also adding many ideas to a single page. The non-linear tools were a way for the focal children to layer their writing within one page. The non-linear conventions and tools were utilized by the learners for meaning construction. Learners also stated that these tools made their writing better and that they could write more, in a linear sense, with the addition of tools.

The focal children consistently mentioned the use of five tools across all three of the interviews. The five tools included: the use of colored text and backgrounds to convey a message to the reader, graphics to explain an idea in a different way, CD music selections, audio voice buttons, and the ability to grab other images from the web. Colored text and backgrounds were used by the focal children to tell the reader about the mood of what they were trying to say regarding the novel. Graphics were used to add to the meaning of linear text. William explained this when he described using a flag graphic on his web page.

> William: I wanted to use the Mississippi flag and the Confederate flag on the web page so that when someone read the page they would see those flags waving and maybe know how hatred was part of the life for these characters. Just what they had to deal with in the book Roll of Thunder and maybe the reader could feel what they, the characters, felt when they saw those flags.

William and the other focal students used the graphics and colored text to encode meaning that was also embedded within the linear text. Angela and Sue used this way to write by alternating between brightly colored and dark web pages to tell the reader which world the main character was functioning within. Music and audio clips functioned in a similar way to add meaning to the projects by layering the text. All of the authoring projects utilized music for two reasons: 1) to listen to as one read the text, and 2) to add to the text through someone else's writing. The music was another way to get their message across to the reader according to all the children. This was also seen in the way they linked their pages to other pages, or cut and pasted text or graphics from other authored pages into their own as a way to write.

Collaboration

Collaboration in this classroom was an integral part of learning for all the children. It was most often described as working together through talk. Allison's description of collaboration in their classroom best described how the focal group felt regarding their collaboration during the two authoring projects.

> Allison: It is good to share your ideas and others' ideas and stuff, because they can be help to you by not even looking at the paper, you know, you can just tell them and they can help you write better. If there's a tough spot, they can talk you through it. Your partner can talk your idea, and add some to it, to make a really great idea.

Planning Our Writing

The focal children engaged in prewriting and playing sessions as they learned the hypermedia tools. They worked in teams of two to collaboratively plan their writing on index cards and experimented with these ideas during their playing sessions in the computer lab. Planning their writing took place during the prewriting sessions in the classroom and it also extended into authoring sessions on the computer. Prewriting, as a writing stage, involved trying out tools and locating the ones that worked best for the project.

Collaboration by the dyads was always described as fun and also as a way to write. The computer tools were seen as helping the writers; however, the collaboration was equally important to the focal children for completing writing tasks and also for enhancing their writing. The critical collaborative community and the use of computer tools were described by the focal children as helping them to think and plan the writing projects. Other benefits from collaboration cited by the focal children included: sharing the writing experience, getting different views on a topic, and having an expert "techie" on the team to make the writing better. This was an idea elaborated by Jack.

> Jack: When you write with your partner you can write more and usually one of you knows the program better, so it is easier. You can divide the work between being the writer and being the computer writer. The writer knows the basic stuff like grammar and spelling, and the other writer can do the stuff like getting graphics or icons from the web.

Jack also implied that he and the other focal children made distinctions between their roles as writers based on their judgment of who had more "techie" knowledge.

Feedback from Friends

The children received feedback on their projects from a collaboratively designed rubric. The layered writing rubric was applied to the writing process as they authored. The children used the rubric to measure what they felt needed to be accomplished during the sessions. All the students completed feedback with the rubric as they presented their projects to the class.

Collaborative feedback was often in the form of comments during the presentations by the entire class. Students always questioned ideas and writing tools or conventions used that did not seem to fit with the theme suggested by the rubric. This dialogue concerning the final projects was summed up in the interviews as bouncing ideas back and forth with an opportunity to revise the writing and obtain feedback at a later time.

When asked how they liked working with a partner with regard to giving each other feedback mixed responses were given. Some said that they liked sharing the work, while others stated that it was hard sometimes because you had to compromise what you wanted. The responses which favored collaboration suggested that collaboration was easier for writing more, their partner helped them plan, they shared the work, and that the writing was better because they worked with a partner.

Watching and Asking Questions Helps Me Learn

Collaborative dyads were established by the teacher and the children also participated in writing groups within their classroom as part of writing workshop. Within the writing workshop many unestablished collaborations formed as a result of learning to use the non-linear writing conventions and tools. These groups were based on learning to use a convention or tool for a purpose within the authoring project. An example of this was Sean's use of a music CD within a page of the project. He formed a small collaborative group. The group had a similar purpose in their learning and they worked the problem, adding music, until they figured out how to accomplish the task. Other collaborative groups formed for the purposes of capturing graphics, solving problems with non-moving animations, and linking pages together. These side collaborative groups involved watching while one person attempted to problem solve and then dialogue took place regarding what should be done next.

Dyads would then come back together and attempt new learning at their computer while still asking questions of the group for scaffolding. This was observed with each dyad during non-linear writing processes; however, it was not observed during classroom writing workshop or other linear writing tasks.

Meaning Construction

Constructing meaning through writing with linear and non-linear text was the teacher's goal for the two authoring projects. The children used the hypermedia tools to construct meaning from three different novels. They also used non-linear conventions and tools that suggested multiple ways to write. They constructed meaning based on their perceptions of the process.

Meaning construction for the focal children was based on the three elements of talk, evaluation, and literacy relationships. The non-linear conventions and tools provided through the hypermedia authoring helped to mediate the process as opposed to creating or shaping it.

Talk Is My Writing

Talk is my writing was always revealed as a way to construct meaning by the focal children. Sharing writing in groups or talking about writing ideas was viewed as the best way to start writing. Sean and James thought talking was the best way to begin writing; however, they expressed that talking to their teacher about their writing before meeting in groups was the process they chose to engage in first. They elaborated on this by suggesting that they did not want to share their writing until it was completely finished. This was their common practice in the classroom; however, the computer lab screen was much more of a public space and they engaged in talk about their unfinished writing during authoring sessions, often acting as experts for other class members to collaborate with.

Whole Group Evaluation, Our Rubric

Group evaluations of the writing projects was based on a writing rubric designed by the class. The rubric was developed by the class during two writing workshop sessions. Students initially selected 20 criteria to include on the rubric and then voted to include only eight criteria. The criteria for the rubric included four linear writing elements and four non-linear writing elements (see Table 5).

Table 5

Peer Evaluations of the Hypermedia Projects

Authors _____ & _____

1. This project tells the reader something about the characters in the novels._____

2. The authors of the project made the writing interesting and lively._____

3. The projects has attractive stack design:_____ a)text_____ b)color_____ c)buttons_____ d)organization_____ e)sound_____

4. The text or writing makes sense to the reader._____

5. The topic of the project is related to the novels._____

6. The authors used a title on each page or navigation to help the reader move around inside the project. _____

7. The project contains: facts_____ and or summaries_____

8. The authors of the project helped the reader by using punctuation._____

Reviewers: _____ & _____

Comments:

Each of the dyads reviewed a project and made suggestions or comments in a written form on the rubric. If the element was present in the project then a check mark was placed on the line. The learners determined that either an element was clearly present or it was not.

The rubric was developed three weeks into the first authoring project and learners referred to it as a reference to guide their progress. All of the focal children received positive feedback from their peers and two of the dyads received comments in the form of questions regarding some graphics used. The reviewers questioned how the graphics fit with the overall meaning of the project with regard to Hyperstudio. These comments prompted the dyads to review and revise the text and graphics to more closely match the objectives specified by the teacher.

Literacy Relationships

The relationships formed between the dyads and within the writing groups. The relationships were spoken of during the interviews across both writing projects. Allison explained the literacy relationship as one that was based on friendship and accomplishing a goal together.

> Allison: You learn to strengthen your friendships when you work with someone else, you have to get along and compromise 50/50 because you need the help and they need you.

The dyads all spoke of how the characters had relationships within the novels and generalized this discussion to their own friendships. This talk of relationships helped

with the writing according to the students. James summarized the four dyads' responses with regard to literacy relationships as:

> James: I trust my group because they tell me stuff that makes me feel good about my writing. I want to hear what they have to say so I know what goes on in their head when they read my stuff...kinda what they think and then I can write after they say something. I get my better ideas for writing from other kids talking about my writing, sometimes I just listen.

Suggestions and compliments were the focal point of the literacy relationships and the focal children utilized the process within the relationship to clarify ideas others did not understand. The dyads all suggested in their interviews that literacy relationships were at times difficult to navigate but well worth the effort since the result helped them to improve their writing and also gain a better understanding of the non-linear conventions and tools.

Web Writing and School Writing

The focal children expressed a dichotomy between authoring tasks in the computer lab and the writing within their classroom. School writing tasks were often completed for a grade and external criteria guided the writing. In contrast to the hypermedia authoring, school writing assignments contained those same evaluation elements for the students; however, the non-linear writing conventions and tools afforded by Hyperstudio (Wager, 1993) and Pagemill (Adobe, 1997) allowed the learner to set a broader purpose for writing. This autonomy to set a

broader purpose created a clear distinction for the children between how linear writing differed from non-linear writing.

Doing School

The phrase "doing school" was suggested by the children as a way to characterize writing tasks in which they invested little of themselves. These were the writing assignments for grades, or standardized tests. The writing projects were often suggested by the teacher or a prompt that came from a novel they were reading. Learners felt that they knew few ways to make the writing project their own. Consequently, they completed the writing task with minimal personal investment to satisfy the grade requirement. Most of their writing tasks in the classroom were described in this category even though they may not have been in a traditional essay format. Learners suggested that the tools they were able to use with linear writing did little to enhance their ownership of the writing and motivate them toward making more of an effort than simply "doing school."

Doing School My Way with Non-linear Writing

In stark contrast to this notion of doing school, one learner described non-linear writing as a pie with many pieces you could manipulate, combine, or get pieces from other pies to make yours better. This student also described linear writing, in a metaphorical way, as particularly getting to eat one piece of the pie and equated this to the use of linear text to express all that he wanted to say.

The non-linear writing, according to the students, was more interesting because they could use the tools to shape their writing by adding buttons, backgrounds, graphics, text, sound, and the ease of editing to invest in changes.

Focal children consistently stated across all three interviews that non-linear writing was more interesting, because you could write in different ways. This allowed them to feel that they were accomplished with their writing as a result of being able to manage the software. Ways to write more and to a deeper level were suggested through the use of graphics or music and then the use of text to explain what it meant according to the author.

Web writing and school writing differed in two additional ways according to the dyads based on traditional linear writing notions: first, they suggested that with web writing in the lab they did not have to revise, they simply made changes as they wrote. And secondly, they felt that the software did the writing for them because the tools suggested ideas or allowed them to combine ideas by mixing graphics, sound and text. Juxtaposing of multiple texts helped them create their own purpose for writing while still satisfying the "doing school" requirement. William sums this up best when he states how web writing differs from traditional school writing tasks.

> William: Writing in my classroom and writing in the computer lab for those types of projects is very different. But in some ways the same. They both use regular words, but hyperwriting lets you write and see how it looks to see if you want to change it. It is easier because you can pick lots of tools and this makes the writing better. You can use music to write and the technology just makes it different. Plus one other thing, the computer writes it for you in the final form, no more drafts.

Ways I have Grown As a Reader and Writer

What were the children's perceptions of their literacy growth as they authored with hypermedia? This question was the salient point in understanding how hypermedia authoring constructed the children's perceptions of authoring and to what extent it moved them along the writing continuum. Answers to the question were found in the ways the children described their reading and writing growth and how they used sign systems to move along the writing continuum. Ways to write grew throughout the study to include notions of readability for meaning construction. Readability was defined by the focal children as types of authoring design that could either help or inhibit meaning construction from the reader's viewpoint based on how non-linear writing conventions and tools were utilized.

Linear Ways

Changes in what the children knew about their literacy development were framed by two notions: improvement in reading through reading more books and changes with linear writing conventions. The linear writing conventions most noted by the focal children were spelling, capitalization, and punctuation. The remainder of the other responses to changes in literacy growth were couched in non-linear ways. It should also be noted that spelling improvement was directly linked to spellcheck in Pagemill (Adobe, 1997) as a tool.

Non-linear Ways

Children's perception of their literacy growth as they authored with hypermedia was tied to the use of non-linear writing conventions, tools, and meaning construction. These three notions formed the basis for understanding

why readability was seen as a sense making process for readers. Readability was couched in design for the purposes of making their documents accessible to all readers who might encounter them.

Non-linear writing conventions were used as a way to make the writing easier to understand while not adding much to the content of the text. Examples cited by the dyads were the ability to write with both hands, spellcheck, grammarcheck, navigational buttons, boxed text to separate ideas, and being able to toggle between the World Wide Web and the authoring tool to see and try out new types of text. Managing a desktop, WWW browser, and authoring tool all at the same time was also cited by four of the students as something they had gained within the realm of writing conventions.

Tool use as a convention to enhance meaning construction was described by all the focal children as the single most important thing that they had learned. Examples of this included the description of characters in a story written with linear text and then the character was also described through the use of graphics to provide visual analogies for character traits. Additional uses of graphics included the use of flags to let the reader know and understand the mood of the novel explained. This use of flags conveyed sadness through the stated text and also the colors and symbols on the Nazi flag helped to explain how the dyad described the crimes of the German Nazis in Denmark. Lastly, audio was recorded to enhance the meaning of a theme in the Hyperstudio (Wagner, 1993) projects. Examples of this included the song, "My Heart Will Go on" (Horner, 1997, track 14) the theme song from the movie Titanic about dreams to capture the emotion of Jonas'

dreams in *The Giver* (Lowry, 1991), and the song, "Just the Two of Us" (Smith, 1998, track 1) to explain the relationship that Jonas had with his brother. William and Sean describe their use of writing tools and how they feel they have grown as literate people in doing this.

> William: I have become a better writer from using Hyperstudio and Pagemill because now I can write in many different ways. The music I used made my writing easier to understand because it was dead music and everyone in the novels was dying. I also learned to use fonts to make statements about characters. If the character was a hero I would use a big, bold heavy font or if a baby then a delicate font, maybe in light blue. If the story needed a setting of a long time ago then I used old English to tell the writer the time period in my writing. I never did these things before in my writing and it made it more interesting and better to read.
>
> Sean: Getting my pages arranged and looking the way I wanted was important to learn in using the tools and remembering where they were. This tells readers who you are as a writer and whether you know the stuff. Graphics tell the reader it is going to be a good read too. If you use graphics to also describe your characters you can set it up

like a game, I get a lot of writing ideas from video games
and how they use characters.

These descriptions of literacy growth represented how the tool mediated and extended their knowledge of writing processes to broaden and include multiple types of texts. Lastly, with regard to literacy growth, the focal children detailed that literate people were those who were also good "techies" and they all expressed that they had grown in becoming better writers through greater understanding of the hypermedia tools.

The Semiotic Use of Signs to Move Along the Writing Continuum

The children's perceptions of their writing development when authoring with hypermedia provided additional data from their prewriting documents and authoring projects. These documents were coded with a semiotic framework to gain some understanding of how the use of signs by the children added to their perceptions of their literacy development. Contrasts between the interview questions that inquired about sign use and the authoring documents provided some data for understanding how semiotics was an integral part of the writing process for these children and how semiotics influenced their literacy growth.

Data from the prewriting documents and final projects indicated that as the children became more comfortable with the hypermedia tools they included more sign systems in their writing. There was also a decline in the amount of prewriting completed by the children from the first to the second project. The first prewriting documents contained many sign systems indicated in linear text while the second set of prewriting documents contained fewer notes for including signs.

However, even though the prewriting documents for the second project contained fewer notations of sign systems the final projects were more deeply layered in writing structure than the first and also contained multiple sign systems within the writing.

The sign systems used by the children in their authoring yielded four distinct ways to categorize and use signs: the school literacy context, the structure of the tool, how the tool ordered choice, and part to whole contrasts and relationships. This structured employment of sign systems was consistent across the four sets of prewriting documents and final projects.

The School Curriculum as Code

The school curriculum formed the code that learners used to navigate the social field. The curriculum also provided the learners with guidelines that gave meaning to the structure. The social field for the authoring projects was the literacy assignments given by the teacher, namely, two authored hypermedia projects. The first was based on the novel *The Giver* (Lowry, 1991) and the second project was based on a central social theme derived by the class. The theme for the second project was the basis used to create a web page linking three novels. These assignment constraints gave meaning to the structure of the social field that the learners authored within.

Examples of this were noted in the semiotic coding framework for each of the four dyad projects. They included the open-ended literacy assignment, the use of six completed cards or pages, headings, the novels selected, and the potential evaluation rubric.

How the Tool Structured the Sign I chose to Use and Limited Them

Differences between the tools used by the children to author, Hyperstudio (Wagner, 1993) and Pagemill (Adobe, 1997), provided a contrast between sign systems and also limited sign system use. Principles that organized the tools for selecting sign systems included: font size, style and color, types of icons selected, choices in sounds or length of audio, linking of pages, amount of linear text, and background choices. This structure in choices for the sign systems was the organizing principle in the prewriting documents and was reflected also in final projects.

The Tool as Choice with Signs

The tool also limited the types of sign systems used by conveying, constructing, or ordering choice. Choice in sign system use was conveyed through the use of sequenced pages, the addition of pages while authoring, navigation within documents, selection of font size, color and style, and linear text structure. Choice of sign systems with the projects was constricted by the structure of the tool. An example of this was Angela and Sue's Hyperstudio (Wagner, 1993) project that contained text dealing with the mood of the book. Angela and Sue indicated to the reader a dark and sad mood through their choice of sign systems from Hyperstudio (1993). The choice was constricted by the available colors of fonts. Sean and Allison preferred to use Pagemill (Adobe, 1997) because their choices in constructing sign systems with text were greater; consequently, the tool they used constructed their sign system with text through more choice.

The tools also ordered choice for the authors of their sign systems through the font size, placement of graphics and placement of linear text and space within the document. Two of the dyads spoke of this as a hindrance in authoring because the sign system ordering choice or placement of the text, was limited in terms of what they wanted to do. Sean suggested to the class that if they wanted to not have choice ordered for them then they would have to learn to code the document themselves instead of letting the program do it for them. He knew how the program was limiting the use of signs and the remedy for this, but lacked the technical knowledge to accomplish this.

Sign Systems Framed by Part to Whole Relationships

Relationships between parts to whole with sign systems were demonstrated by the dyads in the authoring projects; however, this was not evident in their prewriting documents. Examples of this included using buttons and making a link to the whole page. The use of text excerpts from novels to create new stories in different genres with parts of the elements from the original novel, buttons used as navigation based on the text of a character, and the way cards or pages were ordered through navigation to create overall meaning. Buttons had to contain logical text so that readers could connect that meaning to the anticipated page they want to go to. All the dyads did this by providing text and sound so that readers would not be confused. Buttons were also created within text to tell the reader something about the text. Angela and Sue used the name Jonas in the middle of their text to create a button that the reader could listen to and gain additional information regarding the character. Pages were ordered or sequenced

through navigation by Bryan and Taylor so that readers would page through their document based on beginning, middle and end story structure.

These examples are a few of the ways the focal children began to use sign systems to make meaning from multiple types of text. They provided some understanding for how children learned to move along the writing continuum based on how they used and selected sign systems.

Summary of the Findings

The findings explore children's perceptions as they authored with hypermedia and their perceptions of their literacy growth as they authored with hypermedia. Themes that emerged from their perceptions dealt with changing definitions of literacy and literate people. Literate people were described as those who could read and write and also those who were exemplary "techies." Ways to write were described by the children through traditional medium as well as non-linear medium. The children made a distinction between linear writing conventions, non-linear writing conventions and tools. Tools were used as a convention, but also to help construct meaning. Examples of these meaning tools were sound, graphics, and animations.

Collaboration and talk were cited as the most important component needed to author with hypermedia. Meaning construction was supported by collaboration, group feedback, and the authoring of the multilayered writing rubric.

School authoring and web authoring differed based on the purposes the children were able to set for themselves. Web authoring put at their fingertips

more choices in being able modify the writing purpose to satisfy their learning needs.

Literacy growth was noted in some linear ways through the writing conventions of spelling, punctuation, and capitalization. Non-linear ways for literacy growth were described by the children through their use of flexible sign systems to extend traditional text and provide alternative meanings that were expressed in sound, graphics, icons, animations and text choices.

Chapter Five: Discussion

This study had origins from previous literacy learning research and current literacy hypermedia authoring research (Dyson, 1990; Myers, Hammett, & McKillop, 1998). It specifically sought to understand children's literacy perceptions as they authored with hypermedia and the children's perceptions of their literacy growth as they authored with hypermedia. This study added to the body of knowledge related to literacy learning growth, meaning construction processes children navigate with, and technology use as a tool to mediate thinking. The topic was important to investigate because of the rapid changes taking place within literacy and technology education. The study was exploratory in nature and not conclusive because it was important to begin to look at new literacy and technology paradigms of research to understand children's perceptions before attending to pedagogical concerns. The rush to make meaning from new ideas often causes the vision of these ideas to be revealed in ways that simply look like new versions of something older and more familiar (Meyer & Rose, 1998). It was the goal of this research to avoid the rush to make meaning and attempt to understand the children's perceptions of literacy learning from the context of their world and how they constructed it.

Limitations of the Research

The eight student volunteers of the study were from within an elective class, which may have rendered them less than representative of the total school population. Although I was an observer-participant, my knowledge of technology was shared with the students as they had questions. A relationship formed

between the students and myself; thus, I believe it was a trade-off between richer data and remaining on the outside. The project took place to a large extent in the school computer lab rather than the literacy setting of the classroom; thus, this may have limited the finding's applicability to the literacy curriculum. The results from this study were based on using Hyperstudio (Wagner, 1993) and Pagemill (Adobe, 1997) as tools to author hypermedia projects and might not be generalizable to all forms of hypermedia design, although many parallels were drawn to other research related to link authoring. The students' excitement in creating hypermedia projects was a large motivating factor for them since this was the first hypermedia project for many of them. The replication of the study may not create the same level of interest and excitement with future groups of students as more schools begin to use hypermedia. Lastly, many theoretical underpinnings framed this study (collaborative, constructivist, inquiry-based, sociocultural, and semiotic) and confounding effects cannot be attributed to the instructional medium (hypermedia authoring). Eagleton (1999) suggests that this is a common problem with research related to hypermedia design.

Literacy Learning In New Ways: What These Perceptions Suggested

The focal children in the study indicated that literacy was the ability to read and write. Definitions of literacy also included linear and non-linear elements of writing that focused on linear writing conventions, non-linear writing conventions, and hypermedia conventions and tools to mean with. The children's description of linear writing conventions was consistent with traditional notions of writing conventions in some ways. The linear conventions made the writing

easier to read, but it did not enhance the meaning of the text (Graves, 1985). Definitions of non-linear writing conventions and tools used to mean was not a hybrid of linear writing conventions, but rather, a way to shape non-linear writing to make it easier to read and understand. The ease of reading the non-linear text used conventions such as spellcheck, navigation, and page ordering. Tools as conventions were used to mean with and shape the writing in multiple ways so that readers could understand the text from different media. Text was used to explain a character, then sound was added to enhance the character with an opinion by the author, and the graphics were layered in. The use of graphics and text acted to demonstrate the author's meaning with analogies through images.

Rosenblatt (1994) described the children's type of writing as transactional writing within the framework of expression-oriented authorial reading. New sign systems were applied by authors through their use of tools. If meaning through the tool or sign created a problem then revision took place. The writing must make sense with the preceding section, but it must also suggest alternative meanings and make sense to those who come in contact with the sign through non-linear paths. Text written with these hypermedia tools took on dialogic overtones to act as a thinking devices to generate new meanings away from the author (Bakhtin, 1981). This use of text was used to extend and enrich the writer's own understanding. This process led writers to very early revision even as they wrote first drafts. Examples of this were evidenced as the children spent time playing with the tools and trying to learn the software. This play time was actually part of the early revision process.

New definitions for literacy were embedded in the children's perceptions of what literate people can do. They suggested that literate people can not only read and write, but they can also manage technology in sophisticated ways. These "techies" were described as people who could write with both hands, and utilize the computer as part of their meaning construction process while writing. If an individual was an expert with the ability to use digital tools then they were also good writers and very literate people. This was also consistent with Beach and Lundell's (1998) study that indicated that technological knowledge within authoring situations was extremely powerful for those who could manage it. The girls in the study who could participate in multiple dialogues emerging from the screen were viewed as the most literate and able users of the technology. Alvermann, Moon, and Hagood (1999) noted a similar trend related to ways the children in their study described those who were literate. Adolescents in the study who could navigate more than eight windows between the desktop, World Wide Web and chat rooms while participating in conversations and reading were viewed as literate by their peers because of their ability to use technology in a layered way. This empowering effect of technology and literacy was also suggested in Fey's (1994; 1997) research with computer mediated discussion groups. Fey's findings indicated the children in both studies understood how technology and literacy knowledge empowered them as more literate people. Those who held this knowledge were considered in their authoring groups as experts and able to write well.

Defining Literacy with Technology Influences

New definitions of literacy emerged from the interviews as the learners gained more knowledge in using Hyperstudio (Wagner, 1993) and Pagemill (Adobe, 1997). These definitions were shaped by what they could do when working with the digital tools and also by observations of others constructing text. Definitions of literacy took on aspects of visual literacy (Bruce, 1998; Flood & Lapp, 1997) and what Reinking (1998) referred to as hypertextual literacy. The focal children understood that texts were not simply written text, but any type of text that entitled the writer to mean. The children used virtual meaning embedded in sound, graphics and text traits to act out triadic meaning systems and virtual thirdness (Peirce, 1933). Triadic meaning and virtual thirdness was anticipated by the focal children through their definition of literacy and in the ways they acted the definition out. They used multiple sign systems juxtaposed with text to construct meaning because they anticipated that readers would read the web pages or Hyperstudio (1993) stacks by taking different paths.

New Tools Shaping Ways to Write

Distinctions between non-linear writing conventions and tools were stressed as a way to write. Five tools within Hyperstudio (Wagner, 1993) and Pagemill (Adobe, 1997) were utilized consistently by the focal children to create alternative types of text. These five tools: colored text, backgrounds, graphics, audio with music or dialogue, and the ability to take images from the web, may have been positioned for use by the author through the structure of the software. Pagemill

(1997) included an inspector tool that compacted several choices for text and Hyperstudio (1993) included a tool bar for graphics, sound, and text. Meyers et al., (1998) indicated that the use of StorySpace (Eastgate Systems, 1994) positioned the authors in their study to confront critical literacy issues through ways the tool structured the text. The software structure or design may have also impacted tool choice with the focal children.

Ways to write were acted on by the focal children depending on the software they used; however, this way to write allowed the learners to juxtapose text in new ways and intertextually link novels within the same document. Learners utilized the tools of Pagemill (Adobe, 1997) to include reviews of the author's novel or to link to them through the web as a way to write. Linking text indicated that writing was a malleable thing and others' writing was at their fingertips to incorporate into their own (Perkins, 1985). Eagleton (1999) observed a similar shift in the inclusion of others' writing and called into question ideas of intellectual property and copyright, while students found it acceptable and defined it as a way to write. Intertextual linking with hypermedia was a natural way to write for the focal children because much of the linear writing that had been done in the classroom focused on intertextuality across the curriculum (Hartman, 1994). The class discussions of books were extended through the use of hypermedia to promote inquiry and writing as a tool to think. Extended discussion through writing encouraged learners to construct new meanings as discovered through the writing process (Hartman & Allison, 1996).

Additional ways to write that were significant in the study included the use of music to extend the reader's understanding of the linear text. Learners made intertextual links between the lyrics in songs and drew parallels from the lyrics to form relationships with characters in the novels they had read. "Just the Two of Us" (Smith, 1998, track 1), a song about a boy and his dad, was used to express the relationship between characters in the authoring project. The characters were not father and son, but their relationship was structured in this way. The focal children used the song to describe the type of relationship the characters had in the novel. This was a unique juxtaposing of linear text, lyric text, and music that allowed readers to understand the dyad's meaning construction. The dialogic use of text expanded the children's intertextual understanding of the novel and created connections between Lowry's (1991) book and the children's cultural world. The use of music to extend meaning construction was found to enhance the linear writing of student authored multimedia projects in a study done by Kinzer and Leu (1997). They also found that music selected by the students was used as a vehicle for discussing setting and other elements of mood as reflected by the music chosen.

Literate people, according to the focal children, can no longer simply read and write to be considered literate. Literate people must also create and mean with digital tools. Wells (1997) explains that learners now find themselves between convention and invention. They must learn to write with all the linear conventions that are part of our language, but now they must also utilize invention as a way to mean. "Furthermore, both reader and writer, a literate person is

expected to be able to use texts as tools for participating in both personal and collaborative knowledge construction and the development of understanding" (p. 107). The focal children's perceptions suggested ways to write with both convention and invention by the ways they described the three types of writing conventions they used when they authored with hypermedia. Linear conventions were used to clarify text, non-linear conventions were used to also clarify texts; however, these texts were different in structure, and tools were classified as a convention for non-linear writing that helped learners mean.

Collaboration and Talk: The Heart of Hypermedia Authoring

Language Discourse, Text, and the Mediating Experience

"Literacy is situated in a theory of language and language is a dynamic social activity that serves people's purposes" (Barton, 1994, p. 54). Language is made up of many different types and these types of language are referred to as discourses. Discourses are the basis of written language and the texts produced mediate people's experiences. These different types of text are grouped into genres each of which has its own unique conventions to differentiate it from the others. According to Halliday (1985) it is important to view conventions of written language as flexible and dynamic. If conventions are taught as static forms of written language, then learners will risk being limited in their use of discourses. Written language is a way to structure knowledge and relationships. The discourse community is an essential component for creating texts. This community has practices, values, purposes, and interests in common and the

relationship forms the basis for creating texts that mediate the individual's experiences (Gee, 1990).

Language and all of the different discourses form texts. Barton (1994) suggested that in order to understand literacy one has to become involved in studying both texts and the practices surrounding the texts. The practices which surrounded the generation of the texts written by the focal children grew from their talk and collaborative writing.

Talk as the Zone of Proximal Development

The data suggested that talk and collaboration were the necessary ingredients for successful writing engagement according to the children. Access to experts and other writers for ideas were cited benefits from talk and collaboration. Allison hinted, in her statement of collaboration, that the learning was not about the actual text, but about the talk that took place. The talk the dyads engaged in became their text for the projects and often revisions of text took place during the prewriting talk sessions. Further revision of their writing was afforded by the dialogue the dyads and the entire class engaged in while the dyads presented the projects to the class.

The use of talk and collaboration to learn were theoretically supported by sociocultural learning theory (Wertsch, 1991). The children in the study learned from talk and collaboration and clearly understood that talk was the mediating factor in helping them create, revise, and extend their texts. Collaboration and talk provided a zone of proximal development for the learners as they moved through the writing process while trying to incorporate the layered writing, new

conventions and tools (Vygotsky, 1978). The hypermedia tool afforded them the opportunity to balance their learning between oral and written language. Wells and Chang-Wells (1992) would concur that the children used the language events in the classroom and computer lab as a way to enhance their literate thinking as opposed to forming a dichotomy between written and oral language. This dichotomy between oral and written language is sometimes formed as classrooms emphasize spoken language for its own sake rather than combing the two processes of language, written and oral (Wells & Chang-Wells, 1992).

Critical Collaboration

Collaboration in this study, not only involved much talk, but also critical aspects of literate thinking that positioned the learners to think about social themes that were embedded within the novels that they read. Through critical collaboration the learners designed their web sites around issues of conformity, hatred, racism, social injustice, and freedom. The intertextual links of the three novels and the critical collaboration yielded the fruition of these topics into web sites. Intertextuality support with response journals helped to scaffold the prewriting process, and the talk and collaboration yielded new learning acted out through the use of hypermedia (Lapp, Flood, Fisher, & Wilcox, 1999; Lemke, 1998). Similar types of new learning with regard to social issues were constructed through critical collaboration and technology as learners in the Orillas and I*EARN projects used global learning networks to collaborate and share new learning as a way to extend cultural knowledge and reduce intolerance of differences (Cummins & Sayers, 1997). Learners in the global networks and

learners in this study both utilized literate thinking as a catalyst to raise social consciousness toward issues of repression. The web sites also served as new genres to author within and learners drew from the cultural artifacts others had written on the World Wide Web to scaffold this new writing genre they were engaged with. They captured graphics, text and animations to use in their sites as artifacts to scaffold their genre development (Kamberelis & Bovino, 1999).

Written Language Growth Re-birthed: Hypermedia Authoring

The hypermedia projects that the dyads authored took much more time than the classroom teacher had anticipated, because there was much new learning that took place. Some of the new learning involved the mechanics of each of the digital tools used; however, this was only a small piece of the literacy process. Much of the new learning was not revealed until after the projects were completed. Questions were raised by the teacher as to the amount of authoring the learners completed and why they had not written more linear text. The two projects were conceptualized as reader-responses and the new learning task cited by the teacher was the software packages utilized. Answers were suggested in the data regarding their perceptions of their literacy growth as they authored with the hypermedia.

The hypermedia authoring was a symbol weaving process with multiple types of text (Dyson, 1990). The focal children engaged in the uses of writing conventions and also inventions (Wells, 1997). The data suggested that there was much understanding, from the children's perceptions, that non-linear writing differed greatly from linear writing. The data came from the interviews and the

semiotic analysis of the artifacts. The learners compensated for the differences between linear and non-linear text through their use of invention. The invention was the distinction they made between non-linear writing conventions and convention tools to mean with. The invention also included artifacts collected from the web to support their new learning and writing within the non-linear genre. Differences between the two types of writing were expressed in their understanding of how they had grown as a literate person and the larger perceptions from the children revealed that they were learning how to write from a developmental perspective with non-linear text. The children expressed that they were competent writers in a linear sense; however, six of the eight children stated that the authoring projects were their initial experiences with hypermedia. The six children that acknowledged novice status regarding non-linear authoring may have been saying that they were literate and they were working on increasing their non-linear literacy skills.

Written language development was tied to Labbo's (1996) study of kindergarten children who authored with hypermedia. The kindergarten children's emerging concepts about literacy were reinforced by the use of electronic symbol making. They relied on their knowledge of what text was suppose to be in a linear sense and translated this into their writing on the computer. Like the dyads in this study, the kindergarten children were experiencing learning to write while also learning the hypermedia tool. The focal children already had a vast knowledge of written language processes; however, they engaged in developmental writing because the non-linear writing processes

were new and unfamiliar. Evidence for this was noted in the ways the dyads described how they had grown as a writer while authoring with hypermedia tools. A majority of the ways they described growth dealt with non-linear conventions and tools and few touched on learning new written language processes in a linear format.

Written language development was described by Dyson as a "social tool which all children encounter as the same basic encoding system, but they experience different degrees and kinds of discourse functions and forms" (1994, p.301). Dyson further stated that as children learn to write the emphasis on writing as a social tool increases because there are differences in the specific writing behaviors they display. These differences are due to the child's culture and thus writing is the social tool that exhibits these differences. Writing development can not be viewed as a linear process, but more as a recursive process that the learner hones to better understand how text scaffolds and mediates thinking. Print and texts, with reference to this study, were objects for the children to manipulate and explore similar to the way young learners use drawings when they begin to explore their written language development (Vygotsky, 1978).

Dyson (1994) noted five recursive processes that children used as they navigated written language development: establishing equivalences, orchestrating the system, shifting relationships of form and function, integrating symbolic functions, and participating in social dialogue. These processes were evident in the ways the children described how they had grown as literate people while authoring with the hypermedia. However, even though the five processes were

rooted in a similar way, as described by Dyson (1994), they were different because the written texts of the dyads encompassed more types of text. Consequently, these developmental, recursive writing processes were re-framed by the children to reflect their new written language growth with non-linear text. Evidence for this came from the semiotic coding of artifacts and also from the descriptions of growth suggested by the children's perceptions as they authored with hypermedia. Further evidence for re-engaging with writing development was present in the research done with Email discussion groups and link authoring (Leu, 1996; McKeon, 1999; McKillop, 1996; Tierney, Kieffer, Whalin, Desai, Moss, Harris, & Hopper, 1998). These studies suggested that new writing processes were at work as children engaged with digital tools to author and writing development emerged as children learned through and with the tools.

The recursive writing development process was described and linked to Dyson's (1994) notions of writing development; however, it was embedded in the interactive paradigm of learning and focused on non-linear authoring. Further, the examples cited within it were drawn from the children's perceptions of their literacy growth as they authored with hypermedia. The following described the ways the children reframed recursive, developmental writing processes.

Links Between Known and Unknown: Linear and Non-linear Writing

The children created a bridge from what they knew about linear authoring to new ideas presented in non-linear writing. The convention and invention process led them to learn to use the non-linear conventions and tools to expand their possibilities for thinking to architecture a space. The achitechtured space became

an artifact for demonstrating that the dyads did connect the known to unknown in their writing. An example of this was the use of text paragraphs and the linear conventions employed along with non-linear conventions and tools that transformed words within the paragraphs into buttons that contained further audio text. Learners made a link between the two kinds of text in how they combined and layered them.

Learning to layer text and link texts to make meaning was something they understood as they participated in reader-response (Rosenblatt, 1978) as part of their literacy curriculum. Intertextuality was employed as a heuristic device to understand the novels they read in the classroom, consequently, the children used these processes as part of the link between the known and unknown (Beach, Appleman, & Dorsey, 1994). These links between linear and non-linear authoring were further created based on theoretical notions of cognitive flexibility theory (Spiro, Coulson, Feltovich, & Anderson, 1994). The hypertext presented the learners with an ill-structured domain to author within and the playing stages of their authoring were supported in trying out ways to write. This tinkering with hypertext in flexible ways encouraged the learners to author until multiple ways to mean were layered into the artifacts.

Navigating Windows with the Non-Linear Writing Process

Multiple ways to mean with hypermedia had cognitive flexibility theory (Sprio et al., 1994) as an underpinning and also learners engaged in the flexibility of the learning through a second-order fingertip effect (Perkins, 1985). The fingertip effect afforded the learners tools that, not only made their literacy learning more

accessible, but also afforded them tools that mediated their thinking. The second-order effect transformed how the learners thought about the topic and afforded them spin-off learning into other areas (Perkins, 1985). Bryan and Taylor demonstrated this while writing their web pages that dealt with the topic of choices. As they authored and selected graphics to represent choices characters had made in the novels, they concluded in the interviews that they had never thought about choices as representing both good and evil. The text and graphic text represented a new way to think about the social issues of choices. Text included written statements regarding how choice was bad in the culture of the characters from the book and the dyad juxtaposed this notion with a picture of the war in Kosovo. The tool provided a type of spin-off learning, which proved to be critical in nature and connected to other genres.

Dyson (1994) refers to this type of exploration as idiosyncratic and flexible. Children freely explore and gain comfort and familiarity with the text structure, content and function. They learn to navigate multiple windows that engage them through dialogue and experimentation that sometimes proves to be messy in nature (Vygotsky, 1978).

Toggling Between Sign Systems to Learn and Make Meaning

Children begin to understand the use of new media and approach learning from the perspective of previous encounters (Barton, 1994; Halliday, 1977). This was evident as a child placed a warning label on his project warning readers to page through the document as instructed in a linear fashion and not to stray. This child learned to mean in one way from what he understood regarding concepts of linear

text, but later shifted his understanding as he gained proficiency in using Pagemill (Adobe, 1997). Learning to mean initially for this child was focused on a linear format of text that had a distinct beginning, middle and end with regard to story structure and may have included some pictures. The sign systems used to turn pages, icons, took on a different meaning as multiple icons and choices were added to his web page. He came to realize, as an author, he had little control over how readers would navigate the text. The learning that took place in this anecdote resulted from collaborative discussions and participation in the literacy event as the child presented his project and others evaluated it. The literacy event was formed in the ways he explained project one, with the warning, and then project two that included multiple paths for readers with icons (Luria, 1983).

Semiotic sign systems were also used by all the dyads to construct meaning. The children wove their written texts in the ways they selected sign systems to mean. Halliday (1994) described this as the dialogic construction of meaning. Learners used the sign systems available through the digital tools to take something known and tell it in new ways. Semiotically, an experience was construed by the learner and when others came in contact with the shared experience they shared in the construing. The meaning was "created by the impact between a material phenomenon and the shared processes of consciousness of those who participated in it" (Halliday, 1994, p. 75).
The toggling between sign systems was evident from the semiotic coding framework used to understand the artifacts from the study. The signs used indicated that the learners were aware that different kinds of audiences might

encounter their writing, so dyads anticipated this through their use of multiple signs. The four ways to categorize their sign systems indicated patterns that were repeated across both projects. This suggested that the sign systems used by the learners constructed a code, organized the writing through the sign structure, suggested choice, and related contrasts to convey a larger picture of the overall meaning construction. This use of signs was prevalent for all four groups.

Conversation within the Non-linear Writing Process

The children in this study created a layered writing rubric that served as an evaluation for their projects. The rubric was suggested by the children to fulfill their need to have some closure to the projects. The need for closure issue was embedded in their notions of doing school (Allington & Cunningham, 1995). The school context had engrained in them that evaluation was a means of closure. This was the standard operating procedure within their school paradigm. The rubric evolved from class discussions that focused on evaluation. Items selected for the rubric were split between linear and non-linear elements of writing. The rubric did not lead to changed writing behaviors; however, the dialogue that surrounded the creation of the rubric influenced some students to revise their writing before the evaluation and after they received the class input. The children revised their writing ways to meet the newly perceived demands of the rubric. Interaction with the class to create the rubric set up a relationship between the text written and the social demands of the group. More expert techies acted to apprentice the class in designing the rubric to include the non-linear elements. The perception that good techies were also good writers influenced the discussion,

the rubric, and class perceptions regarding the role of those children who were the techies in the class.

Symbols and Social Relationships

The perceptions of the social relationships between the dyads were influenced through the sophisticated ways some learners navigated the use of hypermedia. High regard was held for those who could manage sign systems that were very technical. Sean held this level of status within the class and other learners cited him as the techie of the class. Sign systems used by the children served multiple purposes: they represented the writer's understanding, the signs evaluated the existing cultural milieu, and created social relationships in the classroom. Clearly, the reason the children limited the breadth of their writing may have been because of all they were trying to socially and cognitively manage layered with learning new ways to write. Many more events were taking place during these authoring sessions than simply reader-response activities and weekly computer time.

Implications of These Perceptions

This study, as stated before, was exploratory in nature and not conclusive. The perceptions of expert writer as technology expert and non-linear writing conventions and tools suggested some understanding of children's literacy perceptions as they authored with hypermedia. The perceptions of authoring through developmental writing processes along with the use of semiotic systems and multiple ways to write provided insight into the children's perceptions of their literacy development as they authored with hypermedia. In understanding

children's perceptions of literacy and technology as a tool, greater understanding for constructing pedagogy and curriculum may take place through new literacy research. Lastly, the study raised many new questions that implied that research in the field of literacy and technology education is at an exciting crossroads to gain a greater understanding for how technology as a tool mediates literate thinking.

The children in this study gave some insight into how early literacy learning played a part in learning to write in new ways with regard to writing conventions and tools. The children reflected on how the linear and non-linear writing processes differed; however, they were already fluent writers within the realms of linear writing. They understood a great deal about linear writing and based their perceptions on this knowledge. This idea leads to an interesting question in considering new research related to this study, in that, what are early literacy learners' perceptions of linear and non-linear writing as both processes are emerging. How might these emerging processes interact with each other? And how do young emergent writers perceive their literacy learning growth while authoring with both linear and nonlinear text? The writing continuum for these young learners might include nonlinear dictation and text free web sites that could utilize many sign systems. These questions could form the basis of new research with emergent literacy learners to gain a greater understanding of how linear and nonlinear writing conventions may differ as defined by children.

The children's changing definitions of literacy with regard to technology provide some troubling data related to their perceptions of what they think literate people and good writers need to know. According to the children in this study

acting as "techies" implied that one was a good writer. This notion suggests that the children see the changing definitions of literacy as possibly phasing out traditional writing skills with regard to linear text. It is also troubling in terms of access to technology and those most likely to have access. Those who do not have access to technology will continue to be less literate than those that do have access to technology. This may be a troubling implication for children in low socio-economic status (SES) families and especially for girls.

The changing definitions of literacy related to technology access and especially female children's access is an important question to consider given national goals to improve literacy for less privileged groups. New questions related to this research might consider low SES females and exploration of how they use technology to define themselves as literate people. And also, what are schools doing to promote access to technology and increase the technology fluency and literacy of female students. Is this even an issue for school districts?

The research questions related to new literacy and technology definitions and female access to technology may provide some interesting information to enhance the literacy perceptions' findings.

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APPENDIX

Appendix A

Date:

To: The Parent/Guardian of:

From: Sandra Goetze

Re: Participation in Research

I am a doctoral student at the University of Oklahoma, and I am interested in learning about how children write when they use computers. I have been given permission by the school district and by Principal Dottie Caldwell to conduct research about how children write with hypertext in Mrs. Carol Ochs' classroom at Jackson Elementary School. Over the next few months I will observe and talk to a few of the children about learning to write with hypertext at school. I will also make copies of some of their writing. When I speak with the children about their writing it will take no longer than 10-15 minutes and it will be done outside of direct instruction time.

Your child has been selected to participate in the study. I am asking for your permission and your child's permission to include him or her in the study. A formal consent form is enclosed that explains the research in more detail. Please sign the form and return the signed portion of the form to your child's teacher if you agree to his or her participation. Please return the form by_____, so that I can proceed with the research.

If you have any questions at any time about the study, please call me at 325-1498 (OU) or 737-8269 (home). You may also call the Office of Research Administration at 325-4745 as a contact for questions regarding the rights of research participants. Thank you for your cooperation. I look forward to talking to your child about learning to write with hypertext.

Sandra Goetze
Department of Instructional Leadership & Academic Curriculum
University of Oklahoma

UNIVERSITY OF OKLAHOMA
INFORMED CONSENT FORM

The research described below is being conducted under the auspices of the University of Oklahoma, Norman Campus. This document is a formal request for permission from you to have your child participate as a volunteer in the study described below.

Title of Study: Children's Perceptions of Authoring With Hypertext

Investigator: Sandra K. Goetze, Doctoral Candidate
Department of Instructional Leadership and Academic Curriculum
College of Education
University of Oklahoma
Phone: 325-1498

Faculty Advisor: Bonnie Konopak, Ph.D.
Chair and Professor, Literacy Education
Department of Instructional Leadership and Academic Curriculum
College of Education
University of Oklahoma
Phone: 325-1498

The investigator is a doctoral student at the University of Oklahoma who is studying literacy and technology education in the Department of Instructional Leadership and Academic Curriculum. Her research interest centers on children's perceptions of their own writing development as they author with hypertext. The purpose of the present study is to investigate children's perceptions regarding the authoring process as they write with hypertext and how those perceptions are influenced by using the computer medium.

Your child has been selected to participate in the study. One or two days a week, as a part of the time he or she spends in the school computer lab, the investigator will observe the children and take notes about their writing activities. The researcher will sometimes talk to the children about their writing activities they are participating in as part of the instruction in their classroom. For example, if a child is writing in hypertext a response to a novel that has been read in class, the researcher might ask questions such as, "How is this type of writing different from traditional paper/pencil writing?" or "How do graphics, animations, buttons or bars help you to convey meaning in your writing?" Conversations will only occur when they will not disrupt normal classroom instruction. Copies of their written work will be saved on a disk and or printed. The children will also participate in four interviews with the

investigator as part of the writing workshop that their teacher conducts in class. The interviews will be about the children's perceptions of their writing as they author in hypertext, and will last no more than the small group time designated by teacher as part of their regular instruction. The interviews will take place in the classroom as part of the regular small group writing talks the teacher has them participate in. Children will not miss any regular instruction during this time if participating in this study. Children's participation in the study is expected to be completed by April 15, 1999.

The results of all interviews and observations will be kept confidential. They will not be used in evaluating the child's learning. Only the investigator and the faculty advisor will have access to the identifying data. Pseudonyms will be used in all reports of the research, and all publications resulting from the study will be carefully worded to avoid identification of the participants.

Since data collection involves only normal classroom practices, there should be no potential risk to the children. Potential benefits include an increased understanding of the writing process and computer fluency.

If you choose for your child to participate in the study, please sign and return this form. If you choose to decline, there will be no penalty for your child. Furthermore, if you choose to participate, you or your child can refuse to answer any question at any time, or can totally withdraw from the study at any time without any penalty.

This is to certify that I, _____
(print full name)
hereby give permission to have my child or legal ward,

_____
(print child's full name)

to participate in a study of children's perceptions of authoring with hypertext at school as part of an authorized research program of the University of Oklahoma under the supervision of Sandra K. Goetze, doctoral student. I understand that my child or ward can refuse to answer any question at any time or can totally withdraw from the study without any problem.

_____ _____
Date Parent/Guardian Signature

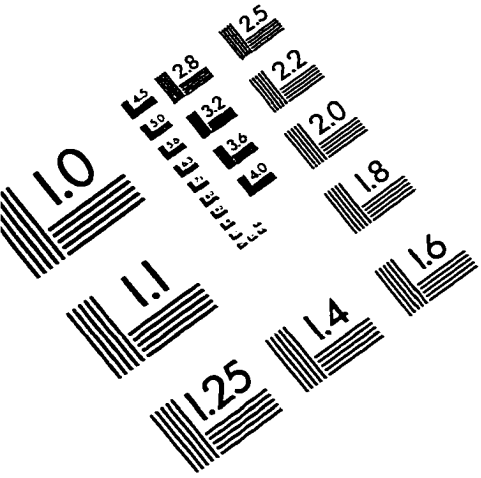
Child's Informed Consent

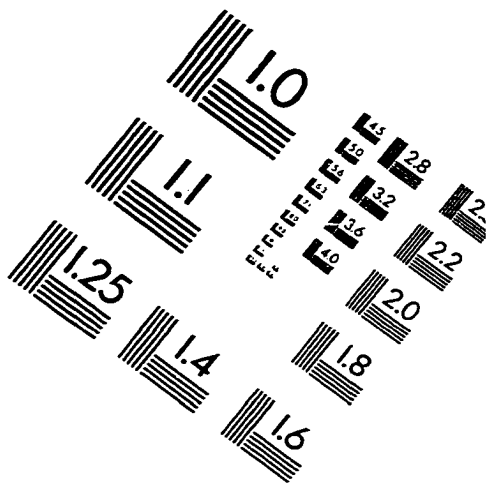
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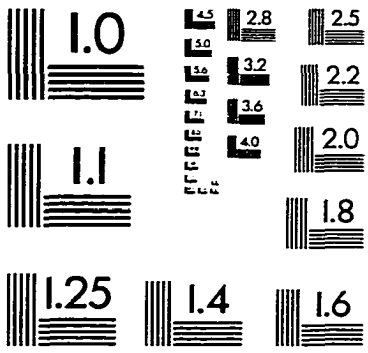
It is all right with me if Mrs. Goetze talks to me about my writing. I am also aware that I may drop out of the study at any time or choose not to answer any questions. I also understand that choosing not to participate will in no way harm me or my grades.

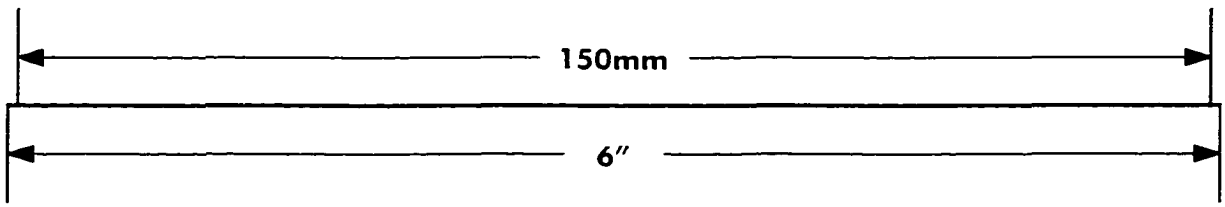
Participant's signature

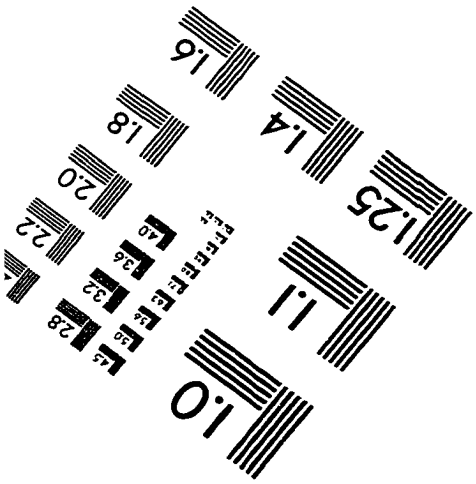
IMAGE EVALUATION
TEST TARGET (QA-3)

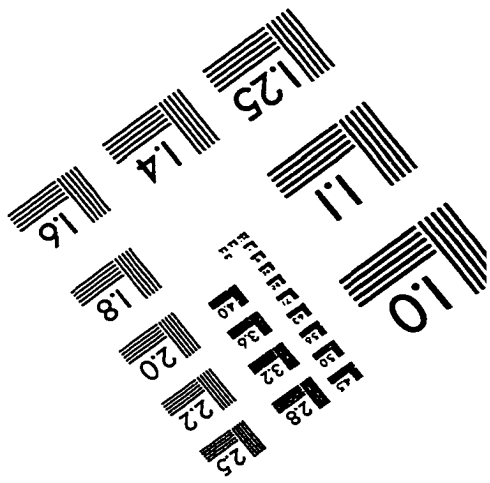












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