LITERACY AND THE INTERNET:
A BLUEPRINT FOR PREDICTING HYPERTEXT COMPREHENSIBILITY

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Literacy and the Internet: A Blueprint for Predicting Hypertext Comprehensibility

BY

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A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree of Doctor of Philosophy

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ABSTRACT

The purpose of this study was to develop a blueprint to guide educators in the selection of World Wide Web resources that would take into account the special nature of hypertext. A new approach to web site comprehensibility was sought because, typically, web site usability: (1) implicates only expert adult users; (2) fails to include the terminology that represents the special nature of hypertext; (3) overlooks visual literacy and navigation factors unique to hypertext; and (4) ignores pedagogical goals.

There were two phases to the study. In phase one, a review of the literature was conducted to identify factors that influence text processing. Based on this analysis, a conceptual model pertaining to both hypertext processing and a social-constructivist view of teaching and learning was created (Bolter, 1999; Foltz, 1996; Lanham, 2000).

The next phase of the study was to test and validate the model by designing a representative grade ten Language Arts topic using twenty *Romeo and Juliet* web sites selected through the use of a search engine. Then, a group of five curriculum specialists independently sorted the web sites from best to worst and defended their rankings. Next, twenty-five high school English Language Arts teachers with varied technological abilities but experience teaching *Romeo and Juliet*, examined the selected web sites. As a final check, the investigator also analyzed the web sites. Last, the responses of the experts, teachers, and the investigator were used to revise and validate the blueprint for teachers to use on their own and with students to evaluate the usability of web site resources.

Results suggested that there are differences in teachers' expectations of hypertext readers across grade levels, that the purpose for using a web site influences whether

visual language is privileged over alphabetic text, and that more teacher-to-student dialogue about web sites is required. A preliminary grammar for processing hypertext was delineated. The blueprint could be used as an instructional aid for evaluating the usability of hypertext selections. Further research to determine processing differences required in reading hypertext, using the blueprint at other grade levels with other topics, is recommended.

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Prologue

> "It is the first recorded sighting of the legendary monster outside the Scottish Highlands" (The *Gazette*, Montreal, June 12, 1999, p. A20).

I was reading the *Montreal Gazette* on a flight home from a national research conference when this newspaper headline caught my eye. Apparently a husband and wife from Texas spotted the Loch Ness Monster on the web site *www.lochness.scotland.net.* Cameras are strategically set up to view the real Loch Ness twenty-four hours a day, and the Loch can be viewed from many angles. Seeing that a vacation in Scotland was my self-imposed reward for finishing my Ph.D., and that I had hoped to take my own face-to-face look at *Nessie*, I was not quite certain how to react. The web site story was exciting, but the extraordinary way that the sighting took place somehow shifted my personal vision of seeing the monster from the real shores of Loch Ness. From my perspective, this newly found ability to see the Loch Ness monster virtually both shocked and shifted a paradigm for me.

And so it is with Internet technology. There are many ways of looking at the same idea where virtual reality augments our perception outside the screen. Multiple perspectives appear to be the law in the land of technology. Likewise, educators have been using the Internet, but not from a social constructivist point of view.

Educators must develop their own perspectives on the relationship between Internet materials and literacy. In the long run, being a mere consumer of web sites is not sufficient, especially if educators hold no agency in the process of determining consumption, only the freedom to do so.

Literacy on the Internet has also been its own elusive monster, involving multiple perspectives, expanded notions of what literacy entails, and the adventure surmised by a "through the looking glass" fantasy land that can only be read one web page at a time. Literacy development using the Internet perhaps remains motivational to users, in part because it is a path less traveled that still engenders mystery and discovery. The mysteries behind learning to read and reading to learn using the Internet are my motivation for having chosen to research this topic.

CHAPTER I

Nature of the Study

This chapter provides the context that underlies the problem of predicting hypertext comprehensibility. Issues discussed include the call for research in the area of literacy and the Internet and the need for the study. Next, web site evaluation, the research agenda, and the research problem are explained. An overview of the study follows. The chapter concludes with a list of definitions.

The study of literacy and the Internet currently revolves around the idea of multiple literacies and the notion that expanded literacy skills are required to process and comprehend hypertext (Bolter, 1999; Reinking, 1998). Though technological and literary theorists have written about this issue since the beginning of computer use, only recently has the need to study technology and literacy together become evident as an issue at the forefront of research agendas in education.

In a comprehensive review of technology, literacy, and research, Kamil and Lane (1998) state: "[W] hat is clearly missing from the literature is a systematic analysis of the relation between reading hypertext and reading conventional text . . . Clearly, nothing in any of the current literacy curricula prepares students for this sort of reading, which requires navigational strategies not needed in reading conventional printed text" (p. 333). Furthermore, many studies report on the cognitive processes that students use in computer environments, but few reports have focused on the metacognitive processes needed to negotiate hypertext, particularly on the Internet (Kamil & Lane, 1998; McKenna, 1998; Snyder, 1996).

The Internet, which is mainly comprised of hypertext, has been identified as a tool for enhancing student literacy, yet, in many classrooms, educators are at odds with this new literacy environment. The problems educators encounter range from technophobia (fear of technology) described by Brosnan (1998), to unclear curricular goals once schools are connected to the Internet (Trilling & Hood, 1999). There is an urgent need to articulate a pedagogy and a grammar for literacy as it is applied in computer environments (McKenna, 1998; Reinking, 1997; Snyder, 1999). Important agendas for literacy and technology are (a) how literacy is expanded through hypertext reading, (b) how Internet resources mesh with the educational objectives of the classroom, and (c) how the Internet can be more effectively used in the development of literacy competence.

Background and Context

Electronic text on the World Wide Web has expanded the concept of literacy beyond conventional printed text. Visual literacy, media literacy, and computer literacy have been added to the list of literacies that contribute to language comprehensibility. Although the idea of expanded literacy seems novel because the respective elements can appear in combination on a web page, the concept of language comprehensibility beyond alphabetic text is not innovative. Language comprehensibility has been an ongoing concern from the beginning of organized civilization to the present (Zakaluk & Samuels, 1996). Predicting language comprehensibility has been an important aspect of language use that has historically included the study of oral, written, and visual language, although the importance of each has been different through the ages.

Today, a wide range of professions demand better clarity and precision from oral speech, alphabetic text, and visuals in order to reach their audiences. Political and religious leaders enlist the help of focus groups and language analysts to determine the strength of their messages for the masses. Publishers regard text comprehensibility as crucial to marketing, and librarians use readability to select books suitable for their clientele. Statisticians carefully select the visual representation of their data. Advertisers also depend upon visual representation to capture consumer attention. The very survival of a message can depend on the strength of its comprehensibility. The need for more depth when reflecting upon language comprehensibility thus seems ever more apparent since today the tools of language have greater breadth.

Educators have also valued language comprehensibility, but mainly in the area of alphabetic text. Educators' main focus has been the readability of written text since books have traditionally been the main vehicle used in the transmission of knowledge. Educators value readability indicators because the grade level equivalents help them match the difficulty of a text with the reading ability of their students. Learning is facilitated through this match. Control over materials also helps educators to be more accountable and provides a basis for managing information sources.

Until the present, the focus on text comprehensibility and the impact of comprehensibility research have largely remained in the domain of alphabetic text. Other forms of literacy have been viewed as secondary. Although speech arts, visual literacy, and media literacy have been valued and do appear in English Language Arts curricula, their adoption has been slow. Pungente (1996) states that classroom texts about media literacy were not even available in Canada until 1988. In addition, television and artistic

representations have been viewed as more passive learning vehicles than books and have been largely ignored in educational settings, probably because they were not viewed as rigorous learning medias (Debes & Williams, 1978; Sinatra, 1980). Public perceptions of television as an "idiot box" and art education as a "frill" also separated literacy learning from media studies. As schools respond academically and fiscally to public concerns, there has been no educational focus on the study of media, culture, or semiotics until recently.

In 1991, when the World Wide Web was invented, the focus of language comprehensibility shifted because writers could then combine sound, text, visuals, and interactivity in a media that schools could accept. In schools, reading and writing to learn through textbooks shifted, in part, to learning through connections to the World Wide Web. Students across the nation began pursuing information through computer use. Although experts agree that the nature of text has changed in dramatic ways, text comprehensibility in the new literacy is difficult to predict because additional elements such as visuals and interactivity influence how text is read and understood.

As Internet use became more common in educational settings and the workplace, interest in research on web site comprehensibility, usability, and readability has dramatically increased, especially since 1994 when major amounts of educational funding were diverted to support online technology use. The larger the number of users, the more important this type of research becomes, as Jakob Nielsen (2000c), a leading expert on web usability, suggests:

> In the early years, the Web was accessed only by very intelligent people who were early adopters of advanced

> technology. But as the Web becomes a more mainstream medium, it will get more average users and also users of below-average intelligence. To accommodate such users, it will be important to increase usability to make sure that content is comprehensible at a grade-school reading level (p. 309).

Although Nielsen's statement may be less politically correct than desired, it points to problems with using the Web as an instructional resource for students. Educators have yet to determine the usability of web site hypertext for school-aged children, many of whom are not mature readers. The skills necessary to enhance learning in hypertextual environments have not yet been determined. To address these problems, Chapter II conducts a comprehensive review of the literature on hypertext and how hypertext changes traditional notions about literacy and literacy instruction. An outcome of this study was the development of a conceptual framework for predicting the usability of hypertext materials for school-aged children in the new media of the World Wide Web.

Purpose

The purpose of this study was to develop guidelines for reading hypertext on the Internet by reviewing the literature on hypertext, analyzing the characteristics of electronic text, and systematizing how teachers could predict the comprehensibility of electronic text for their students. The study focused on: (1) comparing and contrasting traditional readability predictors with possible hypertext predictors found in a review of the literature, (2) synthesizing the results into a blueprint of hypertext predictors, and (3)

validating the resultant blueprint for use in determining the comprehensibility of Internet materials to support a typical English Language Arts topic.

A primary professional responsibility for educators is to take a scholarly stance on the appropriateness of the materials that students encounter on the Internet, yet there are limitations in regard to how this might be realized. For example, little research has dealt with how students read hypertext on the Internet, and there is a lack of research that compares and contrasts reading conventional text with reading hypertext (Kamil & Lane, 1998). Some research indicates that computer graphics may inhibit reading comprehension (Gillingham, 1993); other research shows that although students can use a computer, technological expertise alone does not ensure literacy (Bangert & Drowns, 1999). The most disturbing of all is that the precious hours spent teaching reading may be eroded by sending students off to surf the Internet without regard for the cognitive demands and educational value of the exercise (Smith, 1999b). The pressure to go online can outweigh the educational value of the activity if educators are not informed. Furthermore, educators have been praised for their use of technology without regard for the educational value that underlies the technology-based activities.

Another reason for devising a system for analyzing the differences between reading linear text and reading hypertext, particularly on the Internet, is the growing interest in online learning. Many courses and educational centers have sprung up around the world offering everything from resume writing to university degrees. Although there is a body of research dealing with hypertext on CD-ROMS that has developed over the past twenty years (Lehner, 1993), there is a dearth of research about hypertext online

(Bolter, 1998; Kamil & Lane, 1998). This phenomenon is due in part to the newness of widespread Internet use in schools.

The New Literacy

Further to this, theorists have had to rethink the definition of literacy because hypertext involves more than alphabetic text. Hypertext on the Internet has been described as a splintered literacy because multiple literacies are involved. While there is no guarantee that a unity of literacies might be unearthed as a result of a comparison between the features of linear and hypertexts, it may be speculated that what is already known about reading linear text and hypertext can inform the selection of resources for classroom use. For instance, there is no apparent reason to believe that the alphabet will suddenly go out of fashion due to the presence of the Internet. In fact, part of the reason for the support of Internet use as a learning tool in schools, as opposed to television, may be due to the overwhelming use of alphabetic text. Using the computer to facilitate learning also fuels this view. The image projected when students work with computers connotes the appearance of rigorous, on-task behaviour compared to the image of students watching educational television. Cultural conditioning privileges computers as an educational tool over television since computer work is viewed as real work and television viewing is seen as entertainment. The Internet could be considered education's answer to integrating media into the educational setting.

What we currently know about literacy may inform an analysis of hypertext. For example, computer programmers have relied on readability predictors to inform their decisions about hypertext design for several decades (Kincaid, Aagard, & O'Hara, 1980;

Lehner, 1993). Certainly, it is better to make informed decisions about hypertext design based on a body of research rather than buying into the myth that technology will solve all social problems. In this sense, connections to new forms of literacy may be critically appraised as enhancing older structures or declared entirely different for significant reasons. History has shown that old practices seldom disappear; they merely take a different position within the cultural setting. For instance, radio has not disappeared with the advent of television, but radio's importance as the main media has been diminished. Likewise, calligraphy did not disappear with the advent of print, but has become a form of art for rare books. Also, books themselves have not disappeared with the advent of the computer. However, like radio and calligraphy, the status of text may change over time, influenced by the use of computers and the cultural context.

What we already know about literacy and learning also speaks to the issue of how a model of hypertext predictability can be constructed. Traditional readability criteria, for example, can be applied to assess the comprehensibility of hypertext on the Internet, just as these readability factors have been used in developing hypertext in general (Kincaid et al, 1980; Lehner, 1993). However, the multi-media or interdisciplinary nature of hypertext also informs us that traditional readability has limitations within hypertext environments, perhaps more so when hypertext appears on the Internet. For example, text on the Internet is often moveable and interactive, and there are conceptual differences between traditional and Internet text (Reinking, 1997; Snyder, 1999). In addition, web writers do not have to edit for space as text writers must and they do not have to edit for time as movie and television producers must. The problem with traditional readability measures is that they do not appear to address the special nature of text that appears on

the Internet. Although no one has of yet tested any form of hypertext readability on the Internet, conventional predictors of text difficulty could be useful in an analysis, though it is unlikely that all of the issues associated with text comprehensibility can be addressed within this study alone.

Web Site Evaluation

While it is clear that traditional readability measures have been used successfully by educators for assessing both traditional, alphabetic, print text and alphabetic hypertext (Lehner, 1993; Zakaluk & Samuels, 1988), traditional text readability ignores visual and navigational elements associated with online hypertext processing. In an exploratory study (Smith, 1999a) that reviewed the current state of web site evaluation, a finding was that web sites are evaluated using various broad concepts that relate specifically to hypertext. Although there are Internet evaluation sites (e.g., Argus Clearing House) available on the Internet itself, it is apparent that these sites do not focus on the same instructional goals as teachers in classrooms. For example, many Internet evaluation sites apply to commercial markets while classroom ratings need to focus on how well content is presented to facilitate learning (Nielsen, 2000).

In a review of criteria used by Internet evaluation sites, Alistair Smith (1997) pointed out that the following checklist items were used: scope, breadth, depth, time, format, content, completeness, sources, accuracy, authority, currency, uniqueness, links, writing, graphic design, purpose, audience, reviews, workability, user friendliness, computer needs, searching, browsability, interactivity, connectivity, and cost. In addition, Smith (1997) determined that nine toolbox criteria were consistently prevalent in web site

evaluation checklists: (1) graphic and multimedia design, (2) browsability and organization, (3) currency, (4) content (in general), (5) authority, (6) uniqueness, (7) audience, (8) workability (in general), and (9) connectivity. These criteria address the macro structure of the web site rather than the processing of text itself and are perhaps too broad and general to be used for estimating the difficulty level of hypertext instructional materials. These criterial lists do not examine the differences among visual, navigational, and textual cueing systems. Instead, they allow the user to evaluate the web site as a resource and generally do not address classroom application. The needs of students of multiple ages with varied abilities and motivation are ignored in favour of expert users alone.

Findings from a preliminary study (Smith 1999a) confirm this view and show that current web site evaluation checklists: (1) do not deal with the way students process hypertext, and (2) ignore student processing needs. While hypertext in CD-ROM programs may be intended to tutor students, CD-ROM hypertext is different from hypertext on the Internet in that the Internet selections are not specifically designed for instruction. Added to this complication is the fact that anyone may publish online. One exploratory study (Smith, 1999a) showed that current web site evaluation instruments are lacking and that there is a need to research hypertext comprehensibility from the perspective of the classroom.

However, other templates for web site evaluation are associated with informational literacy (e.g., Schrock, 2001), and do include critical literacy elements that connect web site evaluation with application in the classroom. Libraries, school divisions, and universities often prepare their own web site checklists (See Appendix G.). These

checklists include categories similar to those described by Alistair Smith (1997). Very few, however, differentiate between grade levels, include critical elements affecting readability as identified by traditional formulas, or provide for self-evaluation (Schrock, 2001). Regard for the unmotivated, unskilled reader is not taken into account. A need remains to uncover how school-aged readers are mobilized to move through hypertext and how they use prior knowledge to construct meaning in multi-literacy environments.

Summary. As suggested, web site evaluation criteria should look quite different from the criteria used for evaluating the readability of conventional printed text. The variety of information, the mobility of the text, and the added flair of the hypermedia environment make Internet readability difficult to measure by the application of a formula. Added to the confusion about differences between web sites is their dynamic nature. Web sites are constantly being revised and upgraded. Moreover, present criteria may show what to look for, but not how that information will be used in an instructional setting (Smith, 1999a). Existing web site evaluations merely demonstrate features of web sites but they do not predict comprehensibility. Despite the failure of web site evaluations to predict user comprehensibility, such checklists do point to important predictors of readability including the way readers engage in the text and the way readers and writers of hypertext understand that engagement. They are insufficient, however, in accounting for how readers construct meaning through interacting with hypertext.

Research Agenda

Mosenthal (1993) suggested that the objectives of reading research could be realized more effectively if three agendas that frame problems and goals are considered.

These agendas are: (1) administrative efficiency, (2) client-satisfaction, and (3) the emancipatory power of education. Administrative efficiency has to do with the way goals are set centrally and the way problems are dealt with from a systems point of view. Client-satisfaction frames problems and goals from an individual's point of view and addresses the needs of the individual within an organization. The emancipatory power of education has to do with the cosmopolitan issue of how education socializes individuals and empowers them to create change and become independent in society. Technology and literacy research could possibly have a broader impact if these agendas were considered. However, research about literacy and technology requires a different kind of lens than that normally used by reading experts because literacy in technology is new territory for researchers (Kamil & Lane, 1998; McKenna, 1999).

Kamil and Lane (1998) state that research must also be integrated into the development of technology in the work place. Without a vision of the future of technological innovation, there is little hope that research conducted today will be valuable or even relevant to the future. For instance, studies carried out on CAI (Computer Assisted Instruction) in the 60's bear little resemblance to CAI instruction in schools today because the growth of Internet use is now factored into the equation (Wresch, 1996). Research constants must be sought or the research will not be relevant to either practice or further research.

Another important consideration for literacy and technology research is the need for researchers to define new and expanded definitions of literacy (Bolter, 1998; McKenna, 1998; Reinking, 1997). Bolter suggests that more emphasis in reading should be placed on the visual text that accompanies conventional text. Computer use, multiple

intelligences (Gardner, 1985), and multiple literacies -- including scientific literacy, computer literacy, and visual literacy -- have expanded the concept of literacy. Researchers also note that computer text is different from book text (McKenna, 1999; Reinking 1997). These altered views about reading and writing skills therefore change the nature of literacy.

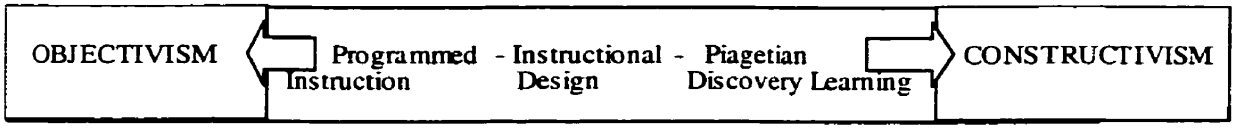
Labbo and Reinking (1999) caution researchers that adopting a singular theory for research within the kaleidoscopic nature of technology and literacy might result in lesser forms of knowledge. They encourage researchers to consider the "breadth of literacy issues affected by new technologies" (p. 479) and to view research in technology as a set of possibilities for literacy rather than a topic within literacy instruction. This study, therefore, was oriented toward constructing a model that could comprehensively make room for the notion of multiple realities, including pedagogical goals.

Accompanying expanded definitions of literacy are concomitant implications for instruction, for example, teaching students new reading and writing forms including the use of e-mail and new ways of editing in hypertextual environments. Garner and Gillingham (1998) found through their research that three major changes occur: first, both the materials and methods in each teacher's repertoire increase, reflection on practice becomes reinvigorated, and there is movement away from a transmission model of instruction to social constructivist pedagogy. The complex interrelationship of literacy pedagogy and the new skills that need to be engendered are central issues in technology and literacy research.

Social constructivism. Jonassen (1991) observes two theoretical poles at work in the educational system. As indicated in Figure 2, he uses a continuum to explain his view.

Figure 2.

Objectivism-Constructivism Continuum from Jonassen



Objectivism-Constructivism Continuum from Jonassen (1991, p. 28)

Objectivism and constructivism form two poles of curriculum instructional design and two separate ways of knowing. Instructional design has most of its underpinnings firmly rooted in objectivism and deals with issues outside the individual learner. The alternative, constructivism, comes from the teachings of Vygotsky (1978) and vonGlaserfield (1977). Constructivism is more concerned with issues about the individual learner. Objectivism and constructivism both make valuable contributions to educational theory, but in the presence of technology there has been too much objectifying of Web knowledge, and too many assumptions that the knowledge for students is out there. A more active information-processing role for teachers would facilitate better reading and thus better learning in the presence of technology.

Lev Vygotsky (1978) asserted that students learn through socially meaningful interactions. Vygotsky thought that students learn best when they interact with adults and collaborate with other students. A student's "zone of proximal development" (Vygotsky, 1978) is the range of tasks that a student can perform with guidance from others but cannot yet perform independently. Students develop schemata for new learning through

assimilation of new knowledge within a social setting. Teachers scaffold classroom learning so classroom interactions are sustained within the zone of proximal development. Students become active participants in learning, relating new knowledge to old through their social interactions. Technology use has a tendency to break the flow of learning in active classrooms especially when students use technology without prior knowledge and without social interaction with their teachers and classmates. A common language sought through discussion of blueprint elements to provide a forum for talking about hypertext could bridge the gap between literacy instruction in the presence of technology.

Exploratory Studies

Two exploratory studies, conducted as a foundation for this study confirm the limitations of current templates to assess hypertext comprehensibility. One study focused on web site readability (Smith, 1999a), and the other related to classroom discourse using the Internet (Smith, 1999b). Although limitations associated with the research prevented generalizing results across grade levels, findings from one of the exploratory studies (Smith, 1999a) showed that most web sites were rated as being at grade nine difficulty or above. Nielsen's (2000c) usability studies also confirmed this general finding. Based on these results, grade ten (Senior II) classrooms appeared to be a logical choice for the focus of the present study because teachers would be using hypertext materials that their students should at least be capable of reading.

The exploratory studies also demonstrated that Internet use is mainly a non-criterion referenced event in schools (Smith, 1999a, 1999b). Educators either: (1)

relinquished the reading of text on the Internet to students, based on the perception that students know more about the Internet than they do, themselves, or (2) perceived that the process of reading on the Internet is self-explanatory and that students will automatically employ intelligent routes to facilitate learning when they go online. More instruction in how to process information from reading hypertext is required.

Statement of the Problem

More and more, the Internet is being used as a teaching tool. It is time to understand this new literacy environment and make web sites integral sources of information to enhance student learning. Although the readability of traditional or alphabetic text is well researched and delineated for teaching purposes, the parameters for estimating the difficulty levels of traditional print material do not apply to the new media. If teachers find value in evaluating the readability of textbooks, then they should equally find value in evaluating the suitability of hypertexts for students. The underlying cognitive processes that prepare readers to meet the navigational demands of reading hypertext must be uncovered since the Internet has "a growing presence in contemporary reading" (Kamil & Lane, 1998, p. 332) across a broad range of readers. Furthermore, researchers in both computer science and education suggest that determining a theoretical and structural basis for reading hypertext is an important mission (Rada, 1993; Ulmer, 1998). New methods must be examined to define the nature of hypertext and these insights must be used as a foundation for predicting appropriate matches between students and materials. The results of this study and those that follow could potentially define the interface between the processing of conventional text and hypertext and

ultimately point the way to refining current literacy models or perhaps re-defining literacy itself.

Hypotheses

In this study it was hypothesized that a set of variables for predicting hypertext comprehensibility could be identified, ranked, and classified and compared to variables required for reading conventional text. Further to this, it was predicted that the factors identified for reading hypertext could expand current notions of literacy. The following questions were addressed:

Questions for Study

- How is literacy different, given the special nature of hypertext?
- What recommendations can be made to teachers regarding the selection and reading of hypertext materials, and what recommendations can be made in order to enhance hypertext reading?
- What elements would contribute to a useful instrument for predicting hypertext comprehensibility?

Overview of the Study

The study took place in two phases. The first phase was to carry out an extensive review of the literature to identify factors that influence hypertext processing and to compile these factors into a conceptual model that contribute to hypertext readability.

Based on this analysis, a set of factors and competencies were synthesized into a hypertext comprehensibility blueprint.

In the next phase, the model was tested and revised using a representative grade ten language arts topic of *Romeo and Juliet* and three groups of participants: curriculum specialists, high school teachers, and the investigator. Twenty *Romeo and Juliet* web sites were randomly selected through the use of a search engine. The group of curriculum specialists, independent of the model, ranked the 20 web sites from best to worst and provided explanations of their ranking. Next, high school teachers who taught *Romeo and Juliet* used the conceptual model to rate elements of hypertext comprehensibility on a Likert scale of 1 to 5. The high school English Language Arts teachers were from a cross-section of technological abilities and economic areas as nominated by department heads, principals, and superintendents. Both curriculum specialist and teacher responses were used to revise and validate the predictors required to read hypertext. As a counter check, the investigator also rated the 20 web sites using the criteria in the conceptual model.

Scope of the Study

The scope of this study is focused on Web hypertext and how it is used in school as a source of classroom materials. The study is directed towards synthesizing factors that influence hypertext comprehensibility and how educators who use hypertext select appropriate electronic materials. A preliminary review of the literature showed that literacy and technology are conceptualized as being separate entities rather than being related (Bolter, 1999). Although it is not possible within the scope of this research to test a model to predict hypertext comprehensibility that could apply across all grade levels

and subject areas, the study is conducted in the area of language arts, which is pervasive in education. Identifying hypertext elements that influence hypertext comprehensibility can bring some synthesis to the problem. A highlight of this research is that it is focused on teacher perceptions and teacher practices in order to develop a pedagogical tool to enhance the selection of appropriate hypertext materials.

Conclusion

Perceptions that students know what to do with the hypertext medium are vastly over-rated. At the same time as Internet materials have been used primarily as resources to augment instruction, what has been forgotten is that literacy skill is also developed through reading electronic text. Educators must consider not only how students read in hypertext environments but also their current instructional practices (Labbo & Reinking, 1999). There is no doubt that technology is having a profound, though as yet essentially unknown effect on literacy in schools and in the workplace. The rush to get online could be undermining the efforts of educators as they teach reading comprehension.

Definition of Terms

Bandwidth: "The rate at which a communication system can transmit data; more technically, the range of frequencies that an electronic system can transmit. High bandwidth allows fast transmission or the transmission of many signals at once. On a monitor screen, high bandwidth provides a sharp image" (Barrons, 1998, p. 41).

Content Behaviours (Element Mobility): In this study, the term used to describe either author-induced or reader-selected routes in navigating and interacting with elements either on a web page, within a web site, or from web site to web site. Examples include the presence or use of links, animations, movies, e-mail, pop-up windows, cursor.

Cognitive Overhead: Web site elements that are not directly connected to the purpose of the web page such as advertisements.

Hypertext: Hypertext is computer-based electronic text with built in hyperlinks. Unlike reading a book, the user can typically read hypertext by following up on different connections to increase understanding. Sources of hypertext documents include the World Wide Web, CD-ROM encyclopedias, and Microsoft help windows (Barron's, 1998)

Hyperlinks (Or simply links): In hypertext documents, links can be words (often highlighted or underlined), graphics or numbers which, when selected, transfer the user to a new location in the hypertext or to another site (Barron's, 1998).

Hypermedia: Links can activate media such as animations, text, or/and movie clips. If these media are activated through links, then the result is *hyper* media or moving media (Barron's, 1998). Further to this, Park (1992) suggests that "there is no principal difference between hypermedia and hypertext except that a hypertext program consists of basically textual information, while a hypermedia program consists of multimedia information such as text, graphics, animation, video, and sound" (p. 260).

HTML (Hypertext Markup Language): "A set of codes that can be inserted into text files to indicate special typefaces, inserted images and links to other hypertext documents" (Barron's, 1998, p. 222). HTML is most often used to publish on the Internet.

Interactive: An interactive web site is an HTML document in which the computer user can participate in the web site. For example, the user can answer questions and then get the answers from the site by clicking on an answer icon (often called a button). Interactive programming (or just interactive, as in "the program was interactive") refers to any programming in which the user participates in the process of reading through and activating the program. Examples include: answering a quiz or clicking buttons based on choices having to do with the content of the program in order to obtain information. The program *reacts* to user responses by providing a selection of paths or links from which to choose. Interactive means the user has to participate in the program itself. Ordinary Internet sites that simply have buttons and links to other sites do not conform to this category.

Intermediality: In this study, intermediality refers to hypertext web site form in which multiple texts are represented -- media texts, visual texts, alphabetic texts, and computer texts (although invisible unless the code is viewed). "Intermedial texts are broadly defined . . . .[B]eing a teacher in an intermedial classroom demands educators that take a critical reading of all texts and engage a critical pedagogy in curriculum and instruction" (Semali & Pailliotet, 1999, p. 17)

Internet: The Internet is a system for sending and retrieving information. It is made up of centers (called servers) in key locations, which form relay stations for directing information. Working much like a relay, information travels from server to server between senders and receivers. Information traveling from one sender to another receiver may be directed through several servers before reaching its destination.

The Internet is a cooperative message-forwarding system linking computer networks all over the world. Originally called the DARPAnet (Defense Advanced Research Projects Agency), the Internet was set up to be a fail-safe computer network for information transferral by the United States Department of Defense in case of emergency or war. Once the network was in place, those fortunate enough to access the network began to communicate about everything from inconsequential chats to exchanges of more rigorous scientific research. The system was so popular that it eventually grew to include academic establishments and lately the public domain (Eager, 1994).

Multiple Literacies:

1. Computer Literacy: Computer literacy is "a general understanding of the ways computers work, including knowledge about the computer's CPU [central

processing unit], operating principles, and the principles of networks so that computer users can move around in a computing environment with relative ease" (Sutton, 1994, p. 11).

2. Information Literacy: Information literacy is "the ability to locate, analyze, evaluate, synthesize, and use information from a variety of sources" (Cleveland State University, 1990, p. 1)

3. Network Literacy: Network literacy is the knowledge and skills required to understand and retrieve different types of information from the network using a range of information tools (Tyner, 1998).

4. Media Literacy: Media literacy is "concerned with helping students develop an informed and critical understanding of the nature of the mass media, the techniques used by them, and the impact of these techniques. More specifically, it is education that aims to increase students' understanding and enjoyment of how media work, how they [media] produce meaning, how they are organized, and how they construct reality. Media literacy also aims to provide students with the ability to create media products" (Ontario Ministry of Education, 1989, pp. 6-7).

5. Technology Literacy: Technology literacy is a complex, integrated process involving people, procedures, ideas, devices, and organization for analyzing problems and devising, implementing, evaluating, and managing solution to those problems. This complex definition presumes that technology literacy is involved in all aspects of learning (Association for Educational Communication and Technology, cited in Silber, 1981).

6. Visual Literacy: Visual literacy is the ability to understand and use images and to think and learn in terms of images, that is, to think visually (Horton, 1982).

Multi-Media: Programs and web sites of this type integrate movies, animation, and audio. Internet sites can also be multi-media. For example: Students can prepare hypertext programs that have the capability of activating laser disks and other digital equipment. This set up can also be referred to as multi-media.

Multi-Modal: Using new media involves more than alphabetic text modality use. New research suggests that new digital media, such as the Internet, activates additional modalities in the comprehensibility of text such as listening, speaking, viewing, and representing (The New London Group, 1996; Tyner, 1998); hence, multi-modality interpretation.

MUD (Multi-user domains; also similar, MOO, multi-user domains, object-oriented): "A type of real-time Internet conference in which users not only talk to each other, but also move around and manipulate objects in an imaginary world" (Downing, Covington & Covington, 1998, p. 307).

Comprehensibility/ Readability/ Usability:

1. Comprehensibility - Comprehensibility refers to the quality of written language that makes it easy to understand (Zakaluk, 1985). The term text comprehensibility thus adds another dimension to the term readability. The term readability can be interpreted in the narrowest sense as a "grade level" designation derived from the application of a readability formula. Readability formula, however, are atheoretical, being based on regression analyses that across many studies show that word difficulty and sentence length consistently account for the most

variance in equations for predicting reading ease. Unlike comprehensibility, no reader or inside-the-head factors such as reading fluency and background knowledge are accounted for. No other text factors are accounted for either, such as modifying the text through the addition of adjunct learning aids exemplified by interspersed questions and/or the statement of objectives. Comprehensibility thus is more than readability and refers to the constructive process in which readers engage as they make sense of the text based on both prior knowledge of the topic and supports built into the text.

2. Readability - Readability refers to both checklists and formulaic methods of assessing written text to determine difficulty level. Two examples of readability formulae are the Fry (1977) and Flesch-Kincaid (Kincaid, Aagard, & O'Hara, 1980). Teachers know the limitation of readability formula, and have an expanded view of readability. Teachers consider interest, concept load and motivational factors in choosing text to match student needs, hence, the use of checklists to predict reading ease.

3. Usability - Web site usability is the term used by Nielsen (2000c) to describe whether a web site will be used or not. This view of reading hypertext assumes that the user operates from a consumer's perspective of web sites. Users are not directed by a teacher or by curriculum that compels them to read a particular site. Nielsen's definition stresses that "usability rules the Web" (2000c, p. 10), and that users make choices to accept or reject web contents and web sites themselves based on personal gain for their intended purposes. As used in this study, the term usability has more to do with suitability for classroom use. That is, whether or not

the site in question is appropriate for use with struggling, resistant, reluctant, and/or advanced learners who need to be challenged.

Visual Language: Visual language is a new, emerging language that is an integration of images, shapes, and words with emphasis on visuals to form a single communication unit. The integration forms visual language (Horn, 1998).

Web Site: A file or related group of files available on the World Wide Web. Information is often created on an HTML file and then posted on the Internet through a selected server for use by Internet users.

World Wide Web (W3): One of the several forms of communication on the Internet. "The Web is a worldwide system of multimedia communication for sending news and information. It is considered the world's fasted access to [the] creation and release of news" (Eager, 1994, p. 250).

World Wide Web Consortium (W3C): Founded in 1994 to develop common protocols for the evolution of the World Wide Web, the World Wide Web Consortium (W3C) is an international association of industrial and service companies, research laboratories, educational institutions, and organizations of all sizes. All of these organizations share a compelling interest in the long-term evolution and stability of the World Wide Web (W3, Web). W3C is a non-profit organization funded partly by commercial members. Its activities remain vendor neutral, however. W3C also receives the support of governments who consider the Web the platform of choice for a global information infrastructure. W3C was originally established in collaboration with CERN, birthplace of the Web, with support from DARPA and the European Commission. W3C's mission is to lead the evolution of

the Web -- the universe of information accessible through networked computers. W3C's long-term goals are to encourage:

1. Superior Web Technology - By promoting interoperability and encouraging an open forum for discussion, the W3C commits to leading the technical evolution of the Web. The W3C mission is to ensure that the Web remains a robust, scalable, and adaptive infrastructure.

2. Universal Web Accessibility: The W3C strives to make the Web accessible to as many users as possible and to promote technologies that take into account the vast differences in culture, education, ability, material resources, and physical limitations of users on all continents.

3. Responsible Web Application: However vast the Web becomes, it remains essentially a medium for human communication. As such, the Web's impact on society cannot be dissociated from decisions that guide its development. W3C must guide the Web's development with careful consideration for the novel legal, commercial, and social issues raised by this technology.

(http://www.w3.org/Consortium/Process/Process-19991111/background.html#W3Cdefinition)

CHAPTER II

Review of the Literature

This chapter reviews the literature on the issue of comprehensibility within the context of hypertext and the World Wide Web with the ultimate goal of developing a conceptual model that teachers would be able to apply on their own, and with students, to evaluate the usability of web site resources. To begin the chapter and provide a setting for the nature of hypertext, both a history of readability and hypertext are presented followed by metaphors of hypertext -- architecture, printed text, television, and the telephone. A section about concepts of literacy follows. Then, four significant factors related to the comprehension of hypertext are discussed. Next, the meta-construction of hypertext provides a shape for a potential model for predicting hypertext comprehensibility. The chapter concludes with a discussion of hypertext processing as it might potentially relate to pedagogical practices.

Readability at the Turn of the 21st Century

There are over 1000 articles on readability and over 100 formulas that have been developed (Strickland, 1999). Educators use text comprehensibility or readability measures in order to match students' abilities and interests with the reading materials they assign. Readability measures range from interest inventories to formulas that predict reading ease and grade level (e.g., Fry, 1977). Text elements that are used to pinpoint readability may include the physical appearance of the text, the difficulty or concept load associated with the topic, word complexity, sentence length, writing style, and the interest

that the text itself generates. Measurement instruments vary but many are in the form of formulas or checklists. Formulas such as the Flesch-Kincaid (Kincaid, Aagard, O'Hara, & Cottrell, 1981) or the Fry Readability Index (1977) can be used to match text difficulty with student reading achievement levels. Checklists and inventories can be employed to help teachers choose a text balanced according to interest, usability, and understandability (Vacca & Vacca, 1999).

From the late 1920s to the late 1960s, publishers attempted to satisfy educators' demands for more readable texts by providing materials that were ostensibly easier to read, had shorter sentences, and more generic vocabulary based on factors that accounted for the most variance in regression equations to predict reading comprehension. These consistently turned out to be word difficulty and sentence complexity (Zakaluk, 1989). To satisfy demands for more readable texts, publishers began to provide educators with materials that were grade-level readable. Inadvertently, by reducing word difficulty and sentence length, publishers produced texts that were too easy and dull to engage students. Altered texts were far less challenging than a rigorous curriculum demanded, students were not as interested in the materials, and educators began to have serious misgivings about applying formulas. Educators also noticed that the application of one particular readability formula did not necessarily result in the same grade level designation as the application of another. Formulas alone provide too narrow a scope for predicting text comprehensibility. Being strictly quantitative, formulas fail to take into account the background knowledge, individual abilities, or interests of the reader (Zakaluk, 1985).

During the 1970s and 1980s, the scope of readability widened to include elements that provided a more balanced view of text difficulty. Educators, turning toward

more holistic approaches to reading and writing instruction, also turned to more holistic approaches for estimating readability. Zakaluk (1985), for example, responded to the need to develop a readability instrument that considered both text and reader elements. Her instrument, a nomograph, was based on a regression analysis formulated to combine the elements of text (word length and sentence complexity), instructional aids such as interspersed questions, content prior knowledge, and word recognition ability. Although the nomograph is relatively easy to use and responds to many of the questions surrounding the fallibility of readability formulas, its eventual use was nominal. With the advent of technology, readability assumed new dimensions as definitions of literacy expanded beyond the framework of alphabetic text alone.

Although readability formulas continue to be criticized, their use as rough estimates of text difficulty endures. However, toward the end of the 1980s and into the early 1990s, text took on a new face as computer use became a hot topic. Hypertext so greatly changed text that a redefinition of literacy was necessary. It seemed impossible to predict hypertext comprehensibility (Morris & Tchudi, 1996; Snyder, 1996; Venetzky, 1995).

The limitations of printed text readability formulas as explained by Zakaluk and Samuels (1988) provide a backdrop for developing a blueprint for estimating the comprehensibility of hypertext. Clearly, an educator must know the nature of the text, be it printed or hypertextual, before an informed decision can be made about suitability. One known attempt has been made thus far. Following printed text readability guidelines, Lehner (1993) attempted to use conventional readability to create a Readability Measuring System (RMS) for hypertext using HyperCard. Lehner's instrument, however,

deals only with one side of hypertext, that of symbolic representation. This model would not satisfy literacy experts who claim that visual literacies, so prevalent in hyertext, expand the notion of literacy. Nor does the model account for the mobile quality of the Internet search itself. Sensory experience cannot be ignored. In addition, it would be cumbersome to apply Lehner's instrument to estimate the difficulty of Internet resources because the RMS cannot be used online. Lehner's model, however, provides a reference point for building a blueprint for estimating online hypertext readability.

Summary

While on the one hand there is evidence to support the application of conventional readability predictors to hypertext (Foltz, 1996), there is also the possibility that hypertext predictors are essentially different. This investigation explores factors influencing Internet readability that are radically different from those that predict the readability of traditional or linear text. Research indicates that visual literacies connected to hypertext can enhance reading ease (Bolter, 1999; Sadoski & Paivio, 1994; Sinatra, 1986). This is particularly noticeable in hypertext environments in which pictures and movies are integrated into the text (e.g., Glasgow, 1994; Hobbs, 1998; Lyman, 1998; Wilhelm, 1995). Therein lies a huge potential for predicting comprehensibility that, as yet, has been unexplored. In addition, visual images in the form of icons are significant both within the structure of hypertext as well as for navigation. In this way hypertext environments are different from text encountered on paper. This is not to suggest that hypertext elements are definitively more complex, just different. A comparison would provide more insight into these differences.

The Changing Nature of Text

Originally, there was no need to change readability measures with the initial introduction of computers because word processing was so similar to typing that the nature of text was not essentially altered. However, with the introduction of the Internet, perceptions of both reading and readability must shift since text processing also changes in a medium that relies heavily on visual cues and requires both scanning and navigational skills.

During the 1980s, word processing was rapidly integrated into the workplace and during the 1990s, it was unusual to encounter anyone who still communicated in the business world without using either a word processor or e-mail. Writing with a word processor did not, for the most part, change the reading and writing of linear text because text styles imitated conventional writing and speaking. Text forms were mostly the same as those produced by the typewriter.

While many web sites developed during the early phases of the World Wide Web merely imitated linear text styles, later, many web site authors moved beyond imitation. Consequently, web site hypertext came into its own as a writing form. This gradually altered the dynamics of both authorship and the way we read. Reading processes had to change in order to accommodate the multi-linear nature of the new text, enhanced with visuals and the flexibility to move easily from one source of information to another. Readers were able to obtain more in-depth information simply by clicking on a link. The Web allowed anyone to publish with an aura of professionalism using standard computer

programming protocols. Hence as Web use became more prevalent, web sites acquired more sophistication. More and more web authors began to include visual and kinesthetic dimensions.

Thus, writing has become a form of design for web authors (Nielsen, 2000c). Web authors may not even have to write the text, but instead can gather together a symphony of textual, visual, and kinesthetic elements -- one form balanced against another to form a coherent whole and the use of links to connect with the web sites of others. The text elements are thus part of a collaborative relationship pieced together, blurring the borders of authorship. The coherent whole often links into other web sites, resulting in the appearance of a never-ending text and essentially creating a conversation among web sites. Web sites therefore can be described as collaborative in design and communicative in nature. Web sites are dynamic and therefore may require quite different processing skills than those required to read textbooks.

Part of the difficulty in rethinking concepts of literacy and text has been defining hypertext itself. Theorists have debated this issue from vastly different points of view since the 1960s. Theodor Holm Nelson (1990), who coined the term hypertext in 1965, suggests that hypertext/ hypermedia is the most basic form of text. To him, linear text is a mere subset of the overall form represented by hypertext/hypermedia. Snyder (1996), a senior lecturer in language and literacy, states that hypermedia and multimedia should all be grouped under the label hypertext. Separating these terms does not reflect the true definition of hypertext. To Snyder, the highest form of hypertext occurs online and CD-ROM hypertexts belong in a separate, less hypertextual category. Horn (1989), a computer scientist, however, separates the terms hypertext and hypermedia stating that

hypertext is but a subset of the broader term hypermedia. In his view, most hypertext no longer exists without audio or media. He therefore does not separate online or offline hypertexts. Both Snyder and Horn agree, nevertheless, that hypertext is non-linear. Agreeing only in part, Landow (1997) claims hypertext is a form of text composed of pieces of text and images joined by links that permit multi-linear reading, neither non-linear reading nor non-sequential, but multi-sequential reading. Still others suggest that hypertext is an amplification of linear text, an expanded form of linear text (Bolter, 1999). Discussions about multiple points of view of hypertext testify to the vision that literacy skills have expanded through the use of computers. Literacy definitions and concepts about hypertext processing have changed so much that hypertext literacy is no longer perceived to be the same as reading printed text in paper form.

The wide spread use of hypertext through the World Wide Web since 1991 has greatly shifted public perceptions of literacy in what some have declared a "post-typographical" era (Reinking, 1995). Educators have had to rethink concepts of text and how to read in light of computer use. Difficulties with the concept of text, however, are not a recent phenomenon. Postmodernists such as Derrida, Lacan, Lyotard, and Foucault complicated our conceptions about text as far back as the early 1960s (Usher & Edwards, 1994; Snyder, 1996). Postmodern deconstruction of text and sign systems led to further depth but less unity in concepts of text. Postmodern theory states that there are no grand narratives, that diversity and change break the monoliths of grand narratives that hold modernist and structuralist theories together.

The World Wide Web is one manifestation of postmodern conceptualization about the nature of text that defies definition. Indeed, many reading theorists have

wondered if hypertext is simply the result of textual discussion or a natural next stage of literary theory (Snyder, 1996). Although these discussions have been philosophically compelling, they have complicated rather than helped educators define the new literacy that has emerged as part of the computer revolution. Therefore teaching students how to read using the new technology has been an unquantifiably defined issue, and estimating hypertext comprehensibility has remained part of the mysticism of the Internet. Indeed, a search for a definition of hypertext comprehensibility is applying a structuralists' tool to a postmodern media.

Defining Hypertext

Many theorists and educators consider the World Wide Web (W3 or the Web) to be the ultimate form of hypertext (Bolter, 1999; Nielsen, 2000c; Reinking, 1999; Snyder, 1996). It is for this reason that the Web can be considered an ideal environment for characterizing hypertext. The World Wide Web is a global, hypertextual publishing machine. The Web is only one part of the Internet but it is the public domain of hypertext, a socially constructed hypertext form in which anyone can be an author and multiple authors shape the nature of the form. However, certain restrictions apply.

Generally, the public believes that the Web is not restricted by a governing body, but in fact, the World Wide Web Consortium (see definitions) monitors the growth and protocols used on the Web. The Web is also a dynamic or evolving publishing machine. New ways of expressing electronic writing are forming daily on the Web as web writers make contact with web readers. Web authorship has at its core the intention of providing information that others will consume in one form or another.

The advancement of the Web occurs through the dialogue between users and authors, users and users, and authors collaborating and linking with other authors. In addition, the purpose for web sites continues to evolve and drives the improvements made in each new phase of the Web's development. Five types of hypertext have emerged from global use of the Web: commercial, personal, fiction-based, information-based, and argumentative (Craven, 2000). These five types of hypertext underlie the purposes for developing web sites. By the same token, a web writer is generally looking for an audience, be it passively, as in posting an information-based web page, or aggressively, as in a commercial web site. When a user performs a web search, a mixture of web site selections appears on the hit list. Searches result in users being constantly exposed to lobby groups and commercial interests when they may be looking for alternate information. At the same time, users have their own purposes for searching the Web and become adept at filtering out or ignoring information. Also, additions to servers, called filters, have the capacity to block out certain types of web sites that conflict with user purpose. Since the survival of web sites depends on the use of any one particular web site, there must be a match between author and user purposes. Part of the process of reading a web site is in recognizing the writer's purpose, sorting web sites for one's own purposes, and filtering out non-relevant information. Analogous to the concept of a tree falling in the forest with no one being there to hear it, a web site is hardly part of the Web if no one receives the information. Web 'rot' eventually takes care of such silent web sites as they disappear from circulation since no one visits them and they eventually are deleted by webmasters from servers because they take away valuable space from active

web sites. The Web is not an ordered information source like a library because it is constantly changing.

The Evolution of Hypertext

Hypertext's evolution is founded in both socio-cultural and literary rhetoric (Snyder, 1996). Even before the invention of the Web, hypertext development had been driven by competing theories of the mind (Joyce, 1995). The initial forms of hypertext were driven largely by scientific research efforts. Later, human-computer interaction drew cognitive science, literary theory, pedagogy, and visual arts into the mix. Most recently, globalization, commercialization, knowledge structures, brain research, and artificial intelligence have converged to draw new conclusions about the structure of hypertext. Underlying all of this is the notion that hypertext is connected to the workings of the human mind, and that the human mind works through association (Conklin, 1987).

From the beginning, hypertext appeared to be an ideal teaching tool. Andries van Dam and the Brown University Group were the first to use hypertext in university instruction. In 1968 they began experimenting with using hypertext and hypermedia combinations to instruct college students. They first used hypertext in English poetry instruction in the 1970s, and later to teach cell biology and English literature. Their system of delivery was integrated into the instructional equation: historical information, style and comparison, biographical sketches of the authors, the actual works of authors, plus student and instructor comments. Basically, the system linked relevant information and dialogue associated with teaching and learning.

In July of 1972, the Zog Group from Carnegie Melon University introduced a multi-use, menu-driven interface with large databases. This interface resulted from the search for a system that would produce rapid responses from a large network through a small menu selection interface. They introduced a hierarchical structure to the organization of hypertext to serve a large group of multiple users and titled the system the Knowledge Management System (KMS). Current versions of KMS are well suited to creating documents where, for example, many users contribute to the overall work of a large, complex, manual of operation.

Nicolas Negroponte and Richard Bolt of the MIT Architectural Machine Group expanded the notion of information management to include other media. They created Spatial Dataland in 1976 to integrate information spatially (i.e., click on an icon or a graphic to manage information). The original datelined concept was a room where a user managed things spatially not unlike many of the current data management systems that now appear on screen. The original room was replete with user interfaces that integrated information retrieval and were spatially oriented, introducing such features as touch screens, cursors, joy-sticks, whole wall display, and voice/sound/visuals. These management devices expanded both the type of information that could be integrated into information retrieval and the way that users retrieved that information.

In 1986, Brown and Guide of Owl International, Inc. made multiple platforming possible by designing hypertext that was compatible with both PC and Macintosh. They developed the first commercial system for two platforms called Guide. This system was the first of its kind to allow the reading of hypertext through scroll and outline architecture, thus allowing large documents to be more easily read by scrolling through

the information. In addition, whole documents could be seen, at least in part, through an outline. The introduction of pop-up notes also enhanced ease of use.

Then in 1987, another hypertext visionary, John Sculley, CEO of a large computer company, created Knowledge Navigator. This information management system used voice activated commands and problem solving. Many of Scully's lectures focused on his vision of education as a life-long endeavor. He based his vision on three principles: "(1) the development of conceptual skills, and the ability to test reality against multiple points of view; (2) the nourishment of individual creativity and the encouragement of exploration, (3) the encouragement of collaboration, and the emphasis on clear communication" (cited in Horn, 1989, p. 268).

However, it was not until Bill Atkinson developed HyperCard for Macintosh that, in a single stroke, hypertext became a part of the life of nearly all computers. To augment this development, Skulley, the president of Macintosh at that time, offered HyperCard free with each Macintosh sold. In 1987, HyperCard enabled users to link to laser disks and CD-ROM's as well as to tap enormous amounts of information through the use of an easy programming language. Essentially Atkinson applied the "expanded brain" metaphor of hypertext with computer programming language. Users would see information as "cards" but the cards would be linked in multiple ways. The combination of a simple word processor, a paint program, and a simple but pleasing-to-the-eye interface made hypertext user-friendly and consequently a common part of computer use. HyperCard was often taught to students in the late 1980s.

Then in 1989 (some claim 1991), the World Wide Web (Web or W3) was invented by Tim Berners-Lee, a British physicist, with the help of his associates at CERN

(European Organization for Nuclear Research). In Berners-Lee's personal history of the World Wide Web, he notes that the present state of the Web was not fashioned single-handedly, rather, it happened through a personal vision that developed through use and making corresponding technical adjustments. The goal was to expedite interactions between humans and machines (See History of the World Wide Web at http://www.historyoftheinternet.com). Berners-Lee's states on his web site:

> The dream behind the Web is of a common information space in which we communicate by sharing information. Its universality is essential: the fact that a hypertext link can point to anything, be it personal, local or global, be it draft or highly polished. There was a second part of the dream, too, dependent on the Web being so generally used that it became a realistic mirror (or in fact the primary embodiment) of the ways in which we work and play and socialize. That was that once the state of our interactions was on line, we could then use computers to help us analyse it, make sense of what we are doing, where we individually fit in, and how we can better work together (http://www.historyoftheinternet.com).

Web evolution has thus shaped concepts of hypertext. From the inception of the Knowledge Navigator until the present, information management and the pursuit of Internet access for the masses has been the technological focus of hypertext development.

The visions of computer programmers are now aimed at human interaction and this is what this study embodies (Nielsen, 2000c; Rada, 1989). It is evident that the success of the human-computer interface is how the machine can do what the human mind cannot, and how the human can do what the machine cannot. From the beginning, mankind has sought to expand the capacity of the human mind through computers. Computers expand the human mind by providing, if you will, metaphorical extensions of how humans remember and retrieve information. The human mind can think independently and more critically than the computer. Strength in the processing of hypertext, however, lies in the reciprocity between mind and machine, the Web has served as a mega-instrument that embodies that vision, joining many minds together in a type of global dialogue that has shaped our present notion of Web hypertext. But an understanding of how both inside-the-head or reader factors and outside-the-head or hypertext factors interact to facilitate meaning making at the individual level is also important.

Metaphors and the World Wide Web

In addition to the conceptualization of hypertext envisioned by computer programmers, other notions of a virtual nature also help readers envision the invisible nature of hypertext. McKenna (1999) comments that many of our concepts of present day technology originated in science fiction. For example, the term "cyberspace" came from William Gibson's (1984) novel "Neuromancer". In response to Gibson's concept, America Online and CompuServe created places and spaces for communication on line. Hypertext has been conceptualized through the use of several metaphors including architecture, printed text, television, and the telephone. These metaphors are informative

in regard to the process of bridging the gap between mind and technology to facilitate reading comprehension.

Architecture. William Mitchell (1999) traced the evolution of cyberspace as technophiles avidly pursued their vision of the architecture metaphor, eventually realizing the concept of whole communities on the Web. Architecture is an accurate metaphor for virtual space. In an article entitled *Replacing Space,* Mitchell cites several events on the Internet that support his view. For instance, the virtual room metaphor was spawned by the game of *Dungeons and Dragons* and is realized in cyberspace as multi-user domains (dungeons) captured in the acronyms MUDs and MOOs (multi-user domains, object oriented). Mitchell states: "The Web is naturally seen as a continually expanding virtual city with lots of new construction going on" (1999, p. 115). The metaphor of architecture helps Web users make sense of information that is beyond human touch, on the other side of the screen. The use of the term "blueprint" to describe the guidelines developed in this study for estimating hypertext comprehensibility had its origins in the architecture metaphor.

Printed text. Metaphors for hypertext also originate from past practices with forms of media. For example, electronic text never left its original frame of reference, printed text. From trash bins to pages, the familiarity of the printed book has transferred into the world of hypertext. Despite the knowledge that hypertext is multi-media, multi-linear, and requires multi-modal abilities to read, printed text metaphors continue to dominate in the medium of electronic text. Computer software makers continue to use printed text as a metaphor for electronic texts. The metaphorical concept of an e-book, pages, or trash bins provides physical grounding in a virtual environment that has no physical tangents.

Television. Television is another common metaphor for hypertext. There are several good reasons for choosing television as a metaphor. First, the computer screen resembles a television set. Similar to the window on the world that television provides, the Web offers up-to-date news information and mimics television's provision of information to the masses. One of the greatest distinctions is that television production, like publishing, has had to be scrutinized by governing bodies and, although there may be misrepresentation in television media reports, that type of misrepresentation does not come close to the misrepresentation that can occur on the Web (Nielsen, 2000c).

Also present in the television metaphor is the standard format of movies, sitcoms, and even commercials with predictable conclusions and timed content. If non-linear represents the ability of the reader to choose alternative pathways from those laid out by the author, then the linearity of television content contrasts with the non-linear content of e-books. Hypertext requires viewer control as opposed to the control of television networks. These contrasts place the Web in direct opposition to using television as a metaphor. But the metaphor that best captures the interactivity between mind and machine present in hypertext processing is perhaps the telephone.

Telephone. Jakob Nielsen (2000c) suggests that Web hypertext is better described using a telephone metaphor. The Web is a mixture of asynchronous (not real time such as information web sites) and synchronous messages (such as chat rooms that allow real time conversations to occur) that contribute to the global dialogue. Without this dialogue or message exchange, the Web does not change or grow, or even represent itself according to its true nature. "Telephony" of the Web, as Nielsen puts it, is beyond the limited technology of the telephone because the written, animated, and auditory aspects

of web technology enhance the dialogue to such as degree that the dialogue could be mistaken for mass media, like television or limited technology like the telephone, that allows only one-to-one conversations (exception – conference calls).

Summary and conclusions. Metaphors build mental images or schema for the concept of the Web. The Web is not unlimited, unlike the metaphors that are used to describe and understand it. However, metaphors provide concrete referrents for the nature of hypertext, an architecture of what is beyond the physical eye. Metaphors provide a mental grounding for the human experience and may serve a role in summoning past experience and activating background knowledge. Metaphors may provide shape to concepts of processing hypertext because they provide a context for visualizing new spaces and places in the dialogical architecture of hypertext. Still, all metaphors perhaps inadequately describe the Web. Perhaps some combination of metaphors sheds greater light. There are theorists that claim that there is a need to move beyond these metaphors to appreciate the full advantage of hypertext (Horn, 1998; Snyder, 1996; Ulmer, 1998). To imagine this type of thinking, one would have to conceive of a world where there were no real world examples, only virtual examples, from which to construct the metaphor. Without the mental construct of a generic metaphor, it would be difficult for readers to imagine virtual space or what lies beyond the immediately visible computer screen. Since background knowledge plays a key role in the comprehension of conventional book text, there is reason to consider that metaphorical knowledge may help transfer background knowledge into literacy in a digital world.

Literacy in a Digital World

Discussion about literacy in a digital world has provided rich discourse for theorists. From postmodernism to technological efficiency, there has been a great deal of polarity evident in theoretical discussions. One such polarity is the division between literacies. Tyner (1998) notes that there are broad divisions between "tool literacies" and "literacies of representation". Tool literacies include computer literacy, network literacy, and technological literacy. These literacies focus on the computer as a tool. A contrast is found in literacies of representation, a category made up of information literacy, media literacy, and visual literacy. (See definitions.) These literacies focus on the information or human discourse created from the tool.

Generally, schools are more concerned with literacies of representation because the majority of teachers and students engage in locating, analyzing, evaluating, and synthesizing information through word processing or information gathering. Tool literacies focus more on hardware issues and representation literacies focus on software issues. The difficulty with the polarity of these literacies is that they are codependent. One cannot exist without the other. However, to expect students not only to be "electrate" as some would describe it (Ulmer, 1998), but also to possess a collective knowledge of representative and tool literacies, involves a huge commitment to computer use plus a paradigmatic shift in classroom instruction, away from the traditional focus on alphabetic text. Hence, the view of literacy in a digital world is splintered.

The purposes for using technology have divided the notions of literacy. Taking a stance in one or another literacy has strengthened the position of that literacy for its own constitution, for earning grants, saving students from pornography, or shifting curricular

focus. However, as suggested in this literature review, a growing need for understanding the codependency of literacies has become evident. Library associations, universities, and research organizations have recently made moves to consolidate a position that pulls literacies into a coherent whole (Cleveland State University, 1990; Sutton, 1994; The New London Group, 1996; Tyner, 1998). The quest for a coherent whole arises from the need to find a vision for future literacy needs and resources. In education, however, a coherent whole also involves finding interlocutors between traditional instruction using printed text and what some describe as the new literacy, using technology.

Having reviewed the literature on readability and discussed the changing nature of text and literacy in a digital world, the inquiry now turns to factors that influence hypertext comprehensibility.

Predicting Hypertext Comprehensibility

Four factors relating to hypertext comprehensibility emerged from the review of the literature. These were: accessibility (Kamil & Lane, 1998; Lehner, 1993; Smith, 1997), coherence (Rouet & Levanon, 1996; Tyner, 1998), critical literacy (Lunin & Rada, 1989; Semali & Pailliotet, 1999), and aesthetics (Cubitt, 1998; Nielsen, 2000c). Each feature is presented in the next section as an important category associated with hypertext processing.

Introduction

Previous attempts at designing a model for predicting hypertext comprehensibility have either ignored the true nature of hypertext or they have emphasized parsing the usability of a web site instead of distinguishing among the types of processing required to

take advantage of each communication element. Nielsen (2000) states that resolving these issues will take time (user time) and that providing models to computer-literate audiences only excludes the majority of less computer-literate users from dialogue about the Web. A satisfying, user-friendly model must not, therefore, focus solely on the knowledge of experts or beginners, but must include the dialogue of both.

Predicting hypertext comprehensibility may at first appear to be similar to predicting the comprehensibility of linear text. As electronic writing has evolved, however, the simple procedure of translating linear text into hypertext has been unsatisfactory (Nielsen, 2000c). Although there are some similarities between using graphic organizers to begin chapters or including text graphics, these similarities do not easily translate into creating a dialogic, dynamic environment for web hypertext. In hypertext, the reader assumes responsibility for navigating the text according to his or her purpose and background. In contrast, the writer has the responsibility for making that journey open to a wide variety of readers with diverse knowledge, and for providing new opportunities for readers to interact in new ways when they return to the website. The new literacy combines visual elements with text, shifts the readers' eyes from viewing static paper to viewing electronic screens, and makes possible a new form of reading and writing that combines visual elements with textual information. To predict the comprehensibility of hypertexts, then, a new way of looking at text as a dynamic, dialogical, multi-modal form of reading and writing must be developed.

Accessibility (Outside-the-Head)

First in the list of factors affecting comprehensibility is accessibility (Kamil & Lane, 1998; Lehner, 1993; Smith, 1997). Simply put, students cannot understand web sites in which the text, visuals, and content behaviours that require technological expertise to manipulate are beyond their capabilities. Currently, many checklists to evaluate web sites take into account only surface elements, and more web site evaluations review web sites from the expert user's point of view (Nielsen, 2000). Reading a web site, however, involves a broad range of web site elements that a broad range of students need to recognize and comprehend. Examples of these elements include such elements as: (a) the text being readable at the student's grade level, (b) pictures that students can interpret, and (c) content behaviours such as a scroll bar that help students navigate through long text.

Some student readers may never attempt to go beyond the perceptual level of the web site, instead, choosing to move naturally from picture-to-picture and perhaps eventually losing interest or purpose (Smith, 1999b). In other words, students may not be able to process and interpret the multiple texts or the rhetorical structure of a web site without knowledge of the basic elements.

Nielsen (2000c) notes that there is a great disparity between groups of computer users. Computer literate students do not necessarily understand the meaning behind the pictures and words that they see. They may have some limited media savvy learned implicitly through watching television, but this is insufficient for dealing with topics in which they must make choices about their hypertext journey. Therefore, background related to the visuals, knowledge of text organizational patterns, and familiarity with

related cultural themes appear to be necessary topics for classroom dialogue when teachers introduce students to Web rhetoric.

Bangert-Drowns & Pyke (1999) gauged the thinking processes involved in becoming literate in computer environments. By observing students in an urban elementary school, they were able to distinguish seven modes of student computer engagement, ranking these modes hierarchically as follows: literate thinking, critical engagement, self-regulation, structural sensitivity, frustrated engagement, unsystematic engagement, and disengagement (Table 1).

Table 1.

A Taxonomy of Modes of Student Engagement with Educational Software

Literate Thinking	Student understands the content of the software from multiple and personally meaningful perspectives. Student manipulates software features to explore different perspectives and develop different interpretations as an opportunity to reflect on personal values or experiences.
Critical Engagement	Student attempts to identify operational and content-related limitations of the software. Student manipulates software feature, keenly observes the effects of the manipulation, and integrates the results in future interactions to test personal understandings or limitations of the software presentation. Software structure becomes an object of critical reflection and a stimulus for perspective-taking.
Self-Regulated	Student creates personal goals within the software to make the software as personally interesting as possible. Student adjusts software features to sustain deeply involved, interesting, or challenging interactions. Student creatively uses software for personally defined purposes.
Structure-Dependent	Student is sensitive to and competent with software operation and navigation. Student pursues goals communicated by the software. Student may not yet display full mastery of software feature, but responds to operation, navigational, or content organization. Students demonstrate patterns of interaction that make competent use of software structure.

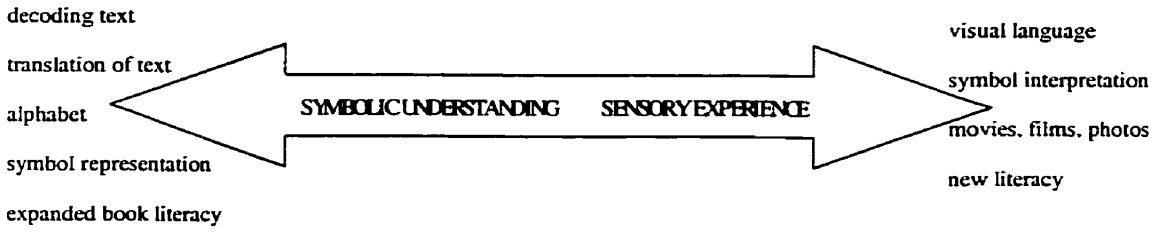
Frustrated Engagement	Student possesses clear goals when working with the software but is unsuccessful in accomplishing them. Student tried to interact effectively with the software, but is unsuccessful. Student knows what the software can do, but cannot accomplish it. Student may manifest stress or frustration in negative comments, confusion, aggression, erratic behavior, agitation, distress, or anxiety.
Unsystematic Engagement	Students are aware of the goals structure of the software. Student has unclear goals when working with the software. Student moves from one incomplete activity to another without apparent reason. Student successfully completes simple tasks within the software but does not link tasks for high-order goals. Students remain engaged with software.
Disengagement	Student avoids working with the software or discontinues use prematurely. Student resists or stops interacting with the software Student may sit and tinker with the software in a seemingly purposeless or disinterested way with little or no response to feedback from the computer. Or, student may in fact turn away from the software or resist using it at all (p. 3).

These levels of engagement can also be applied to hypertext literacy. A broad range of engagement and technological expertise is required to negotiate hypertext and to make reading the Web a literate act. Researchers need to consider these factors as they relate to hypertext comprehensibility.

While governments and technophiles are promoting the use of technology, contradictory conceptualizations prevail in regard to the extent of hypertext literacy. These differing opinions have implications for how reading is interpreted in practice and have confounded research on the use of hypertext. Bolter (1999) has suggested that the promoters of hypertext adhere to either one or the other of two points of view, illustrated in Figure 1.

Figure 1.

Views of Hypertext Described by Bolter (1999)



> One group, including many enthusiasts for the World Wide Web, emphasizes the hypertextual nature of electronic communication . . . . Their vision is that all texts (verbal and graphic) may ultimately be linked into a single electronic library to which everyone both has access and can make contributions. This proposal sounds radical, but it is in fact more traditional than is commonly recognized. For these promoters of hypertext are still working within the tradition of written communication; they still understand communication as a process mediated by arbitrary symbols, such as the alphabet, supplemented by graphics or other media. For them, the computer is the latest in a series of technologies of writing, a new kind of book that now supersedes the printed book. Existing (linear) texts can be translated into the medium of electronic hypertext, just as many texts were earlier

> translated from the papyrus roll to codex or from codex to print (pp. 458-459).

Thus this group of advocates see hypertext as a new form of linear text. They recognize language as verbal, replete with symbolic representations.

Still another group view hypertext environments more globally, as a language of symbols and visuals that take precedence over verbal language. Bolter (1999) explains:

> A second group of computer enthusiasts is more radical. This group seems to believe that the printed book will be replaced not by electronic hypertext but rather by the computer as a new perceptual medium. For them, the computer works to overcome the limitations of textual communication; this position is more radical and at the same time more naively popular. It limits the use of arbitrary symbols (writing) as a means of communication. Instead, it sees the computer as the heir to the tradition of television, film, and photography. The naïve understanding of all these media is that they are not media at all but channels for unmediated perception. Unlike painting, photography is assumed to show a viewer what a scene really looks like. Unlike a newspaper, a television news broadcast puts the viewer 'on the scene' (p. 459).

Those who advocate this point of view seem to be more interested in the viewing and representing aspects of the Internet. They regard language as secondary to visual information in communicating meaning and facilitating learning.

The main difference between these two views about what modes of information facilitate learning from hypertext is that the relationship between "sensory experience and symbolic understanding" (p. 460) is seen in reciprocal terms. The first group regards the scripted text as the most important facet of the experience, while the second group regards visuals as the foundation.

These opposing views of hypertext have implications for how classroom literacy learning activities are conducted using the Internet. In addition, these views confuse the issue of defining hypertext comprehensibility. Where some believe that literacy is augmented through hypertext use, others believe that reading hypertext is a totally new enterprise. By comparing linear text predictors with hypertext predictors, this study seeks, at least in part, to reconcile the issue of whether it is the text or the visual information that contributes more to reading ease.

Hence a necessary part of any research on hypertext comprehensibility would be to evaluate the differences between visual comprehensibility and textual comprehensibility. While a broad range of elements unique to hypertext need to be considered so that students can engage in hypertext reading in a fully literate manner, as outlined, the issue of accessibility is one of the most important factors to consider in a blueprint to predict hypertext comprehensibility. Coherence is a second factor.

Coherence (Inside-the-Head)

An amazing clarity comes from the full comprehension of text at a variety of interpretive levels. The hypertext reader assimilates elements into a coherent whole that shapes their understanding of the hypertext. Judith Langer's concept of reader response offers insight into how this might occur in hypertext reading. Langer's (1995) four recursive stances for literary and informative text are: (1) being out and stepping into an envisionment, (2) being in and moving through an envisionment, (3) stepping back and rethinking what one knows, and (4) stepping out and objectifying the experience. Langer's concept of envisioning the text simulates a hypertext reader's experience of creating a vision of cyberspace. Her stances can be applied to describe how hypertext readers travel through text, eventually having to leave the same space/time position, never to return again to exactly that space and time in the hypertext because rethinking and objectifying has taken place.

Reading hypertext is also limited by a combination of the reader choosing an entry point and then exercising power over the depth of processing. Nielsen (2000a) suggested through his research into cyberspace eyetracking that:

> It was more than three times as common for users to limit their reading to a brief skimming as opposed to reading a full article. Even when focussing on a "full" article, users only read about 78% of the text (p. 1).

Nielsen proposes that when they engage in hypertext processing, readers search for information and "ruthlessly" ignore details. He describes the process of reading web sites as "foraging and consumption". On the other hand, Tapscott (1998) claims that

students have a natural sense for the overall elements of the Web because they have never known a world without the Web. They are naturally attuned to the type of dialogue inherent in web sites because they are raised into a Web world much like a French child learns to speak French in France -- because everyone is talking that language and they are a part of the conversation. Others disagree with this notion because they believe that Tapscott is looking at a marginal and privileged population (Wresch, 1989). What Tapscott is saying may be partly true, however, in the sense that students who have participated in Web dialogue since their early years do indeed understand web dialogue at a seemingly innate level, but this is not a pervasive notion, although it is held by some adults.

Transactional reading theorists (Diamondstone & Smith, 1999) state that an overriding goal of literature instruction should be "to engage students in developing an understanding of how texts work so that they can effectively assert their textual power" (p. 194). Assessing a web site by its individual elements alone is not sufficient for helping the novice reader since it does not provide students with a concept of how hypertext is constructed. Students may not be able to synthesize elements that they cannot identify or connect to their background knowledge. Knowledge of both the elements and rhetorical structure of hypertexts should thus be included as factors that influence hypertext comprehensibility. A third factor relates to authority.

Authority (Critical Literacy)

Bolter (1998) states that "[H] ypertext seems to embody a model of reading as the active construction and critique of meaning. Social constructivists agree that students

ought to be critical readers who understand their role in the process of meaning construction" (p. 10). Together with the widespread use of the Internet is the increased commercialism tied to education. The fact that students must wade though commercials as they appear in Web hypertext, tagged onto headlines and interspersed with text, reinforces educators' concerns about commercial interests coming into conflict with educational pursuits (Marginson, 1997).

Many educators and the public are nervous about the merging of commercial and educational interests in online education because they view these purposes as inherently oppositional. Pornographic web sites top the list of public concerns. Much of the rhetoric on web site authority focuses on inoculating students from the ills of the Web. Critics see the Web as a propaganda machine. These critics abound and legalities have forced schools to adopt filters that restrict Web access. Certainly, we do not want students exposed to pornography, but the application of filters introduces some other problems that related to hypertext comprehensibility.

There are two issues: (1) Filters keep out good web sites as well as bad, thus limiting the information that can be accessed in schools (but not necessarily at home); and (2) The responsibility for being a critical hypertext reader is taken out of the hands of educators and students when filters become censors. These problems leave schools as sterile web site receivers that cannot realize the full extent of the Web. Further, filters reduce the need for teachers to talk about critical literacy in conjunction with Web use because the filters, and not the minds of students and teachers, do much of the critiquing. If teachers cannot model behaviour and students cannot make decisions about web sites because the filter arbitrarily eliminated the site, then opportunities for critical analysis are

limited. Overly protective filters provide an unrealistic view of the Web in classroom environments. On the other hand when students are reading web sites, they need to be aware of the role of filters since filters are not perfect and some undesirable web sites can still find their way into classrooms. Teachers must therefore make an effort to monitor student interaction with the Web and enter into conversations about what is on web sites so students can make better choices as they navigate hypertext.

Critical literacy also has implications for hypertext processing. Rabinowitz and Smith (1998) maintain that the Web makes authors out of readers. The authority of reading a web site is shifted in part from the web site author to the reader. Knowledge formation in hypertext shifts from the responsibility of the writer to a shared responsibility with the reader. Thus, critical thinking shapes the concept of hypertext, placing some, if not most, of the agency for navigation and meaning-making to the reader.

A fourth and final category underlying hypertext comprehensibility is design and appeal or elements associated with aesthetics.

Aesthetics (Design and Appeal)

Up to this point in the discussion, accessibility, coherence, and critical literacy have been considered as important features that shape hypertext comprehensibility. This entire conceptual base is overturned, however, when it comes to a discussion about design and appeal. One of the main reasons that design and appeal affect hypertext comprehensibility is the personal nature of interest and novelty. Engagement based on elements of design and appeal can range from simple and subtle effects associated with

text size to a full-blown, interactive, avatar experiences evoked by the use of colour, light, movement, texture, shape, layout, and proximity. It is still a rare moment to have an aesthetic experience on the Web, yet it does happen. Sean Cubitt (1998) in his book entitled *Digital Aesthetics* suggests that speed and precision interfere with the common concept of freedom and looseness that society associates with aesthetics. Mainly, web design has to do with simplicity and protocols that facilitate speed and communication, not with direct appreciation of the Web as art (Nielsen, 2000c). Yet, there is a type of "digital aesthetic" or flow in design and functionality that facilitates engagement.

Aesthetics and design could be the hook that tunes students into certain web sites while ignoring others. Historically, HyperCard was one of the first programs to make use of aesthetic appeal in conjunction with design flexibility. Computer games also push those boundaries. Visual play in the form of cartoons, for example, is common and appreciated even on serious web sites. Cubitt (1998) states that an aesthetic, cultural connection launches cyberspace into another realm. Novelty is often ignored or down played. He argues that corporate and global communications undermine and silence individual communication on the Web. Therefore, acknowledging the idea of a democratic Web, Cubitt encourages individuality, not standardization.

A reader may be more likely to read an ugly message, out of novelty, than read a well-designed web site. Literary theorist, Peter Rabinowitz (1987) notes that writers must sense the commonalities of their "authorial audience", but on the Web those commonalities may be connections of a tenuous personal nature. The grand narrative of the Web is broken by the voices and responses of individuals. In terms of readability, influenced in subtle ways by both design and aesthetics, a model of comprehensibility

would need to delineate how students respond to web site humour, cultural overtones, and visual aesthetics.

Summary Statement

As indicated in the foregoing discussion, any blueprint for predicting the comprehensibility of hypertext must consider each of the preceding factors: accessibility, coherence, critical literacy, and aesthetics. But technological elements are also important.

Meta-Construction of Hypertext

In the next section, the design of hypertext from the ground up is discussed. The meta-construction of hypertext for comprehensibility involves technological considerations in addition to elemental factors. Included in this discussion are two divisions associated with hypertext processing: (1) the functional semantics of content and (2) the functional semantics of rhetoric. The three main sub-categories of each of these divisions are: alphabetic text, visuals, and interactive elements. The parts or elements that make up the meta-construction of hypertext in turn have implications for multi-medial hypertext processing.

Technological Considerations

Hypertext on the Web is generally described as being made up of four parts: Hypertext Transfer Protocol (HTTP) which is fairly invisible to the user, Uniform Resource Locators (URL), File Transfer Protocol (FTP), and Hyper Text Markup Language (HTML) that tags text and graphics including video and audio features and

dictates how the text and the graphics will be displayed on the screen. These four parts create the accessibility, interactivity, and novelty that have contributed to the popularization of the Web. The range of technical interaction with the computer itself includes physical contact with information (e.g., using a mouse, audio input, touch screens), manipulating the information (e.g., searching the Internet, word processing), and virtual contact such as that provided by Multi-User Domains (MUDS). On top of the parts of the Web, one can program a seemingly limitless variety of displays and user interfaces. The underlying technology of the Web is fairly invisible to the user except for HTML that can be seen quickly on a browser and used to correct and edit personal web pages.

Developing a web site can be carried out in a variety of ways with a variety of program languages. At this point in time, there are basically two ways of undertaking web site development: (1) Using HTML code (or other such related mark-up languages) and (2) WYSIWYG (What You See Is What You Get). The first development type is more like computer programming, and the second is more like using a sophisticated word processor. In addition to understanding all aspects of web site development, the advantage for web site users in becoming familiar with HTML code lies in being able to detect code errors that can cause malfunctions on the web page. Users are able to see the results of code applications immediately. Most users are able to learn web site development tools in a matter of a few hours.

Other programs and protocols take much longer to learn and demand concerted effort on the part of programmers to keep up-to-date with new developments. HTML creates a dynamic but not an interactive web site, so more complex protocols are

necessary. In order to solicit feedback from other users (e.g., forms, surveys, search engines), it is necessary to use the Common Gateway Interface (CGI). Although CGI does the job of making web sites interactive, it also slows processing somewhat. Therefore web developers use client-based scripting languages such as Java and server-side scripts such as Active Server Pages (ASP) that resemble HTML when they arrive on the user's machine. HTML and ASP both use *cookies* (files stored on a client machine) that are small client-side files that allow processing to occur on the client machine.

The technology associated with creating web pages is rapidly expanding and the ease of producing web pages from visible protocol (e.g., HTML scripts) appears to be separating users from programmers. Users no longer need to program in order to produce either HTML or simple CGI script. The source code for these scripts can be pieced together using script dictionaries and other such texts, often called source code bibles.

The binary mathematics and scripting of code behind web pages is invisible to the eye, but is an important aspect of web authoring because knowledge of binary mathematics can limit the ability of everyday users to write more advanced web sites. Currently advanced scripting (e.g., CGI) also slows the motion of downloading because machines take time to process the coded information. In the future, new technology may make the speed of information processing congruent with real user time. Download speed may eventually become a minor consideration. Likewise, being able to write using voice, visuals, texts, and motion may eventually become unimportant as code is perfected and the machine carries out more and more invisible tasks. Web architecture will continue to evolve to suit the usability of the masses, limited only by the invisible mathematics that underlies screen display. More important to this discussion is the understanding that

hypertext expands the invisible nature of text beyond the mere processing of static text. This suggests that both the mental construct of the medium, as well as the message of the medium, contribute to hypertext comprehensibility. But rhetoric as it relates to comprehensibility is still another factor.

The Functional Semantics of Content

Other theorists have examined hypertext from a rhetorical point of view. In particular, Robert Horn combines text and visuals into what he terms "visual language". Horn claims that visual language is a new language that is emerging from hypertext. He states that visual language is different from the "multitude of communications methodologies" (1998, p. 5) because hypertext does not lead to the cognitive processing of alphabetic text, visual text, and the use of content behaviours as separate elements encountered one at a time. Instead these elements are met in combination and form deeper meaning than they would as deconstructed parts.

"Functional semantics of content . . .[is] the study of the purpose for the inclusion of each element in a visual language unit. Hence, the study of what job each unit is doing" (Horn, 1998, p. 159). In Horn's view, elements interact with each other through juxtaposition. Semantics is the study of the development and meaning changes inherent in speech forms, and semantics is a study of the process by which meaning is derived from symbols, signs, text, and other meaning-bearing forms. On a web site, content can include any of these elements. Readers surf conceptually using the category of functional semantics of content, identifying elements that contribute to the communication unit and connecting them perceptually with background knowledge and purpose.

There is, as suggested earlier, an invisible architecture related to hypertext that controls its display. Hypertext development and display are limited by the invisible structure or code of the Web. The invisible mathematics that translate information into hypertext and the invisible image of the construction of hypertext meet at one point, that is, the visible web page. Christina Hass (1989) identifies some of the main difficulties associated with reading electronic text:

> The most common complaints of computer writers are difficulties they experience in reading their texts online . . . . Some writers mention a difficulty in knowing how the finished product is going to look, while others have difficulty detecting errors on the screen. . . . Writers also say they find it difficult to look at large sections of their writing on-line or move quickly to a specific place in the computer text. Others say they don't trust their own ability to read critically from the screen, reporting a problem "getting a sense" of their on-line texts (p. 17).

The invisible nature of most of the structure of hypertext suggests that there is a need for mental representation skills not only for authors but also for users of hypertext.

Hypertext is different than book text because it in electronically generated. This allows some freedoms but at the same time may constrain and complicate the reading process. Reading hypertext requires skills over and above those required for reading conventional, alphabetic text. Like a variable in a science experiment, electronic text

changes literacy and produces effects. Some of the effects entail freedoms from conventional constraints; but this freedom, in turn, causes its own constraints.

The following comparison chart of factors that positively or negatively influence the processing of hypertext is an attempt to capture these elusive elements in which meaning is either more or less than the sum of its separate parts. In addition to accessibility, coherence, authority, and aesthetics, the factors depicted in the comparison chart help provide a blueprint for evaluating the comprehensibility of hypertext.

Table 2.

Freedoms and Constraints of Hypertext

FREEDOMS	CONSTRAINTS
Organization of ideas can take several paths.	Writer loses control of the text. Reader can get lost in the text.
Multi-media can be easily added to increase impact.	Multi-media can either distract the reader or deter from comprehensibility.
Multiple elements associated with web site forms such as e-mail, movies, and text can be economically combined in one web page.	Reader either ignores or has to stop to explore multiple elements, taking away from readers' understanding of other parts of a particular web site. Can also narrow the breadth of a search.
Readers are able to surf quickly through information to choose what they want through searches.	Reader only reads in a shallow manner, missing and ignoring parts of the web site.
To suit their purpose, readers are able to retrieve huge amounts of information in one computer sitting, to suit their purpose.	Low computer literacy skills, slow equipment, and inability to scan quickly can cause readers to give up in frustration.

As suggested, the hypertext reading process is multifaceted, involving multilevel, multimodal reading strategies and practices (Horn, 1998; Tyner, 1998). Reading is at once more demanding and more readily comprehensible. When multiple strategies and practices are combined, they require deeper analysis as well as synthesis so that the reader is able to construct full meaning. While one level of analysis refers to the "functional semantics of content", Horn (1998) calls the second the "functional

semantics of rhetoric." The "functional semantics of content" refers to elements held still for the reader in a sort of snapshot of comprehension. In contrast, the "functional semantics of rhetoric" is about the meaning conveyed as hypertext elements perform rhetorical functions on the Web. While the elements of content give readers their first impression of the subject, the functional semantics associated with rhetoric include familiar or natural cues that describe or show: who, what, what's inside, where, when, how it works, how to do it, motion, names and labels, definitions and examples, what can't be seen, comparisons, and quantities (Horn, 1998).

Functional Semantics of Rhetoric (Organizational Messages)

If there is a strong link in the processes that readers and writers engage in then it follows that one set of predictors of hypertext comprehensibility can be found in the study of rhetorical structures.

Functional semantics of rhetoric includes the manner in which the contents communicate, shape thinking, and inform the reader. "Rhetorical functions . . . [are] those parts and properties of a communication unit that communicate direction, instruction, organizational messages, or emphasis and tone . . ." (Horn, 1998, p. 181). Examples of these communication unit elements would include functions that: guide readers through a web site, focus attention, cluster visual and verbal elements, organize an overall page, show the context underlying concepts, provide lightness, humor and irony, increase impact, and prompt users to manipulate the environment (Horn, 1998). Horn admits that his visual language categories of functional semantics are conceptual and incomplete. Functional semantics of rhetoric, however, also provides a useful frame of reference for

classifying elements in predicting hypertext readability, and makes Web rhetoric visible to readers. As Morris & Tchudi (1996) state: "Literacy is the rhetorical ability to discover the rules and principles of discourse and the power to use, extend, and modify those rules to accommodate one's own experiences, understanding, and needs" (p. 202). Understanding the rules and structures of Web rhetoric also involves the reader, who to a great degree constructs the text through navigation. Hypertext processing thus becomes part of Web rhetoric.

Reader as author. Straw (1990) suggests that there is a strong relationship between the processes in which not only readers but also writers engage in while constructing the meaning of text. He elaborates on this notion by naming this function "reader as rhetor, text as audience" (p. 80). The reader, he states, is the "composer of meaning". This notion is manifest in the nature of hypertext processing since readers must forage for meaning in a multi-linear environment -- making guesses about what will come next after they click on a link and relying heavily on their own background knowledge to interpret the text. Writers must also anticipate the difficulties readers might have as they process the text and make corresponding revisions. As suggested by Rada (1989), a computer scientist, a strong predictor of hypertext comprehensibility is the manner in which writers organize the hypertext dictated by their perception about how readers will negotiate the text. Hypertext authors believe that readers will follow the connections between nodes that they create. Consequently, the way authors organize connections is based on their forecast about readers' moves through the text. Readers progress through hypertext by relying on prior knowledge and the nodes that signal the organization. The writer anticipates how the reader will engage in the material and tries

to avoid losing the reader in the hypertext maze. Both parties participate in a mental imaging of each other's thinking process. Representation forms through which a writer moves are a mirror image of those through which the reader moves (Rada, 1989).

Rada (1989) also states that browsing styles contribute to the way writers organize text. Writers must consider a broad range of readers who browse with multiple purposes and varied facility. Therefore, the relationship between the reader and the writer is important to consider in the complexity of hypertext because writers want to construct hypertext that directs the reader. There is a strong suggestion that readers should know what writers are thinking in order to construct their own notions of text and vice-versa.

Summary Statement

As indicated to this point, the process of web site construction lies somewhere between the technological ability of the web author, the technology available for building a web site, the computer skills of the user, and the ability of readers to negotiate and process that information. Therefore, the tasks of composing a web page and processing the information are a shared social construction. Web authors decide content based on how they believe readers will respond; similarly, readers choose where they will venture on the Web. Thus the major elements associated with web site comprehensibility can be synthesized into the "functional semantics of content" and the "functional semantics of rhetoric" combined with such factors as accessibility, coherence, authority, and aesthetics.

But surprisingly, the simple availability of choices sets in motion the need for web authors and readers to explore these options. It is unusual to find web sites with text only,

or pictures only. It is probably impossible to find a website that is exclusively interactive without the use of text or visuals. Communication within this unique form usually takes advantage of the technology that is available. Thus, a web site usually contains some text, some pictures, and some moving parts or what programmers call content behaviors. Content behaviours can be either dynamic, such as an arrow that a reader chooses to use in order to move through the content, or interactive, like a quiz that provides immediate feedback to the reader. Consequently, any blueprint to predict hypertext comprehensibility must also consider the following elements as they relate to processing difficulty, the nature of: alphabetic text, visual language, and content behaviours or mobility. These elements are discussed next.

Text

The debate between the linear nature of book text and the non-linear nature of hypertext continues in theoretical circles. Although it is important to compare and contrast printed text and hypertext in order to understand the medium of the Web, it is also part of hypertext rhetoric, from an evangelist's point of view at least, to suggest that "hyper is good and linear is not" (Perfetti, 1996, p. 157). The separation of hypertext and linear text has tended to contrast the mediums so that hypertext and linear text appear as two different entities. Instead, there is a distinct intertextuality between text and hypertext that is separated only by the word hyper. Hypertext text has its own set of conventions such as lexica and syntax that make it similar to printed text (Landow, 1997; Tyner, 1998). Many times writers merely insert, through word processing programs, copies of text on the Web that were originally intended for printed environments. This is initially

efficient because it moves the text onto the Web and increases availability, but the new text then lacks the specific conventions of hypertext that make possible its "hyper" readability. "The Web is designed to be hypertextual" (Bolter, 1998, p. 4). This means that scroll bars and outlines need to be added to the web site to make it hypertextually efficient. Without these conventions, the transferred text can be boring or difficult to read because the text lacks a quick entrance into the invisible text on the other side of the visible screen. The text is not broken up into chunks of information and is not outlined to facilitate moving quickly from topics to sub-topics. Instead, readers must progress tediously through each piece of text, page-by-page to find the information they need. Hypertextual guides help the reader considerably since text is also more difficult to read on the computer screen than in a book, usually because there are fewer dots per square inch (dpi) and often because the reader cannot predict the whole content of the web site without some sort of outline (Ware, 2000).

Is hypertext merely non-linear, suggesting it is the opposite of linear text? And if so, should it be an educational goal to teach the reading of non-linear text structure? The non-linear versus linear debate has suggested on the one hand that there is no control or logic to navigating hypertext, and on the other that the opposite is true. Linear text can be controlled and logical. Instead, well-written hypertext is simplified and honed into a very structured state that simultaneously offers opportunities for readers to read the web site in different ways according to their own choices (Nielsen, 2000c). Essentially, the organization of the hypertext is carried out from multiple points of view.

Still, text on the Web does not actually lose its linear quality. As Landow (1997) points out, the text is instead available in a different form. While the text may be linear,

chunks of linear information in hypertext can be read according to the readers' concept of linear, not just the authors' concept of linear. The author offers the reader opportunities to read the text in a multitude of linear ways, or offers a multitude of hypertext trails. This is Horn's term (1989) for the mapping links between hypertext information that the reader can follow. To state that hypertext is non-linear would mean that it had no ties to the readers' conception of text conventions. Hypertext would be the opposite of linear text. Instead, hypertext is simply offered in a different package. Multiple links and connections make up the fabric of hypertext. Thus, instead of a book with a visible beginning and end, hypertext appears to be without beginning and end on the Web, invisible. The reader constructs the beginning and the end.

Economics and forms that meet conventions play a strong role in the shape of a printed text. The conventions of book text are controlled by production, editors creating a publishing environment that promotes materials that suit the conventions of book text. For example, it is more costly to add pictures to print. When given the choice, publishers avoid increasing costs. In the same way, choosing work that is concise avoids the costs associated with length. If text is invisible or follows the metaphors of thought, then book text is no more linear than hypertext, only the conventions of publishing hold published text in this frame of thought. Similarly, complications associated with adding interactivity to websites currently hold web sites in a particular frame of thought. Commonly used, visuals and dynamics change the frame of thought, but to date, do not allow the average web site author the full spectrum of hypertext publishing possibilities.

Linear text has its forms such as letters, novels, and stories; hypertext has it own forms such e-mail, story spaces, and e-stores. Both hypertextual and print text,

nonetheless, follow conventions of order and etiquette, but the meaning constructed in a hypertext can be thought of as more provisional and situational than that constructed through reading printed text. In evaluating web sites for comprehensibility, then, readers must consider where they are in the text (location), and whether the information fits their purpose at any one time (situated comprehension). Visual language also plays a role in hypertext comprehensibility as discussed in the next section.

Visual Language

Examples of visual elements include; movie clips, charts, photos, drawings, icons, clip art, video, graphics, text art, tables, and animations. These elements can be experienced without navigation. However, hypertext processing goes beyond stationary looking, becoming a journey through the architecture established by the web author and enacted by readers. Reading hypertext is a dynamic process. In this dynamic process, connections develop both between the information presented visually, through the use of media literacy, and alphabetic text elements. The journey allows readers to bounce from topic, text block, picture, shape, or micon (movie icon) thus creating associations between content elements. There is accordingly a dynamic quality associated with hypertext comprehensibility.

Horn (1998) describes the interplay of visuals with words as visual language. He describes visual language as: "(1) the integration of words, images, and shapes into a single communication unit, and (2) the use of words and images, or words and shapes to form a single communication unit" (p. 8). Typically, visual sign study or semiology has been about sign symbols and their meanings. Formalist semiology, for example,

categorizes visual primitives such as shape, texture, value, color, size, and orientation; however, visual language categorizes visuals in relationship to a readers' background knowledge and surrounding elements. Whereas formalist semiology identifies the meaning in visuals as a language of its own, as separate elements from text; the new, emerging concept of visual language identifies the meaning of visuals in context. Horn claims that there is an emerging semantics of visual language that he maps into the following broad categories -- the semantics of: (1) tight integration (pictures close to words), (2) visual metaphors, (3) diagrams (representational illustration), (4) cartooning, (5) space, line, and composition, and (6) time (informed by the conventions of film and illustrations). Within Web hypertext, there is little separation between words, shapes and images; therefore, a new language emerges that morphs formalists' conceptions of semiology into another construct -- a new way of looking at viewing and representing images. The relationship between text and visuals thus becomes one of the units of study that leads to understanding hypertext comprehensibility.

Visuals can also provide an instant context or even a motivational "read me first" message. This may be especially true for children or for other readers that have no context for their web search other than the limited vocabulary associated with topic keywords. For example, if readers were to look at a web page about Shakespeare, they may not even have to read an alphabetic headline; a picture of Shakespeare signals readers that they are in the desired topic area.

Electronic writing forms provide visuals not available in printed text. The cursor, for example, signals the presence of the reader in the text. Animations can be made to flash in order to highlight headlines, inviting readers to look in that direction. Color and

light can also be used to divert readers from certain topics and focus attention on other, author-driven information. On the other hand, visual attention can also distract readers from their purpose and compete for attention through such author-generated distractions as ads or poor graphic design (Ware, 2000).

Some theorists project that visuals potentially are the most important entry point for reading web sites (Bolter, 1998; Horn, 1998; Ware, 2000). This speaks to the perception that "a picture says a thousand words". However, a limited number of studies about eye tracking (Lewenstein, 2000; Nielsen, 1994, 1997; cited in Nielsen, 2000a) demonstrate that text attracts attention before graphics. Lewenstein, the principal investigator in a study on eyetracking, found that within the first three points of eye-fixation, a full 78% of the fixations were on text and only 22% were on graphics. These tests were conducted with expert adult readers who may not require the same additional or alternative web site elements as school-age readers to ensure accessibility. Expert adult readers may be more textually responsive or textually aware than students with less alphabetic text experience. Reader purpose, simple browsing for example, may also trigger the use of visual cues while not activating alphabetic cues.

Visuals also provide background. Readers skimming headlines, in much the same way as they read newspapers, may not connect the idea of the headline with adjacent visuals. Yet, through the proximity of visuals to headlines, readers are given more context for meaning-making. The chance for developing meaning is doubled through the use of the two sources. Proximity thus contributes to the opportunity for readers to arrive at meaning through association (Horn, 1998; Ware, 2000).

Just as alphabetic texts in print and online are intertextual, visuals also have their own interart dialects. Some refer to these relationships as intermedial (Semali & Pailliotet, 1999). Static art forms such as Dadaism, Surrealism, Cubism, and Impressionism, manifested through drawing, collage, and oil painting have their own traditions and historical significance in culture and social construction of knowledge. Just as conventional book text, the dialects of art have their place in directing the gaze, mobilizing options and creating complementary illusions that enhance the processing of hypertext.

Content Behaviours or Mobility

Content behaviours, the third category of web site elements is critical in describing the special nature of hypertext. Web authors program content behaviours into their web sites. Content behaviour codes set both alphabetic text and visual language elements into motion. Examples of content behaviours include: the start-up or the stop of animation, clicking on and moving to a different link, and flashing or moving elements set to activate automatically in response to mouse clicks. Content behaviours are different from movies and animations themselves. Movies and animations cannot move unless content behaviours are programmed by the author. Adding content behaviours constitutes the difference between bits and bytes (Liberty, 1999). Bits represent the information and bytes constitute the code that activates the content. Content behaviours allow readers to move through web sites. They make web sites dynamic and potentially interactive.

Readers need content behaviours to move through the existing architectural structure of a web site. Ruffini (2000) states that four structures are used to access pages

within a web site: "Sequences, grids, hierarchies, and webs." (p. 58). Text and visual language elements such as graphic organizers, provide clues directing readers either to subsections within a web site or links to other web sites. Additionally, readers may click on alphabetic text or visual language elements to start a content behaviour. For example, readers could click on a micon (movie icon) to view a movie on a web page. Web authors often provide a basic outline of any given web site so that readers can jump to the information that they prefer. Nielsen (2000c) recommends that web authors provide outlines that are both easy to understand and devoid of clutter.

Within the complexity of navigation, content behaviours can also mislead readers and result in becoming lost. To guard against this happening, web authors often provide graphic organizers that are like road maps or "signs", showing readers either how to return to the home page or where they are located within the web site. As web sites are developed over time, they can become overwhelming to navigate. Assistance provided by graphic organizers, outlines, or "signs" is imperative.

Special interests and reader purpose help readers decide between content-behaviour cues. Potentially, readers can drift aimlessly from interesting topic to interesting topic, forgetting their initial purpose for searching the Web or causing them to become lost in cyberspace. Helpful visuals, such as arrowed icons, guide readers through a particular web site. An underlined sentence may signal topic importance and reader location, or provide directions for linking with additional information. Sign system literacy (semiotics), visual literacy, media literacy, and alphabetic text literacy appear to work in concert when readers process hypertext. Thus, content behaviours are highly dependent on alphabetic text and visual language clues. Reading hypertext, as a

navigational process, also requires readers to use multiple cognitive functions (navigation, context meaning, and background knowledge) simultaneously or carry out multiple tasks at the same time.

Other types of content behaviours interact with readers and allow readers to communicate with a broader community of web users. Some refer to this as the purpose of the Web (Nielsen, 2000c). Complex content behaviours allow readers to obtain feedback from web sites in preprogrammed responses and participate in synchronous, real-time behaviours, for example engaging in chat centers. In educational web sites, content behaviours can serve as tutors. Students can take tests and obtain immediate feedback on their performance. The web site, *Wizeup.com*, for example, sells e-books (electronic books available on the Web for higher education courses), but this web site goes beyond the usual commercial e-book web site. Links to related web sites, optional Web resource material such as other e-texts, guided practice sessions, and online tests come with e-book purchases. This commercial educational site is closer to hypertextual characterization than most web sites of its type, permitting readers to communicate with a greater community beyond the classroom.

Summary Statement

The foregoing literature review has provided the framework for a blueprint to predict hypertext comprehensibility, the two major categories being the "functional semantics of content", juxtaposed against the "functional semantics of rhetoric", with the following categories becoming subsets of each: accessibility, coherence, authority, and aesthetics. Within each of these categories are text, visual language, and content

behaviour or mobility elements. This chapter concludes with a discussion of what is involved in hypertext processing, and the teacher's role in facilitating the comprehension of hypertext.

Hypertext Processing

Colin Ware (2000), a specialist in information visualization, comments that readers see a web page much like an information-gathering searchlight. Using this metaphor, one could infer that readers have either a low or a high beam searchlight and can only shine it in the direction that will help them in their journey. The searchlight prevents them from stumbling on obstacles in their path and helps define what they see on closer inspection. Movement in the dark causes viewers to shine their searchlight in the direction of the unknown (perhaps in curiosity) and because hypertext provides many distractions due to the competing desires of both the writers and the readers, there is an additional burden placed on readers -- to stay the course (their purpose) as they use constructivism to determine what is in view of the searchlight and, based on background knowledge, what they predict lies beyond. The interactive process of reading hypertext is made even more complex by the outlying dialogue (that not in the view of the searchlight). The readers' ability both to see the writer's purpose and to maintain their own purpose and thus process from many points of view is essential in becoming a good hypertext reader.

In a classroom, each child has different literacy needs. That is, each child is not at the same reading achievement level. Visuals and alphabetic text weave in and out of students' cultural experiences and tap different decoding abilities. Since students at different age levels have varied prior knowledge, perhaps the processing of low-ability

hypertext readers as compared to high-ability hypertext readers is different. A clue to addressing this dilemma may be in discovering what individual students find automatic. Possibilities for improving hypertext processing may lie in providing: (1) more background about the topic prior to assigning reading, and (2) more computer experience. Individual differences that limit web site comprehension also need to be identified.

The potential for hypertext to support novice readers does therefore exist. Considerate hypertext can facilitate constructive processing but this potential, unique to hypertext, is not often realized because of the time required to develop reader-friendly web sites. Additionally, web site authors may not be content experts nor see the value of scaffolding web site information. The teacher therefore has an important role to play in teaching students how to process hypertext.

The Teacher's Role in Facilitating Hypertext Comprehensibility

The theoretical discussion of the skills required for hypertext reading has included elements of a web page and analyzing how those elements serve reader purpose. Perfetti (1996) notes that this type of analysis does not deal with the process of reading hypertext. In one sense reader-use forms the *what* and not the *how* of reading hypertext. The process of reading hypertext is concerned with the nature of hypertext, not just the elements, so hypertext readability analysis must go beyond the individual elements and even the message itself.

Navigation on the Web is an individual activity and is often self-regulated. Therefore, the type of blueprint that educators devise to predict Web comprehensibility should account for the freedom of selection inherent in Web surfing. Teachers need to

dialogue with students and openly collaborate with them as they interact on the Web. Teaching is conversation. The following suggestions about the teacher's role in facilitating hypertext processing, based on earlier classroom-based studies by the author (Smith, 1999a; Smith 1999b) and this literature review apply.

1. Background knowledge must be supplemented with visual and cultural coordinates.

2. Skimming must be encouraged to help students deal with the selection of huge amounts of information.

3. Standards in visual arrangement and hypertext mapping need to be taught to prepare students for navigating the web. Students require metacognitive strategies to use the outlines and infer the author's organizational plan.

4. Reading for a clarified purpose and critical inquiry into the writers' purpose(s) also needs emphasis.

5. Emergent morphs of language which surface through textual and visual juxtaposition should be introduced so that students can interpret intermedial relationships in hypertext.

Educators must deal with the reality of the classroom, not the dreams of the highly computer literate. They must consider the wide range of student abilities present in their classrooms as well as the expanded blend of reading demanded by the Web. As indicated in the preceding review of the literature, in order to predict hypertext comprehensibility, educators need to adopt the following pedagogical stances:

1. Adopt an expanded view of literacy -- that is move from conceptualizing literacy as linear to understanding that literacy encompasses both visual and textual worlds.
2. Teach new "textual" rules commensurate with the interactive, dialogic, and multi-linear nature of hypertext. Reading/writing processing must include multi-linear forms.
3. Focus on issues related to reading rate and processing speed – which requires attention to visual perception, the ability to skim for headlines, and infer meaning.
4. Strive for skill diversification and metacognitive control -- hypertext readers must become not only visually and textually literate but also computer literate.

Without developing a totally new theory and vocabulary for understanding the reading process, educators are creating a series of amplified and complementary notions about reading that are growing by leaps and bounds as the Web develops. It is time to make students more metacognitively aware of the multi-disciplinary, multi-medial aspects of reading hypertext. As reading on the Web appears to be as natural as watching and understanding television, an expanded language to deal with processing hypertext is emerging that needs to be understood. Educators can use the World Wide Web as a baby sitter -- much as television has become in some households, or they can provide instruction on how to participate actively and successfully in reading this new media.

Conclusion

This literature review reveals how hypertext is represented as a splintering of literacies. Some elements of these literacies cannot even be characterized adequately unless they are in motion, so quantifying them into a readability formula that makes the processing stand still while researchers measure comprehension seems elusive. Moving literacies are as impossible to place in a snapshot as a movie is to comprehend frame by frame. While a movie is the result of showing the viewer 26 snapshots or frames per second, the result is hardly a movie unless it is moving. Reading hypertext entails dealing with a moving literacy, where the snapshots move but the reader takes control of the speed with which the frames are shown. So, only those that read hypertext can determine its comprehensibility. As web site consumers, teachers need to read hypertext with a critical eye if they expect to engage their students in learning from this multi-literacy environment. Teachers need to dialogue more with students as they process hypertext.

A major tenet of this study is that knowledge of the meta-construction of hypertext can provide a basis for interpreting and processing hypertext. The meta-construction of hypertext involves technological, textual, and artistic constructs. The elements that make up the meta-construction of hypertext are interpreted on a continuum from simplistic to complex. To have students comprehend hypertext, a broad range of rhetorical structures must be delineated. The limited number of studies carried out in this area point to the idea of expanded literacy (e.g., Bangert-Drowns & Pyke, 1999; Nielsen, 1993, 1997; Smith, 1999b). An amazing clarity of comprehension, beyond typical Web surfing should emerge when a broad range of elements and structures become evident to hypertext readers.

The review of the literature will be applied to create a blueprint of hypertext comprehensibility predictors in the next chapter.

CHAPTER III

Methodology

This chapter builds upon the teacher's role in facilitating hypertext comprehensibility introduced at the end of Chapter II. The concept of bringing together diverse hypertext elements for pedagogical purposes frames the methodology of the research. Thus, a global construct of text processing is envisioned, composed of variables associated with the processing of conventional text as well as variables important to processing hypertext (The New London Group, 1996; Tyner, 1998). Accordingly, this chapter begins with pedagogical concerns and then outlines the conceptual model for predicting hypertext comprehensibility which shows that processing hypertext is much more complicated than processing linear text, thus answering the first research question: How is literacy different, given the special nature of hypertext? The design of the study is presented next followed by pedagogical goals. Finally the procedures and the selection of participants are explained along with procedures for data analysis.

Pedagogical Concerns

The interdependence between the reader, the text and the pedagogical goals imposed by the teacher which shape readers' transactions with hypertext are important in addressing hypertext processing. Requiring students to surf and read web materials independently, without prior knowledge of pedagogical goals, places the instructional emphasis on the web materials and may, in fact, place learners in the position of seeking material that is easily accessible rather than information rich in terms of support for topics taught in school. The reading process needs to be balanced by more teacher

intervention before, during, and after students have engaged in Web materials. In developing the blueprint, the investigator therefore worked from the premise that teacher involvement was an essential component of web site selection.

There are several reasons for seeing teacher intervention as a major factor in choosing web sites. First, in two exploratory studies (Smith, 1999a; Smith, 1999b), findings suggested that the task of seeking Web materials was often assigned as an independent activity. If selecting web sites is an independent activity, students require knowledge of pedagogical goals and some degree of computer expertise in order to carry out the search successfully. Locating complex and valuable sites requires advanced search methods. Teachers perceived that students were more computer literate than they were, and that teacher involvement had little value in terms of finding and reading hypertext material. This mistaken view had a direct impact on pedagogy when technology was introduced. Observations showed that teachers failed to provide instruction in hypertext processing. In one of the studies (Smith, 1999b), students demonstrated limited skill in finding and reading web site materials and merely appeared to be experts because they possessed manual dexterity -- being able to move the mouse easily, point easily, and enter search words. Many students were unsuccessful in their Web searches. As a result, students turned to others in their immediate social setting for help. If peers did not have the required expertise or refused to collaborate, then students literally withdrew from the task and stopped their research. It was therefore deemed necessary, in this present study, to not only include teachers' views of how readable the hypertext material would be for their students after examining web materials themselves, but also to include a role for teachers in the ultimate model of hypertext processing.

The Conceptual Model

This study investigated factors that contribute to the difficulty level of hypertext reading materials available on the Internet. This facet of multimedia research contrasts with the study of how best to select web sites, parse web information, measure eyetracking, or even choose one web site design over another. This research is therefore different from studies that investigate web site usability because teachers' expectations of how students are both able and willing to read web sites as sources of information also need to be considered. The study also attempts to reach into both the aesthetic and efferent (Rosenblatt, 1994) layers of Web hypertext processing. In effect, a reading model for predicting hypertext comprehensibility must be based on an examination of hypertext which includes: (1) parts of the (hyper)text, (2) responses to Web texts (including visual texts), (3) movement through and acceptance of text information based on critical judgments, and (4) the relationships between Web text and both pedagogical purpose and student interest. The terms comprehensibility, usability, and readability are therefore used interchangeably because the reading of the Web depends on more than bottom-up or top-down processing; rather, Web reading supported by a constructivist theory of reading comprehension is a transaction between the new ideas on the web page, what readers already know, and the social and pedagogical setting in which the reading takes place.

Krathwohl (1998) states that "evidence of content validity is a representation problem and therefore involves sampling" (p. 428). In the preliminary phase, sample criteria for this study were developed from an extensive review of the literature to delineate: (1) factors that influence the processing of linear, alphabetic text, (2) criteria

related to the processing of hypertext (Horn, 1998; Bolter, 1999), and (3) pedagogical concerns. Several in-depth reviews of hypertext were found in articles by: Bolter (1991, 1999); Duchastel (1989); Foltz, (1996); Horn (1998); Lanham (1995); Laurillard (1993); Lehner (1993); Lunin & Rada (1989); Nielsen (2000); Rada (1989); Rouet, Levonen, Dillon, & Spiro (1996); and Snyder (1996, 1999); (Tyner, 1999); and Ware (2000). A list of elements that are unique to the nature of hypertext was organized into a theoretical framework, and a blueprint was developed from the review of the literature in Chapter II.

This list of elements for predicting hypertext comprehensibility contains two major categories: (a) functional semantics of content, and (b) functional semantics of rhetoric (Horn, 1998). Within each of these headings are four sub-categories. The first of these sub-categories is "Accessibility", having to do with levels of engagement including literate thinking and self-regulation. The second sub-category, "Coherence", is broader than the first and includes the prior knowledge that students need in order to assimilate elements into a coherent whole, including making a bridge between symbolic representations and the sensory experience provided by visual elements. The third sub-category is "Critical Literacy" which addresses the decision-making required to understand and value both information and elements that stimulate navigation. The fourth heading is "Aesthetics", or the design and appeal of the elements. Beneath each of these headings, the elements themselves are categorized into three types: alphabetic text, visual language, and interactive elements.

Processing hypertext. This preliminary conceptual model or blueprint is shown in Table 3 and represents the multiplicity of factors identified in the literature review as having an influence on hypertext comprehensibility. Thus, in answer to the first question

for study, processing hypertext is different than processing linear text as indicted by the accompanying blueprint. Hypertext literacy is different in multifaceted ways – a multitude of factors need to be considered in the processing of hypertext information. A Likert scale of 1 to 5 was added to the model so participants in the next phase of the study could rate each element from least to most important.

Table 3.

Initial Blueprint Used to Rank Importance of Categories

BLUEPRINT Part A **Functional Semantics of Content** "Functional semantics /n/ - The study of the purpose for the inclusion of each element in a visual language communication unit. Hence, the study of what job each unit it doing" (Horn, 1998). Circle a number that represents the importance of the item to students' ability to read the web site, 1= least and 5= most important. No response = not important or irrelevant.					
ACCESSIBILITY: *Outside-the-head* (Zakaluk, 1985) elements of web site TEXT	**Least**				**Most**
❑ Web site is readable at Senior 2 reading level (e.g. as determined by analyzing the text using Fry or Flesch-Kincaid readability measures)	1	2	3	4	5
❑ Web page and theme assignment(s) uses the same vocabulary. Text compares for transfer (has similarities)	1	2	3	4	5
❑ Text includes questions	1	2	3	4	5
❑ Text lists information	1	2	3	4	5
❑ Text is expository	1	2	3	4	5
❑ Text is narrative	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows who (e.g. Picture of Shakespeare)	1	2	3	4	5
❑ Shows where	1	2	3	4	5
❑ Shows when	1	2	3	4	5
❑ Shows examples	1	2	3	4	5
❑ Shows comparisons	1	2	3	4	5
❑ Shows ads	1	2	3	4	5

INTERACTIVE ELEMENTS					
❑ Contains buttons/icons that move the reader through multi-media, text, or visual elements	1	2	3	4	5
❑ Contains links to other sites	1	2	3	4	5
❑ Individual elements are easy to manipulate and operate	1	2	3	4	5
❑ Contains a variety of automatic multi-media elements that make site more accessible (e.g. film clip starts automatically)	1	2	3	4	5
COHERENCE: *Inside-the-head* (Zakaluk, 1985), cognitive artifacts and prior knowledge required negotiate a particular web site	**Least**				**Most**
TEXT					
❑ Flexibility - That is, site is broad enough in textual content to connect to a diverse range of students	1	2	3	4	5
❑ Background - Student must have seen or be familiar with books or stories closely related to this play	1	2	3	4	5
❑ Connections - Student must be able to relate the web page and theme/assignment(s)	1	2	3	4	5
VISUAL LANGUAGE					
❑ Flexibility – That is, site is broad enough in visual content to connect to a diverse range of students	1	2	3	4	5
❑ Background - Student must have seen or be familiar with related TV or movies to connect with ideas (e.g., West Side Story)	1	2	3	4	5
❑ Connections - Student must be able to visually relate web page and theme/assignments (i.e. Blocks of text and visuals have something in common with other class materials.)	1	2	3	4	5
❑ Shows what cannot been seen (e.g., Opening page visuals help make the rest of the web site's organization obvious.)	1	2	3	4	5
INTERACTIVE ELEMENTS					
❑ Interactive elements meet the needs of a diverse range of students	1	2	3	4	5
❑ Student must be taught or have prior experience using web sites' interactive elements (e.g. chat center, MOOs, MUDs, avatars)	1	2	3	4	5
❑ Loading speed does not interfere with ability to access to interactive elements	1	2	3	4	5
❑ Interactive elements are self explanatory	1	2	3	4	5
AUTHORITY: Critical literacy elements	**Least**				**Most**
TEXT					
❑ Web site names web author who is connected to a reputable institution	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows symbol or picture of web author/institution that is well recognized as reputable	1	2	3	4	5

INTERACTIVE ELEMENTS					
❑ Web site gives the impression that it is reputable because it si so well designed for interactivity (e.g., film clips, mini-tutoring session, interactive speech with other visitors), despite lack of visual and textual connections to authoritative institutions.	1	2	3	4	5
DELIGHT: Aesthetic elements	**Least**				**Most**
TEXT					
❑ Headlines motivate students to look through web site	1	2	3	4	5
VISUAL LANGUAGE					
❑ Photos/charts/symbols motivate students to look through web site	1	2	3	4	5
❑ Overall "look" of the web site stimulates interest	1	2	3	4	5
INTERACTIVE ELEMENTS					
❑ Students will be impressed by the technical qualities of the web site	1	2	3	4	5
❑ Multi-media aspects are important motivators because they present a challenge to readers	1	2	3	4	5

Teacher Comments:

BLUEPRINT Part B

Functional Semantics of Rhetoric

"Rhetorical Functions /n/ - Those parts and properties of a communication unit that communicate direction, instruction, organization message, or emphasis and tone to a reader" (Horn, 1998).

"Rhetoric /n/ - 1. originally, the study of the means of persuasion in verbal discourse. 2. the study of methods and means of communication." (Horn, 1998)

ACCESSIBILITY: Inside-the-head (Zakaluk, 1985)	**Least**				**Most**
TEXT					
❑ Guides readers through document	1	2	3	4	5
❑ Shows context of concepts (i.e. web site does a bit of tutoring)	1	2	3	4	5
❑ Keywords and related words focus attention on concepts	1	2	3	4	5
VISUAL LANGUAGE					
❑ Guides readers through document (e.g. arrows, lines, images)	1	2	3	4	5
❑ Shows context of concept (i.e. web site does a bit of visual tutoring)	1	2	3	4	5
❑ Key visual concepts focus attention on theme (e.g., photo of *West Side Story* on a *Romeo and Juliet* link shows that there is a conceptual comparison between *Romeo and Juliet* and *West Wide Story*)	1	2	3	4	5
INTERACTIVE ELEMENTS					
❑ Interactive elements cue the reader on how to act within the web site	1	2	3	4	5
❑ Individual elements are easy to recognize and show where the functions of the interactivity will lead	1	2	3	4	5
❑ Web site functions do no interfere with reading the web site visually and textually (e.g., no annoying pop-up windows)	1	2	3	4	5
COHERENCE: *Inside-the-head* (Zakaluk, 1985), cognitive artifacts and prior knowledge required to negotiate a particular web site	**Least**				**Most**
TEXT					
❑ Student must have prior knowledge of keywords and related words to choose links within the site	1	2	3	4	5
❑ Student must have read the play	1	2	3	4	5
❑ It is obvious by the text, that the web site author must have known which links/text would connect to what prior knowledge students at this grade level would have (i.e. Web author has regard for audience)	1	2	3	4	5
VISUAL LANGUAGE					
❑ Clusters visual and verbal elements (e.g., chart or web diagram)	1	2	3	4	5
❑ Shows contents of concepts (e.g., thumbnail of what is in the next/other section (s))	1	2	3	4	5

❑ Shows overall organization of the web site on opening and/or subsequent pages (e.g. graphic organizer)	1	2	3	4	5
INTERACTIVE ELEMENTS					
❑ Web site is consistent in format with previously negotiated sites	1	2	3	4	5
❑ Student needs a sophisticated level of computer skills to negotiate the web site (i.e. Or they might get lost in cyberspace)	1	2	3	4	5
❑ Student needs previous experience with similar web sites to recognize where the functions of interactivity will lead	1	2	3	4	5
AUTHORITY: Critical literacy aspects that provide clues to authority of the writing	**Least**				**Most**
TEXT					
❑ Web site includes recent date (e.g. "Updated January, 2000". There is a certain amount of authority in the web site being current.)	1	2	3	4	5
❑ Connections – The web site links and connections have logical groupings, associated ideas are located together.	1	2	3	4	5
❑ Text names connections and associations with other authorities in the field	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows movies, pictures, and other visuals associated with other authorities in the field	1	2	3	4	5
❑ Connections – The web site visual have logical groupings, associated ideas are located together.	1	2	3	4	5
INTERACTIVE ELEMENTS					
❑ Web site shows number of visitors and is interactive when student becomes a new visitor (More visitors, more authority)	1	2	3	4	5
❑ Authority of the site in its strong multi-media elements	1	2	3	4	5
DELIGHT: Aesthetic elements	**Least**				**Most**
TEXT					
❑ Provides lightness, humor and/or irony	1	2	3	4	5
❑ Supplies interesting interpretations of the play's elements	1	2	3	4	5
VISUAL LANGUAGE					
❑ Pictures provide lightness, humor and/or irony	1	2	3	4	5
❑ Icons motivate students to look through web site	1	2	3	4	5
❑ Increases impact (e.g. Visual elements are used to influence reader's point of view on the subject)	1	2	3	4	5
❑ Individual sites need a media culture tie-in (e.g., scenes from *Shakespeare in Love*)	1	2	3	4	5

INTERACTIVE ELEMENTS					
❑ Has high level interaction (e.g., avatar, tests with auto-feedback, responses to student questions)	1	2	3	4	5
❑ Interactive elements allow students to express their viewpoint (e.g. chat center)	1	2	3	4	5

Teacher comments:

Additional Questions Underlying the Research

While the blueprint for predicting the comprehensibility of hypertext selections made sense from a theoretical point of view, a primary concern was whether or not the conceptual model had practical significance and addressed pedagogical concerns. The validity of the model was therefore addressed through by the following questions, the first associated with the methodology of the study, and the second with findings:

1. Based on evidence from a literature review and a collection of criterial elements obtained from articles pertaining to web site evaluation, which web site elements, features, or structures best represent a set of criteria, and a starting point, for predicting hypertext comprehensibility?
2. Based on an analysis of the preceding question, how would practicing teachers rank these elements and competencies in regard to their instructional purposes and their students' ability to read web sites?

A formative experimental design seemed most appropriate to investigate these issues.

Design

Formative experimentation is recommended for evaluating problems in technology and literacy (Jacob, 1992; Reinking & Watkins, 2000), especially those problems that deal with pioneering new technology instruction. Formative experimentation is defined by Newman (1990) as follows: "[T]he researcher sets a pedagogical goal and finds out what it takes in terms of materials, organization or changes in the technology to reach the goal" (p. 10). This research therefore considers teachers' goals and is formative in nature.

Pedagogical Goals

In order to take into account the multi-faceted dimensions of hypertext literacy as well as the educational context, it was imperative that the investigator involve practicing teachers in establishing the validity of the blueprint because ultimately, students would become the end users of the technology. The underlying pedagogical goals were primarily to (a) increase the language and perspective of high school teacher participants as they read web sites and selected them for students, and (b) involve teacher participants in making decisions about particular content as well as the rhetorical elements of web sites that influence comprehensibility. Further to this, the pedagogical goal for the teacher participants related specifically to their own instruction and selection of Web materials for a grade ten (Senior II) ELA play called *Romeo and Juliet*. Since students primarily read web sites in isolation, the ultimate goal for the students was to foster self-regulation

or metacognitive skills for processing web contents. The following procedures were thus developed.

Procedures

To begin, the research involved examining the Web from the perspective of what factors might best predict hypertext difficulty. Two exploratory studies (Smith, 1999a, 1999b) demonstrated that most web site text was readable at a grade 9 level or above and that an important part of selecting web sites focused on the set of skills and strategies required to read that site. Since teachers sent students to discover information on a topic being studied in class by conducting a search, it was predicted that teachers had a pedagogical purpose for the activity, and that teachers had an understanding of whether or not their students were capable of reading the discovered material. From these procedures and assumptions, a process for creating and validating the model to describe factors that influenced the difficulty level of hypertext reading materials was established.

Selecting Materials

A typical Shakespearean topic for grade ten (Senior II) students as suggested by the provincial curriculum guide (1996) was selected. *Romeo and Juliet* was chosen. A keyword search led to the selection of 20 web sites that teachers could use with the topic. The procedure for the selection of the web sites was based on using a keyword search and choosing the top 20 web sites that emerged regardless of their quality so that a random selection could be made. The top five hits from searches on *Hotbot*, *Yahoo*, *Netscape*, and *Alta Vista* were selected. The investigator did not intervene by eliminating web sites or by choosing those that appeared to be good matches to the topic; instead, an expert group

(two university professors and three language arts coordinators) commented on the usability of the 20 web sites and ranked them from best to worst. A typical teacher might conduct web searches in a different manner and perhaps this method of selection does not match typical classroom search methods, but it was predicted that a variety of web sites would emerge from this type of search so that web sites would be varied. In this way, the personal bias of the investigator would not influence the choice of web sites and therefore, there was a better chance that web sites would be diverse. The web site Universal Resource Locator (URLs) were assembled onto a list that was forwarded through e-mail to each expert and teacher participant in the study so they could click on web sites and link directly.

Web sites were selected to support a Shakespearean play because the popularity of the topic among students (perhaps due to the movie industry) appealed to English Language Arts (ELA) teachers at this time and provided a greater variety of hypertext than other possible topics. For example, in one of the exploratory studies (Smith, 1999a), the topic was *Who is a Canadian*? Much of the hypertext that was encountered consisted of lists of information with very little text that was either narrative or had literary value. The Shakespearean topic expanded the types of hypertext that were encountered. Further to this, selecting one play rather than a collection of topics under a theme was intended to increase the reliability of responses to the blueprint. The goal was to make a better choice of topic to maximize the number of predictors of hypertext difficulty and at the same time, retain the reliability of responses.

Participants

After the selection of web site materials, as indicated, three groups of educators were involved in the validation of the model. The first group was curriculum specialists or experts who assessed the web sites independently, the second group was high school teachers who rated the hypertext elements in terms of their value for predicting text comprehensibility, and finally the investigator, who used the blueprint to confirm the presence of the elements on the web sites.

Panel of Experts

First, a panel of five experts ranked the 20 sites according to congruence with the outcomes documented in the province-wide curriculum (See Appendix B), rating the sites either high, medium, or low based on their perceptions about usability. The expert group consisted of two ELA university professors with senior high backgrounds in teaching the Shakespearian play *Romeo and Juliet*, one Provincial Department of Education ELA consultant, and two senior high ELA coordinators at the school division level.

The expert group's ranking of the web sites independent of the model was conducted to provide additional criteria about general characteristics of good and bad web sites and congruence with the curriculum. Additionally, suggestions from the expert group were assembled into a table and then included as elements in the blueprint. The next step was to obtain teacher responses in regard to the suitability of the blueprint in order to validate the criteria.

Teacher Participants

In keeping with the second question, it was essential that teachers participate in the study so that data could be verified in the field. First, teachers generally decide the purpose for selecting resource material, and second, teachers would be able to report on the potential readability of web site elements. As Rouet and Levonen (1996) state: "[T] he issue of hypertext usability cannot be reduced to simple comparisons between 'linear' and 'non-linear' presentation of the same materials. Evaluating hypertext requires a multiple-factorial approach, taking into account user characteristics, the type of task performed, and design option" (p. 11). Therefore, the blueprint represented multiple factors, and participants were invited to elaborate on their own observations based on their shared pedagogical goal -- teaching a topic using web sites as a source of material.

Measuring readability, usability, and/or comprehensibility is awkward considering the immensity of the web, competing purposes associated with the development of web sites, the variability of user skill, changes in technology, web site updates, and the variety of available web site material. However, good results from usability studies can be achieved by testing no more than five users and running as many small tests as possible as explained by Landauer & Nielsen (1993). They state:

> The most striking truth of the curve is that zero users give zero insights. As soon as you collect data from a single test user, your insights shoot up and you have already learned almost a third of all there is to know about the usability of

the design. The difference between zero and even a little bit of data is astounding.

When you test the second user, you will discover that this person does some of the same things as the first user, so there is some overlap in what you learn. People are definitely different, so there will also be something new that the second user does that you did not observe with the first user. So the second user adds some amount of new insight, but not nearly as much as the first user did.

The third user will do many things that you already observed with the first user or with the second user, and even some things that you have already seen twice. Plus, of course, the third user will generate a small amount of new data, even if not as much as the first and the second user did.

As you add more and more users, you learn less and less because you will keep seeing the same things again and again. There is no real need to keep observing the same thing multiple times, and you will be very motivated to go back to the drawing board and redesign the site to eliminate the usability problems. After the fifth user, you are wasting your time by observing the same findings repeatedly but not learning much new . . . .the curve clearly shows that

> you need to test with at least 15 users to discover all the usability problems in the design.
> (http://www.useit.com alert box 20001224.html)

Since there were no prior studies that included multiple literacies directly associated with web site comprehensibility, procedures from Nielsen's usability studies were adapted for use in this study to help shape and revise the blueprint through user responses.

To accomplish this task, in Phase II of the study, twenty-five teachers from four urban school divisions were invited to participate in a usability analysis of the selected web sites. In sets of five, high school teachers from a cross section of technological abilities and economic areas, as nominated by principals, superintendents, and coordinators, examined the sites and in a follow-up discussion, collaborated with the researcher in evaluating the blueprint elements. The investigator used jot notes during the rating of the web site elements and in the follow-up discussion to record participant observations.

All the suggested participants had experience with teaching *Romeo and Juliet.* The participants ranged in teaching experience from one to over 25 years. All teacher participants rated their own computer skills on a scale from 1 to 7 so that a range of computer expertise could be verified. Levels of expertise ranged from 1, technophobic to 7, web site designer or expert user.

Nielsen and Landauer (1993) determined that participants in useability studies should include a range of technological ability to represent the reality of web site use, so if the recommended participants had appeared to come from only one level of expertise,

such as web author, additional participants from a different level could have been recruited. Also, user ability was not directly connected to how users were affected by web sites. Finally, all efforts were made to have a representative distribution of teacher ages and gender. There were 11 males and 14 females participants. Teacher participants were not asked to give their chronological age but they were asked how long they had been teaching the play *Romeo and Juliet.*

Teachers were instructed to keep the purpose of the topic in mind. They then responded to each element using a scale of one to five. Teacher responses represented their prediction of how each element made hypertext more (5) or less (1) readable for students. That is, they were concerned with the ability to read the hypertext on the web site as a whole, the relationship between the web site and the classroom topic, and the degree to which they believed students would become engaged in the web site. In the same manner as teachers predict and read along with their students using traditional texts, this task obliged teachers to consider the process of reading the Web. They took the same journey that their students would take in reading web sites. The teachers predicted the comprehensibility of the sites by applying the criteria in the blueprint.

The task was to examine the set of selected *Romeo and Juliet* web sites and to decide, using a Likert Scale from 1 to 5 (1 = least, 5 = highest) which criteria predicted comprehensibility. Participants individually rated the blueprint elements while the investigator guided them through the blueprint by: (1) explaining unfamiliar terminology, (2) asking for comments, and (3) collecting final responses. The blueprint was revised based on the feedback from each set of five teachers.

Review of the Web Sites by the Investigator

The analysis of the web sites by the investigator provided a third point of reference to confirm the opinions of both the curriculum specialists and the classroom teachers. The main purpose for this counter-check was to question the web site writer about what was actually on a web site; however, there was an added advantage to this analysis. Compared to what was actually there, both the expert group and the teacher participants held different *impressions* of what was on the web sites. This revelation was interesting in that it demonstrated that some inconsistencies exist between visions of hypertext and hypertext construction.

The 20 selected web sites were analyzed by the investigator, element-by-element online using the blueprint. Elements were rated using a three-part scale: (1) element not present, (2) element somewhat present, and 3) element fully present. For example, if the web site element under scrutiny was "readable at the senior II [grade 10] level", and if the web site was clearly readable at a senior IV level (grade 12) or above, the element was considered to be "not present". If the web site was readable at a Senior II level, for the most part, the element was considered to be "somewhat present". Finally, if the web site was entirely readable at the Senior II level, then the element was considered to be "fully present". A table showing the presence of elements appears in Chapter IV.

Data Analyses

Data obtained from each of the five sets of teachers provided feedback on the efficacy of the blueprint and were analyzed by the method of constant comparison (Lincoln & Guba, 1985; Taylor & Bogdan, 1998) in order to identify themes and derive

grounded theory. In the constant comparative method ". . . the researcher simultaneously codes and analyzes data in order to develop concepts. By continually comparing specific incidents in the data, the researcher refines these concepts, identifies their properties, explores their relationships to one another, and integrates them into a coherent theory" (Taylor & Bogdan, 1998, p. 107).

Summary

In addition to providing a blueprint to predict hypertext comprehensibility based on a literature review, this chapter stresses the importance of considering pedagogical goals in the conceptualization of hypertext processing. Curriculum experts, classroom teachers, and the investigator evaluated 20 selected web sites related to the Shakespearean play, *Romeo and Juliet*.

Input from participates resulted in revisions to the original model or blueprint that was developed from a review of the literature. The validated model and its characteristics, to be used in predicting the comprehensibility of web site materials, are presented in Chapter IV.

CHAPTER IV

Analysis of Results and Discussion

In answer to the first question for research, this chapter begins with a discussion about the special nature of hypertext and then, based on feedback from participants, goes on to describe what might enhance the blueprint to estimate hypertext comprehensibility. Finally, there is an analysis of the actual web sites using blueprint criteria. A summary of results and the presentation of a validated blueprint conclude the chapter.

The data collected in this study provided a theoretical overview of the nature of hypertext by connecting suppositions about theory as they applied to hypertext processing in school settings. Constant comparisons (Lincoln & Guba, 1985; Taylor & Bogdan, 1998) between theory and practice were made as participants rated and defended their web site rankings using the proposed blueprint for predicting hypertext comprehensibility. Teacher ratings and responses helped shape and validate the blueprint. The questions posed at the beginning of the investigation serve as an organizing framework for reporting the results of the data analysis. These questions were:

- How is literacy different, given the special nature of hypertext?
- What recommendations can be made to teachers regarding the selection and reading of hypertext materials, and what recommendations can be made in order to enhance hypertext reading?
- What elements would contribute to a useful instrument for predicting hypertext comprehensibility?

How is Literacy Different Given the Special Nature of Hypertext?

This question was addressed in both Chapter II and Chapter III and explored further when participants were introduced to the study. The literature review helped establish a blueprint for creating a hypertext predictability model but participants soon confirmed that theory was somewhat different from practice. Teacher discussions related to evaluating the web sites revealed, overall, that participants recognized hypertext literacy is more complex than conventional literacy because multiple literacies are involved -- computer literacy, multi-media literacy, cultural literacy, and linear text literacy. Steeped in a tradition of linear text literacy, many participants reported that they did not feel comfortable on the Web and used it tentatively with their students. Teachers were undecided about the value of the web for several reasons:

1. More than half of the participants reported that their students knew as much or more about the Web than they.
2. Teaching purposes could be more easily realized without the Web. For example, sharing, reading responses with others, an activity well suited to the Web using e-mail, could, they believed, be accomplished more simply through class discussion.
3. Censorship filters prevented natural use of the Web because the filters blocked out topics such as "love and loyalty" that related to the topic *Romeo and Juliet*.

4. Equipment was not readily available or working properly; solving breakdowns made teachers feel as if they were computer teachers rather than ELA teachers. Too much effort needed to be expended for so little gain.

5. Web sites themselves, in their opinion, were not very stimulating compared to what could be learned in class.

Further to this, all participants were very receptive to learning anything about the Web that might facilitate using technology more effectively. Two of the 25 participants were confident web users and authors who write web pages for professional English Language Arts organizations. Two other participants had barely any personal web experience, expecting their students to access the technology on their own. Yet, surprisingly, teacher responses to the blueprint did not vary substantially.

Logistical problems such as booking the computer lab for a class were not insurmountable. All teachers believed, that if they wanted, they could gain access to computers. One school even had a special English Language Arts computer lab not only attached to the classroom but also maintained by a computer technician. The decision to use or not use the Web came down to pedagogical purpose.

Participants perceived that the Web would suit them for one of two reasons: to motivate students or to supply additional printed material for course work. When participants used the blueprint, they were either biased toward print or toward visuals according to their pedagogical purpose. Visuals seemed to translate into factors that would motivate students and print seemed to translate into factors that would provide additional materials to supplement what students were doing in class. All participants

valued visuals in combination with Web text and saw visuals as an important and necessary part of web sites. There was general acceptance for the idea that web sites should contain visuals and some interactive elements, although interactive elements were less valued than visuals.

All participants expected web sites to be self-explanatory, as well as accessible to students without the need for external guidance. This contrasted with the general classroom expectation that students would require assistance to understand Shakespearean writing. Perhaps participants expected less depth in web site documents or that visuals would make web sites easier to understand. If web site materials had depth, the documents would be printed and examined more closely at a later date. Altogether, teacher impressions of literacy on the Web were different from their conceptions about literacy in the classroom, especially pedagogically.

Conclusions

The following conclusions in regard to Questions 1, how is web site literacy different given the special nature of hypertext, were drawn from participants' interactions with the blueprint and the ensuing discussions:

1. Web sites should be "good enough" to enable students to read web materials on their own with no teacher support.
2. Web sites should be considered independent reading material, separate from materials used in class instruction.

3. Facility with the technology, or willingness to play, gave teachers the impression that students were expert at reading web materials. Students were presumed to be less technophobic than teachers.

4. Re-reading web documents was considered irrelevant and only deemed necessary when web materials were highly related to the topic and thus worthy of being printed.

5. Interaction with a larger community of users at other schools and in other jurisdictions to increase collaboration and enrich instruction was not generally encouraged or provided for as a facet of Web reading.

6. Visuals were generally valued for aesthetic and motivational purposes rather than efferent purposes.

7. Web sites recognized as having merit though the granting of an award from an outside agency were less valued than, for example, an award-winning literature selection. Web materials were not trusted.

8. Elements of graphic design such as text placement, colour, text blocks, and visuals that harmonized were considered essential but what teachers considered "good" was not consistent.

9. Textual, visual, and content behaviours were valued.

10. Scaffolding and tutoring elements contained in the web site were appreciated but not seen as related to the teachers' role.

11. Homogeneity between web sites and even on a single web site was considered boring and less valuable in relationship to comprehensibility.

12. The reputability of web sites was viewed as having more to do with the social/cultural connotations of web elements than with web content itself. Participants were not willing to acknowledge the credibility of a web site unless they could personally connect some reputability to their own experience and background.

13. Participants wanted web sites that motivated students to read beyond the first page. They perceived the first page as a hook and an entrance to other connected pages.

14. Ads were considered elements that students would ignore. Teachers believed that ads had little impact on readability except they conceded that some ads might be useful for informing students where associated products could be purchased.

Generally, the teacher participants perceived that in hypertext reading, students are exposed to both good and bad information over which the teacher has little control. Instead, the locus of control is turned over to the web site and the student. In a social constructivist classroom, however, few teachers would expect to assign the reading of linear text and have students report back later. Instead, there would be mutual interaction and discussion with the text. Active, online reading and "talk" to facilitate learning would be encouraged. Currently, in the presence of technology, reading is seen as an objectivist's task. The knowledge is presumed to be out there.

A delineated in the next section, the second question that guided data analysis was concerned with making recommendations to teachers in regard to both hypertext selection and classroom instruction using hypertext.

What Recommendations Can Be Made Regarding Hypertext Comprehensibility?

Recommendations for comprehending hypertext emerged from the data that were collected from both the curriculum specialists as they independently interacted with web sites and the teachers as they interacted with the web sites using the blueprint. A third source of information was the investigator's analysis of the twenty web sites used in conjunction with the blueprint. What follows is a description of: (1) the responses of both the curriculum specialists and teacher participants as they examined the web materials; (2) the investigator's critique of the 20 web sites; and (3) a list of recommendations pertaining both to hypertext selection and classroom use.

Responses of Curriculum Specialists

The five curriculum specialists were asked to rank and comment on the suitability of 20 randomly selected web sites, rating them from best (1) to worst (2), keeping in mind the curriculum connection and the classroom usability of the hypertext as related to the play *Romeo and Juliet*.

Findings

Based on the ratings of the 5 curriculum specialists, there were few agreements about top ranking web sites, excluding web sites #4 and #15. However, four curriculum specialists ranked web site #4 among the top five and one curriculum specialist ranked it second last. Also, although 4 out of 5 curriculum specialists ranked web site #15 among the top five, curriculum specialist #3 rated the site as not appropriate (NA) to use in

conjunction with the topic. Thus, the ranking of web sites failed to produce gross indicators of high, medium, and low usability.

Curriculum specialists' descriptions of their ranking may explain why there was little agreement. First, all curriculum specialists agreed that ranking the web sites was a frustrating task because of difficulties associated with remembering what was in a particular web site. All curriculum specialists were either mildly or seriously agitated by the task of ranking 20 web sites. Specialist #1 thought that the web sites took too long to rank and were widely disparate, making the task difficult. Specialist #2 found that ranking web sites without a specific lesson purpose in mind was too cumbersome. Specialist #4 thought that ranking so many web sites with so much variety, both within and across sites, made the task "artificial and cursory".

Nonetheless, two classifications emerged from the discussions with curriculum specialists' about their web site rankings. These are summarized in Table 5 according to: (1) preferred web site characteristics and (2) dislikes. Four curriculum specialists preferred web sites that were student rather than teacher-oriented, as if they expected that students would be using the web sites more than teachers and without direction. The fifth curriculum specialist stated that sites should be equally appealing to both students and teachers. A variety of visuals, links, and contents was another characteristic preferred by four out of five experts. Dislikes included the presence of commercialism and uninteresting content. Any web site that appeared to be "boring" because it had too much text or too many visuals received a low rating. Balance between visual and textual information appeared to be a desirable characteristic.

Table 4.

Web Site Characteristics: Preferred and Not Supported

CURRICULUM SPECIALIST	PREFERRED WEB SITES THAT:	DISLIKED WEBSITES THAT:
#1	Possessed • Broad background information • Lesson plans • Field-tested information • Variety • High student-oriented information	Were • Inferior to student work • Commercial • Out-dated
#2	Had • Student-orientation • Pre-study activities • Many visuals • Questions	Were • Resource-based
#3	Were • Engaging rather than entertaining, • Motivating • Academic and complete Had • Variety • Good examples of web site writing • Many links • Good layout, formal structure • Information and processes to make connections to other learning	Had • Too much glitz which turns off highly academic students who only want text and supporting visuals
#4	• Coincided with a pre-set provincial protocols • Were written for students rather than teachers	Had • Too much variety
#5	• Grabbed student attention • Had many links That presented • Great visuals and glitz • Cultural links (eg. current movies) • Variety (texts, pictures, tests) Were • Of equal interest for both teachers and students • Models for student web site writing	That presented • Information falsely Contained • Commercialism • Text that was stuffy and difficult to read • Prejudice toward ethnic/intelligence groups

Responses of Classroom Teachers

Teachers were eager to participate in research about the Web. Specifically, they were interested in the influence of visual language on readability. A distinct bias toward either text or visuals was evident in teacher responses depending upon the author's

purpose for developing the web site and their own pedagogical goals. This finding suggested that text-based thinking might influence the selection of web sites. Further, if teachers were to focus on textual cues almost exclusively, other comprehension cues of benefit to hypertext users might be entirely overlooked. Visuals, for example, can motivate and ease readers through difficult sections that would otherwise be inaccessible. Similarily, text alone may deter readers unless their purpose is tightly tied to the text that is offered. On the other hand, in a surfing medium, long text or too many visuals might not motivate readers/users.

The set of themes that emerged from applying the method of constant comparison (Lincoln & Guba, 1985; Taylor & Bogdan, 1998) to the data obtained from the teacher participant groups is presented next.

Themes

Recurring themes focused on: (1) the descriptors or terminology used to identify web site elements, (2) technological considerations, (3) issues related to student motivation, (4) critical literacy and advertisements, (5) student ability, (6) the role of the teacher, and (7) pedagogical goals. Terminology used to explain web site elements was the most contentious theme associated with refining the blueprint. This theme is discussed first.

Terminology. Language terms needed to hold meaning for both expert and novice users. The initial set of five teachers who worked with the blueprint was unduly influenced by the word "delight" that was originally used to describe aesthetics. To them, the word "delight" implied superficiality. As a consequence, the category "delight" was

re-labeled "Aesthetics: design/appeal". Another descriptor that caused concern was "Interactive Elements". The intention of this term was to be clear about web site items that moved, but participants interpreted this descriptor more broadly to encompass such web site features as e-mail. Additional hypertext elements, such as moving text or animations, also did not fit the descriptor of "Interactive Elements" in that moving text and animations cannot be classified as interactive. The term "Interactive Elements" was subsequently changed to "Content Behaviours", which appeared to hold more meaning because it encompassed a broader set of elements, both interactive and moving. Therefore, any element that had motion was placed in the category of "Content Behaviours".

Terminology again emerged as a theme with the third group of teachers. One participant remarked: "Keywords are really important" to readability because the students read in a shallow manner to get the gist of what lies below the keywords or headlines. She continued: "Reading is like a scavenger hunt . . . . those who have low computer literacy skills need almost to accidentally get to the sites through this" (She meant keywords that move readers through web sites.).

The third group of teacher participants suggested that some items were in the wrong categories and needed to be moved. Re-clarifying items created a set of redundancies, pointing to a larger problem with the blueprint, and challenging the main categories: "Functional Semantics of Content" and "Functional Semantics of Rhetoric". Perhaps the rhetorical could not be separated from the content. Perhaps all content is in some way rhetorical. However, it was the notion of aesthetics that prevented a merger of the two major categories. Some elements are simply not aesthetic unless they are meant

to communicate. One such item was the rhetorical item "humour" because it is a response-based element.

Despite these concerns, when the third group participated, the blueprint seemed to be working since this group of participants was able to complete their rankings in far less time than the first two groups. This group also required less instruction. The blueprint terminology seemed more self-evident. One participant completed the blueprint in less than ten minutes, not because she was technologically savvy or because she was disinterested, she just found the descriptors sufficient. This participant was the first to complete the blueprint on her own without much assistance or explanation from the investigator.

The next theme to emerge was technological considerations.

Technological considerations. Several technological considerations appeared in the first group's comments. In one participant's school, computers did not have sound cards. The full multi-media experience of the Web was therefore not available for her students. This participant also stated that filters were problematic to senior students because the filters blocked good as well as inappropriate web sites. Another participant stated that diversity of web sites was paramount. This participant wanted students, as a group, to have both technologically challenging and simple-to-read web sites stating, "Diversity is a high priority". Overall, the participants agreed that they wanted the technology to be easy for students to use. They did not want computer problems to interfere with use. On the other hand, three of the first group of five teachers believed that the use of web sites would detract from learning. They were ambivalent about a media/culture tie-in such as a video clip about *Romeo and Juliet* on a web site. One

participant even commented: "It could be distracting," suggesting that this participant's priority centered on using alphabetic hypertext.

Participants in the second set of respondents made several comments related to technology and motivation. One suggested that "excitement dies early", that working with the computer should be "smooth". In his opinion web site design should facilitate ease of operation. Supporting this same idea, another participant stated that the heuristics of the web site should allow students to "learn as they go". Web sites should provide novel information that inspires students to "read further, explore the web site further". On the topic of technological considerations, group two noted that slow downloads did not affect readability, but that slow downloads were lethal to student motivation.

Filters were another technology issue bothersome to this group on two counts. They believed: (1) teachers should do the editing of web sites on their CD tower because filters block out too much good content, (2) keyword searches for words such as *love* or *loyalty* used with ***Romeo and Juliet*** could not be used with filters because the filters blocked such search words as "love".

One participant, who perceived himself as having little or no technological experience, provided interesting and different responses than the other participants. He stated that, "[T]he classroom was more important than tutorials on the Web". He wanted the web sites to be serious and not to contain "lightness or humour" that might distract from the seriousness of the pedagogical topic. He did not want students to express their opinion on the Web, communicate with other peers on the Web, or interact with web site elements. He commented that the Web was "more for information -- like a library", a use

similar to that associated with alphabetic hypertext. Other participants contended that visuals and content behaviours would be motivating.

Yet another participant in group four made comments about classroom authority in relation to tutorials provided on the Web, "I generally let students check out their own web sites. I use it [the Web] more as an information-gathering source than a tutoring tool. I am the teaching vehicle . . . . the Web is only one of the sources for materials". This participant was more frustrated with accessing the lab and then waiting to get online. It was clear that this participant rejected technological issues in favour of sustained classroom talk. All of the participants commented that students generally know quite a bit about web sites, several stating, because "they spend more time surfing or playing on the Web" than teachers.

The next theme to emerge was student motivation.

Motivation. The presense of advertisements raised the issue of student motivation. It seemed that participants believed that just using the Web with all of its "bumps and scars", such as advertising only represented web sites realistically. Ads, some participants believed, might be motivational to students. Surprisingly, most participants thought advertising was inconsequential and that students would simply ignore ads. Participants stated that given a strong purpose for searching the Web, students might even find advertising interesting since they could see products connected to the topic.

The literature review also showed that critical literacy would be enhanced by the presence of ads. Moreover, participants did not think ads had any effect on readability, although ads may constitute "cognitive overhead", or in layman's terms "too much information" to make the message clear. One participant commented: "It depends on

whether you use the Web to make the assignment", suggesting that some decisions regarding readability depend on whether a teacher starts with web materials to support pedagogy, or starts with printed text and then sends students off on their own to search web sites for materials. Accordingly, the item "the web site shows ads" was not dropped from the blueprint. Teachers seemed to think that the presence of advertisements provided a useful opportunity for web site critique. Critical literacy connected to ads therefore emerged as another important theme.

Critical literacy. The theme of critical literacy surfaced in discussions with group two. Teachers did not seem to believe that ads influenced text processing and consistently rated this item as either 1 or 2. Perhaps participants skipped over the ads as they read for main ideas. The metaphor of the flashlight that Ware (2000) used to describe multi-medial reading relates to this phenomenon. Learners simply do not have their searchlights shining on ads as they read. Consequently that type of cognitive overhead disappears from view.

Other blueprint items under the category of critical literacy could not be dropped because they were identified in the literature review. One was "awards won by web site" and another was "recent date of web site". Some participants in group four believed that awards could be falsified and that a "500 year-old play" did not require a recent date.

Group four believed that students did not need to be critical of web sites because filters weeded out inappropriate material and reduced the number of critical issues. A broader range of items was therefore added under the category of critical literacy, extending beyond elements that might harm students or represent poor choices based on physical attributes (e.g., date on web site). These included items to address bias and

deception such as the "text can be verified through paper resources" and "the site indicates award won", thus requiring users to consider symbols and connections to authoritative sources.

Several varied notions of authority came forward. One participant stated that connections to reliable authorities could be falsified. Awards could be "faked", thus implying that web site authority would always be disputed if taken only at face value. To be a good judge of authority, one would have to know one's topic from sources other than just the Web. One participant commented: "text is more important" as an indicator of authority over visuals and content behaviours. One participant felt that the Web itself had more commercial bias which other printed sources did not share.

The participants expected that students would "intuitively" seek out resources on the Web. Otherwise, they would dismiss or not even bother reading web sites. In their view, hypertext readability also involved choosing to read or not to read, whereas, with printed text, students would be expected to read what the teacher assigned. With hypertext, students could simply move to another web site if the one they were reading was found wanting. On the one hand, teachers believed that they needed to provide sufficient hooks to motivate students to examine particular web sites. On the other hand, teachers did not seem to want to preclude students' innate desire to surf the web. Teachers suggested that speed and purpose for reading influenced both what and how readers would choose to process hypertext. Student ability also emerged as a theme.

Student ability. The teacher participants believed that web site variety was desirable because an assortment of materials could help address the needs of a diverse group of learners: "Some students may have no experience [with the Web] and still need

to get something out of it". One participant commented that the International Baccalaureate program (IB) changes the concept of hypertext comprehensibility, that more advanced and less heterogeneously distributed students would read web sites with a different purpose. Therefore, in some cases, the focus on certain types of web elements would be less important. This participant talked about alphabetic text readability being less important with advanced readers. Lack of sophisticated content seemed to be an issue. Another participant noted that more advanced students do not gain a lot from using the Web for research.

Group three thought that web sites should contain a lot of visual, textual, and media effects but that links to other sites were not important since students should make their own links through the use of search engines. A good web site should stand on its own without a plethora of links. Another participant stated that she did not have the "patience for trite sites", indicting that a certain amount of web site sophistication has to be present in the hypertext itself. This participant indicated that she would like to see web sites that are (a) created by teachers, (b) eyecatching, and (c) fast.

One participant from group five, a web master, had further comments of interest. He stated that the response to the item that read "technical qualities will impress students" would be very different in elementary school, meaning that in his elementary school experience using the Web, motivation was achieved with technical bravado.

The role of the teacher. Participants felt that they trusted a site more when the author's biography appeared on the site. There were differences in opinion about the teacher's role in helping students find web sites, however. Although it was conceded that students would most likely read web sites independently, some group members would

prefer more teacher involvement. Other participants believed nearly the opposite, stating: "I like [having students] looking and searching on their own". Some teachers referred to the nomadic aspect of surfing the Web as if reading were a discovery event. In the end one teacher concluded: "My students are visual".

Another participant spoke about teaching styles when the Web was used. She said she would not care about the currency of the web site: "not for a 500 year old play". There was also some caution expressed about the element "communicating with a broader community, through e-mail for example", that communicating with others should be an activity controlled by the teacher. Yet another respondent said that divisional filters prevented this and they would appreciate more freedom from filters. Whereas a third participant said, "We're just beginning to appreciate, to understand and use the Net as an educational support, and we are unaware of its dangers".

Another theme that emerged was related to pedagogical goals.

Pedagogical goals. Diversity of web site material was important to every participant, especially to those in group three. Teachers referred to the purpose the Web served in their assignments and how purpose would determine how elements were read and interpreted. One participant, who appeared to be a technological determinist, stated: "There are no homogeneous groups in education . . . . Technology allows for the diversity in our teaching". He further stated that teachers need to use "the machine" in the context of student learning, implying that hypertext should not be used as a tool or an add-on, but an integral part of a social constructivist classroom.

Some of the participants stated that they would not use the Web as a single source of information for their pedagogical topic. One participant said that her "main concern"

for using the Web was motivation, implying that the Web would constitute a type of "play" for students but not an entire information source for serious study. Another participant, reacting to the level of playfulness on one of the web sites, stated that student "opinions at [age] 14 or 15 will change". This participant was concerned about the authority of web sites opinionating students on a subject. She worried that web site tutorials could be misleading. She wanted students to be the "originators of their own opinion". Secondly, she was concerned that making the "sophisticated parts of a web site too simple" would mislead students. They would think that developing web sites was easy. Then, when they were actually required to author their own web sites, they would become discouraged because it was a lot harder to make sites look sophisticated than they were led to believe. Finally, she said, "I am a guide [for web site use]. I want the web site to be a guide, too -- match my teaching style and be process-oriented".

Blueprint Modifications

After each teacher completed the blueprint for predicting hypertext comprehensibility, they were asked to make further suggestions. For example, the first group of five teachers suggested that more checklist items should be added to the blueprint such as: (a) author's biography is included, (b) funding source is included, (c) text scrolls, (d) web site performs like a tutor, (e) multi-media aspects challenge readers, and (f) allows students to communicate with a broader community (e.g., e-mail or chat room). These suggestions were considered in the constant comparative analysis and judiciously added, deleted, moved, or revised.

It was obvious that elements within the blueprint were functioning by group three and much better by group five. Yet, there were some gaping differences between the responses of participants that considered themselves computer literate and those that did not. It seemed that there was a tendency for participants with the least technological experience to be more text bound and those with more technological experience to be more visually and content behaviour (navigation, interactivity) bound. One of the participants said, "Visuals are meant to simplify the text". Although participants seemed to respond to blueprint elements in relatively the same manner, more technologically experienced participants commented more often about the global nature of the Web and the importance of communicating with a broader community. It seemed that the more experience participants had with web sites, the more they expressed favourable responses to visual language and content behaviour elements as texts unto themselves with their own message.

A less technologically experienced participant commented that multi-media should just "enhance the [alphabetic hypertext] text -- students can get off topic -- chat is abused in our society". This response seemed natural, since less experience with the Web would entail less experience with these elements. Still, to help clarify such personal views, it seemed necessary to add a rating at the end of the blueprint to identify where users would place themselves on a scale of one (novice) to seven (expert) in terms of technological "know-how". Further reflection from observing teachers rate blueprint elements one by one showed that participants would learn more about what they thought influenced web site comprehensibility by using a self-evaluation scale in conjunction with analyzing their overall results. Accordingly, a technological rating scale was

developed and introduced when group four participants rated the web sites. This summary rating focused on pedagogical purpose, teaching style, and how these matched student concerns.

The value of tallying up blueprint responses became evident when the fourth group rated the web sites. Summarizing what elements they valued least and most and looking for a pattern in their responses helped participants realize whether they had a balanced view about factors that influence hypertext comprehensibility -- or whether they were unduly partial to certain elements such as visual literacy. Filling in the blueprint seemed to hold more meaning when teachers completed the self-evaluation checklist and synthesized how they had rated the various web site elements. Knowing their own bias would inform their teaching. It was decided that the fifth round of participants (teachers #21-25) would also complete the self-evaluation checklist about their expertise and teaching style. These ratings are contained in Table 5.

The experience of the final group in using the blueprint to rate the web sites was the most satisfying. Adding the summary rating to the blueprint helped participants reflect on their own use of the Web. Comments included: "As the grades progress, the emphasis changes [from motivation to supplementing research materials]". "The Web can hook kids 'on site' but once in, accessibility becomes more important". One participant stated that although her concerns were for accessibility and critical literacy, aesthetics added impact to these elements, suggesting that there is an intermediality between and among hypertext elements that makes them inseparable.

Table 5.

Technological Expertise: Self-Rating Scale Completed by Group 5 Teachers #21-25

Item	Scale/Category	21	22	23	24	25
I rate my own computer skill as:	Technophobic 1-7 Web author/computer literate user	4	5	5	7	3
I rate my students' skill as:	Technophobic 1-7 Web author/computer literate user	3	5	5-6	6	5-6
I mostly use web sites to:	(a)motivate students or (b) supplement research materials	b	b	b	a, b	a
My teaching style with web sites is mostly:	(a) student directed (b)teacher directed or (c) shared	b	c	c	c	c
My teaching style is best complemented by web sites focused on:	(a) textual (b) visual language or (c) content behaviours	c	b	c	a	b
My students will be most interested in web sites focused on :	(a) textual (b) visual language or (c) content behaviours	b, c	b	c	a	b
I am most concerned with web site:	(a) accessibility (b) coherence (c) critical literacy (d) aesthetics	a, c	b	d	c	c
I am least concerned with web site:	(a) accessibility (b) coherence (c) critical literacy (d) aesthetics	b	a	c	d	a

Summary

In summary, considering the input from each of the five sets of teacher participants, the following factors appeared to be most important in influencing the actual reading of hypertext on the Web: (1) the actual elements of the Web (a snapshot of what is there at any given moment), (2) readers' perceptions as they focus on elements -- *what* readers actually focus on, and depth of understanding, (3) readers' critical judgments that influence staying or leaving (what influenced the decision-making); and (4) affective domain considerations that are woven into the decision-making process as readers navigate the Web.

In keeping with the premise that teachers must be involved in the process of validating a conceptual model for predicting hypertext comprehensibility, a table summarizing elements that were added, deleted, moved, or revised appears in Appendix C. The table is based on the input of the 25 teachers from the first to the final draft, not including interim changes.

The final copy of the blueprint as refined and validated by teachers is presented next. The question of what elements contribute to a useful instrument for predicting hypertext comprehensibility, the third question for study, is considered following the blueprint.

Table 6.

Final Blueprint Used with Group Five

BLUEPRINT Part A **Functional Semantics of Content** **"Functional semantics /n/ - The study of the purpose for the inclusion of each element in a visual language communication unit. Hence, the study of what job each unit it doing" (Horn, 1998).** **Circle a number that represents the importance of the item to students' ability to read the web site, 1= least and 5= most important. No response = not important or irrelevant.**					
ACCESSIBILITY: *Outside-the-head* (Zakaluk, 1985) elements of web site	**Least**				**Most**
TEXT					
❑ Web site is readable at Senior 2 reading level (e.g. as determined by analyzing the text using Fry or Flesch-Kincaid readability measures)	1	2	3	4	5
❑ Text lists information	1	2	3	4	5
❑ Web page and theme assignment(s) uses the same vocabulary. Text compares for transfer (has similarities)	1	2	3	4	5
❑ Text is expository	1	2	3	4	5
❑ Text is narrative	1	2	3	4	5
❑ Text includes questions	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows who (e.g. Picture of Shakespeare)	1	2	3	4	5
❑ Shows where	1	2	3	4	5
❑ Shows when	1	2	3	4	5
❑ Shows examples	1	2	3	4	5
❑ Shows comparisons	1	2	3	4	5
❑ Shows ads (ads could be for products such as books related to subject)	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Contains interactive elements	1	2	3	4	5
❑ Contains links to other sites	1	2	3	4	5
❑ Long text has scroll bar	1	2	3	4	5
❑ Contains a variety of automatic multi-media elements that make site more accessible (e.g. film clip starts automatically, animated figures)	1	2	3	4	5
COHERENCE: *Inside-the-head* (Zakaluk, 1985), cognitive artifacts and prior knowledge required negotiate a particular web site	**Least**				**Most**
TEXT					
❑ Flexibility - That is, site is broad enough in textual content to connect to a diverse range of students	1	2	3	4	5

❑ Connections - Student must be able to relate the web page and theme/assignment(s)	1	2	3	4	5
❑ Background - Student must have seen or be familiar with books or stories closely related to this play	1	2	3	4	5
❑ Student must have read the play or parts of it	1	2	3	4	5
VISUAL LANGUAGE					
❑ Flexibility – That is, site is broad enough in visual content to connect to a diverse range of students	1	2	3	4	5
❑ Connections - Student must be able to visually relate web page and theme/assignments (i.e. Blocks of text and visuals have something in common with other class materials.)	1	2	3	4	5
❑ Background - Student must have seen or be familiar with related TV or movies to connect with ideas (e.g., West Side Story)	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Interactive elements meet the needs of a diverse range of students	1	2	3	4	5
❑ Student must be taught or have prior experience using web sites' interactive elements (e.g. chat center, MOOs, MUDs, avatars)	1	2	3	4	5
❑ Loading speed does not interfere with ability to access to interactive elements	1	2	3	4	5
❑ Interactive elements are self explanatory	1	2	3	4	5
AUTHORITY: Critical literacy elements	**Least**				**Most**
TEXT					
❑ Shows that web site is made by another teacher	1	2	3	4	5
❑ Shows that web site is made by another student	1	2	3	4	5
❑ Web site names web author who is connected to a reputable institution (e.g., Dept of Education, University)	1	2	3	4	5
❑ Text names connections and associations with other authorities in the field	1	2	3	4	5
❑ Author's biography is included	1	2	3	4	5
❑ Funding source is included	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows symbol or picture of web author/institution that is well recognized as reputable	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Web site is well designed for interactivity (e.g. mini tutoring sessions, interactive speech)	1	2	3	4	5
❑ Authority of the site is in its sophisticated multi-media elements (More sophisticated multi-media elements, more authority)	1	2	3	4	5
AESTHETICS: design/appeal	**Least**				**Most**
TEXT					
❑ Text blocks are well organized/placed on the web pages	1	2	3	4	5
❑ Text size is easy to read	1	2	3	4	5

VISUAL LANGUAGE					
❑ Visual elements coordinate well with text	1	2	3	4	5
❑ Plain background and dark text/visuals	1	2	3	4	5
❑ Very active backgrounds and visuals do not interfere with reading text	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Technical qualities will impress students	1	2	3	4	5
❑ Content behaviours are limited to only a few (i.e. selected to be minimal)	1	2	3	4	5

BLUEPRINT Part B

Functional Semantics of Rhetoric

"Rhetorical Functions /n/ - Those parts and properties of a communication unit that communicate direction, instruction, organization message, or emphasis and tone to a reader" (Horn, 1998).

"Rhetoric /n/ - 1. originally, the study of the means of persuasion in verbal discourse. 2. the study of methods and means of communication." (Horn, 1998)

ACCESSIBILITY: Inside-the-head (Zakaluk, 1985)	**Least**				**Most**
TEXT					
❑ Text guides readers through document	1	2	3	4	5
❑ Text orients the reader to topic(s)	1	2	3	4	5
❑ Keywords and related words focus attention on concepts	1	2	3	4	5
❑ There is a lot of text	1	2	3	4	5
VISUAL LANGUAGE					
❑ Visual elements guide readers through document (e.g. arrows, lines, images)	1	2	3	4	5
❑ Visuals orient the reader to topic(s)	1	2	3	4	5
❑ Key visual concepts focus attention on theme	1	2	3	4	5
❑ There are a lot of visuals	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Contains buttons/icons that move the reader through multi-media, text, or visual elements	1	2	3	4	5
❑ Interactive elements cue the reader on how to act within the web site	1	2	3	4	5
❑ Individual elements are easy to manipulate and operate	1	2	3	4	5
❑ Pop-up windows do not obscure view of text or visuals	1	2	3	4	5
❑ Links to a wide variety of web sites outside content of class	1	2	3	4	5
❑ There are a lot of interactive elements	1	2	3	4	5
COHERENCE: *Inside-the-head* (Zakaluk, 1985), cognitive artifacts and prior knowledge required to negotiate a particular web site	**Least**				**Most**
TEXT					
❑ Connections – The web site links and connections have similar groupings.	1	2	3	4	5
❑ Student must have prior knowledge of keywords and related words to choose links within the site	1	2	3	4	5

❑ Web author has regard for audience and knows which links/text connect to student background knowledge at this grade level	1	2	3	4	5
❑ Associated ideas are located together	1	2	3	4	5
❑ Web site is self explanatory	1	2	3	4	5
VISUAL LANGUAGE					
❑ Clusters visual and verbal elements (e.g. time line or web diagram)	1	2	3	4	5
❑ Shows overall organization of the web site on opening and/or subsequent pages (e.g. graphic organizer)	1	2	3	4	5
❑ Connections – The web site visuals have logical groupings, associated ideas are located together	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Web site performs like a tutor (e.g., interactive speech and response/answer commands)	1	2	3	4	5
❑ Student needs previous experience with similar web sites to recognize where the functions of interactivity will lead	1	2	3	4	5
❑ Student needs a sophisticated level of computer skills to negotiate the web site (i.e. Or they might get lost in cyberspace)	1	2	3	4	5
❑ Allows student to be in touch with a broader community	1	2	3	4	5
AUTHORITY: Critical literacy aspects that provide clues to authority of the writing	**Least**				**Most**
TEXT					
❑ Web site includes recent date (e.g. "Updated January, 2001". There is certain amount of authority in the web site being current.)	1	2	3	4	5
❑ Text can be verified through paper resources	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows movies, pictures, and other visuals associated with other authorities in the field	1	2	3	4	5
❑ Shows award won by web site	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Web site shows number of visitors and is interactive when student become a new visitor (More visitors, more authority)	1	2	3	4	5
❑ Web site gives the impression that it is reputable (i.e. Looks like web site is not made by an amateur.)	1	2	3	4	5
AESTHETICS: design/appeal	**Least**				**Most**
TEXT					
❑ Headlines motivate students to look through web site	1	2	3	4	5
❑ Text provides lightness, humor and/or irony	1	2	3	4	5
❑ Supplies a variety of interpretations of the play's elements	1	2	3	4	5

VISUAL LANGUAGE					
❑ Photos/charts/symbols motivate students to look through web site	1	2	3	4	5
❑ Pictures provide lightness, humor and/or irony	1	2	3	4	5
❑ Increases impact (e.g. Visual elements add impact to text or content behaviours)	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Has high level interaction allowing a high level of student participation (e.g., avatar, tests with auto-feedback, responses to student questions)	1	2	3	4	5
❑ Interactive elements present a challenge to users	1	2	3	4	5
❑ Interactive elements allow students to express their viewpoint (e.g. chat center)	1	2	3	4	5

SUMMARY RATING

Circle one choice for each item.

I rate my own computer skill as: technophobic 1 - 2 - 3 - 4 - 5 - 6 - 7 web author/expert user

I rate my students' computer skill as: technophobic 1 - 2 - 3 - 4 - 5 - 6 - 7 web author /expert user

I mostly use web sites to: motivate students / supplement research materials.

My teaching style with web sites is mostly: student directed / teacher directed / shared.

My teaching style is best complemented by web sites strong in textual / visual language / content behaviours.

My students will be most interested in web sites focused on textual / visual language / content behaviours.

I am most concerned with web site: accessibility / coherence/ critical literacy / aesthetics.

I am least concerned with web site: accessibility / coherence/ critical literacy / aesthetics.

DESCRIPTION OF STRENGTHS:

DESCRIPTION OF WEAKNESSES:

The third question for study is addressed next.

What Elements Would Contribute to a Useful Instrument for Predicting Hypertext Comprehensibility?

Investigator's Ratings of Web Materials

The investigator's analysis of web sites was completed after the final group of participants responded to the blueprint to provide further validation of the conceptual model. Participating in the analysis of the web sites allowed the investigator to work with the blueprint and, in doing so, led to the realization that the blueprint was too long in format; therefore, the blueprint was changed to a two page checklist with the summary information on a third page. The shortened blueprint format allowed the investigator to compare elements across sub-categories and have a better over-all view of factors that influence hypertext comprehensibility. The investigator's rating was not part of the original design of the study but appeared to be necessary in order to make comparisons among web sites.

As shown in Table 7, the investigator's shortened format of the blueprint contains three numbers separated by slashes to represent the number of web sites that possessed each element. For example, 1/3/16 indicates that a total of 20 web sites were evaluated. The first number in the table indicates that the element was not evident in one web site, the second that the element was somewhat evident in three web sites, while the third indicates that the element was fully evident in sixteen web sites.

In the following example that rated text size (shown in Table 7), the numbers were 1/3/16, meaning that out of the 20 web sites, only one web site had text size that

was difficult to read, 3 web sites had text sizes that were somewhat easy to read, and 16 contained text sizes that were easy to read.

Table 7.

Investigator's Analysis of Web Site Elements

FUNCTIONAL SEMANTICS OF CONTENT **Web Site Number: 1-20**

Part A	ACCESSIBILITY	COHERENCE	CRITICAL LITERACY	AESTHETICS
ALPHABET TEXT	❑ Web site is readable at Senior 2 reading level and above (e.g. as determined by analyzing the text using Fry or Flesch-Kincaid readability measures) 0/15/5 ❑ Text lists information 4/2/14 ❑ Web page and theme assignment(s) use the same vocabulary. Text compares for transfer (has similarities) 4/5/11 ❑ Text is expository 1/4/15 ❑ Text is narrative 3/1/16 ❑ Text includes questions 12/0/8	❑ Flexibility - That is, site is broad enough in textual content to connect to a diverse range of students 6/6/8 ❑ Connections - Student must be able to relate the web page and theme/assignment(s) 8/5/7 ❑ Background - Student must have seen or be familiar with books or stories closely related to this topic 10/5/5 ❑ Student must have read classroom reading materials or parts of them 17/3/0	❑ Shows that web site is made by another teacher 11/0/9 ❑ Shows that web site is made by another student 14/1/9 ❑ Web site names web author who is connected to a reputable institution (e.g., Department of Education, Harvard) 11/0/9 ❑ Text names connections and associations with other authorities in the field 5/1/14 ❑ Author's biography is included 17/0/3 ❑ Funding source is included 12/0/8	❑ Text blocks are well organized/placed on the web pages 3/6/11 ❑ Text size is easy to read 1/3/16
VISUAL LANGUAGE	❑ Shows who (e.g., Picture of Shakespeare) 5/1/14 ❑ Shows where 13/0/7 ❑ Shows when 15/0/5 ❑ Shows examples 10/2/8 ❑ Shows comparisons 10/1/9 ❑ Shows ads (ads could be for products such as books related to subject) 10/1/9	❑ Flexibility – That is, site is broad enough in visual content to connect to a diverse range of students 12/1/7 ❑ Connections - Student must be able to visually relate web page and theme/assignments (i.e., Blocks of text and visuals have something in common with other class materials.) 8/8/4 ❑ Background - Student must have seen or be familiar with related TV or movies to connect with ideas (e.g., West Side Story) 13/5/2	❑ Shows symbol or picture of web author who is connected to a reputable institution 8/1/11	❑ Visual elements coordinate well with text (i.e., visually balance) 5/4/11 ❑ Good contrast in visuals (e.g., plain background and dark text) 4/5/11 ❑ Very active backgrounds and visuals do not interfere with reading text 5/2/13
CONTENT BEHAVIOUR	❑ Contains interactive elements 13/0/7 ❑ Contains links to other sites 4/1/15 ❑ Long text has scroll bar 3/0/17 ❑ Contains a variety of automatic multi-media elements that make site more accessible (e.g. film clip starts automatically, animated figures) 16/2/2	❑ Interactive elements meet the needs of a diverse range of students 13/4/3 ❑ Student must be taught or have prior experience using web sites' interactive elements (e.g., chat center, MOOs, MUDs, avatars) 16/2/2 ❑ Loading speed does not interfere with ability to access to interactive elements 8/3/8 ❑ Interactive elements are self-explanatory 5/1/14	❑ Web site is well designed for interactivity (e.g. mini tutoring sessions, interactive speech) 16/2/2 ❑ Authority of the site is in its sophisticated multi-media elements (More sophisticated multi-media elements, more authority) 13/3/4	❑ Technical qualities will impress students 15/3/2 ❑ Content behaviours are judiciously selected to balance with text and visuals (i..e., Not just a media circus) 13/1/6

FUNCTIONAL SEMANTICS OF RHETORIC

Web Site Number: 1-20

Part B	ACCESSIBILITY	COHERENCE	CRITICAL LITERACY	AESTHETICS
ALPHABET TEXT	❑ Text guides readers through document 3/5/12 ❑ Text orients the reader to topic(s) 3/5/12 ❑ Keywords and related words focus attention on concepts 3/1/16 ❑ There is a lot of text 6/5/9	❑ Connections – The web site links and connections have similar groupings (i.e., logical associations) 4/5/11 ❑ Student must have prior knowledge of keywords and related words to choose links within the site 12/6/2 ❑ Web author has regard for audience and knows which links/text connect to student background knowledge at this grade level 4/9/7 ❑ Web site is self-explanatory 0/0/20	❑ Web site includes recent date (e.g., "Updated January, 2001". There is certain amount of authority in the web site being current.) 8/0/12 ❑ Text can be verified through paper resources 4/0/16	❑ Headlines motivate students to look through web site 6/4/10 ❑ Text provides lightness, humor and/or irony 11/4/5 ❑ Supplies interesting interpretations of the classroom reading material's elements 6/9/5
VISUAL LANGUAGE	❑ Visual elements guide readers through document (e.g. arrows, lines, images) 9/7/4 ❑ Visuals orient the reader to topic(s) 10/3/7 ❑ Key visual concepts focus attention on theme 8/1/11 ❑ There are a lot of visuals 15/3/2	❑ Clusters visual and verbal elements (e.g. time line or web diagram) 7/7/6 ❑ Shows overall organization of the web site on opening and/or subsequent pages (e.g., graphic organizer, what cannot be seen) 6/4/10 ❑ Connections – The web site visuals have logical groupings, associated ideas are located together 7/6/7	❑ Shows movies, pictures, and other visuals associated with other authorities in the field 10/1/9 ❑ Shows award won by web site 17/1/2	❑ Photos/charts/symbols motivate students to look through web site 10/2/8 ❑ Pictures provide lightness, humor and/or irony 14/2/4 ❑ Increases impact (e.g., Visual elements add impact to text or content behaviours.) 11/3/6
CONTENT BEHAVIOUR	❑ Contains buttons/icons that move the reader through multi-media, text, or visual elements 7/4/9 ❑ Interactive elements cue the reader on how to act within the web site 11/4/5 ❑ Individual elements are easy to manipulate and operate 6/0/14 ❑ Pop-up windows do not obscure view of text or visuals 6/0/14 ❑ Links to a wide variety of web sites outside content of class 8/7/5 ❑ There are a lot of interactive elements 16/3/1	❑ Web site performs like a tutor (e.g., interactive speech and response/answer commands) 16/3/1 ❑ Student needs previous experience with similar web sites to recognize where the functions of interactivity will lead 16/4/0 ❑ Student needs a sophisticated level of computer skills to negotiate the web site (i.e., Or they might get lost in cyberspace) 20/0/0 ❑ Allows student to communicate with a broader community 9/2/9	❑ Web site shows number of visitors and is interactive when student becomes a new visitor (More visitors, more authority) 18/0/2 ❑ Web site gives the impression that it is reputable (i.e., Looks like web site is not made by an amateur.) 7/5/8	❑ Has high-level interaction allowing a high level of student participation (e.g., Avatar, tests with auto-feedback, responses to student questions) 16/2/2 ❑ Interactive elements present a challenge to readers 18/1/1 ❑ Interactive elements allow students to express their viewpoint (e.g., Chat center) 10/1/9

From this investigator analysis, three significant findings were noted. These related to (a) web site elements and implications for readers and writers, (b) web elements related to participants, and (c) web elements related to pedagogy.

Implications for readers and writers. The first insight was that in addition to using the blueprint to estimate comprehensibility, it was evident that the blueprint could also be used by authors to critique and build more comprehensible web sites. Further, although teacher participants found content behaviours to be a major aesthetic element for comprehensibility, the number of content behaviours did not balance with the number of text and visuals. There were few content behaviours on web sites and those that were present appeared to be just add-ons rather than integral hypertext elements.

Another issue was that web sites rarely contained questions even though teachers valued this element. A third significant element was that few web sites had a broad enough textual, visual, or content behaviour base to connect to a broad range of student abilities.

Web site elements as they concerned teacher participants. The investigator's analysis of web sites confirmed curriculum specialists' impressions that there was little Common Gateway Interface (CGI) scripting on the web sites, and thus very little interactivity. Web sites would have been more interesting for classroom use with interactivity. Contrary to this, the investigator's analysis confirmed curriculum specialists' impressions that each web site was so different, regardless of programming, that comparisons and contrasts were "cursory at best". What became evident was that writer's/readers' purposes played an important role in favouring one web site over another. Ranking one web site over another for multiple curriculum purposes and uses, as

the curriculum experts were asked to do, proved to be an impossible and annoying task. When teacher participants looked at the blueprint, however, they were all quite certain that they would use web sites for either student motivation or for finding text or visuals that could be applied to classroom projects. The best match for web sites and student purpose is therefore directly connected to teacher's pedagogical purpose.

Web site elements related to pedagogy. The investigator's analysis of web sites suggested that students could use the blueprint to understand the structure of text on the Web better. Grade ten students are often as capable of reading and using reading to learn as adults. However, in using the blueprint, it was obvious that younger students would need more teacher support to negotiate Part B of the blueprint because this part of the model requires a broader knowledge of text structure.

A surprising finding in comparison between teacher participants and the web site analysis was the contradiction found in relation to interactive elements. The blueprint states both "Interactive elements are self-explanatory" and "Technical qualities will impress students". The meaning of impress suggests that there is some challenge or difficulty that is impressive. Video games, for instance, are impressive because they have technical difficulty and require mastery to negotiate. Teacher participants were interested in web sites that would challenge their students. At the same time they wanted easy-to-use web sites. Perhaps this contradiction could be resolved by teaching students how to use more sophisticated web site elements that require more technical expertise. The web site authors, however, appeared to have chosen ease of operation over impressive technical qualities (e.g., interactive animation) because few technical qualities on the web sites were challenging or impressive.

Overall, the investigator's analysis of the web sites showed that hypertext continues to evolve over time. If any descriptor could embody the concept of hypertext it would be change. Even some items such as "Clusters visual and verbal elements" were viewed differently depending on the computer that was used because the relationship between elements changed depending on the size of the monitor and the browser being used. During the investigator's analysis, there were subtle and dramatic changes in the web sites, but most of all there appeared to be an energy in the revised sites, suggesting that improvements were on the way, that web authors were interested in change, that being familiar was positive but being static was negative.

Additionally, in visiting the web sites again and again online as part of this analysis, the web sites seemed to "talk to" and address readers personally. Although the analysis of web sites in this manner is not natural to web site use because the investigator looked at all parts of the web site for the purpose of the research, there was something familiar about the web site "talking to you" and the experience of visiting familiar web sites on a frequent basis (e.g., web sites such as online newspapers that one might read on a daily basis). This experience came through to the investigator as item 4, Part B, Content Behaviours' Coherence, "Allows student to communicate with a broader community". The voice of the 20 web sites grew stronger with repeated visits. There was a comforting feeling knowing that someone was "out there".

Summary of Overall Findings

Several themes emerged from the analysis of the results. Repeatedly it was acknowledged that hypertext elements lack common terminology. Second, it was evident

that technological know-how should play a secondary role in the construction of meaning for students reading hypertext. Third, web sites should facilitate accessibility and content coherence but not dominate or take over the act of teaching. Fourth, students need to become critically literate to navigate hypertext successfully. Fifth, hypertext diversity plays a key role both in motivating students and in appealing to the diverse needs of different student populations. Sixth, pedagogical goals may not always be attained by Internet use. A better interlocution of pedagogical goals and Web use needs to be forged.

For the long-term, the decisions of educators today will shape the Web of tomorrow. Educators will need to study how readers learn how-to-read using hypertext, and how reading-to-learn shapes knowledge and pedagogy. The potential of the Web is that it can motivate students and provide multiple resources for student inquiry through the multiple literacies that converge in Web hypertext. The web sites that appeared in this study show that this potential is not sufficiently realized in web site material, but could possibly be realized through education about the elements and rhetorical structures of hypertext. Better-informed users can be more demanding of web authors and even create better web sites themselves, therefore facilitating the development of Web literacy.

Building a blueprint for predicting hypertext comprehensibility at first appeared to be a relatively simple task. A review of the literature would yield a list of elements that anyone could apply in evaluating the comprehensibility of a particular web site. In reality, however, this procedure conflicted with the processing of hypertext in which meaning is essentially constructed by the reader. Both curriculum specialists and teachers demonstrated that preferring one set of elements over another was not universally representative of how one engages in reading web sites. Preferring one set of elements

over another would result in web sites being developed generically and ultimately indistinguishable from one another. Variety and the element of delight were desirable characteristics. As one curriculum specialist remarked, "The web sites were boring enough as is".

There are two formats of the blueprint in this chapter; the elements are identical but the layout is different. Each can be used for a different purpose. The longer version is helpful to readily identify patterns of responses and to become informed about web site deficits. The investigator's form with the reduced font size could be used for the examination of a large number of web sites across a broad list of elements.

Conclusions from the study appear in the next chapter.

CHAPTER V

Conclusions

This chapter synthesizes the findings of the present study and reflects on these findings from a theoretical perspective. Discussion centers on splintered literacies and the notion of multi-level processing plus implications for instruction. The limitations of the study are also addressed, followed by implications for future research. The chapter concludes with a summary of hypertext comprehensibility.

Discussion of Findings

Splintered Literacies

Hypertext processing is different from the processing of traditional linear text. Although most discussion in relation to literacy and technology has provided a splintered picture of literacy (Snyder, 1996; Tyner, 1998) in which visual literacy, media literacy, technological expertise or computer literacy, and information literacy have been conceptualized separately, findings from this study show that the web site hypertext cannot be splintered. As woven together through navigation, and in keeping with reader purpose, the multi-media present on the Web is integral to meaning-making. The visuals, the interactive elements, and the alphabetic text act in concert to facilitate comprehension. Literacy is expressed differently on the Web than in any other form of literacy.

Marshall McLuhan's much quoted phrase, "the medium is the message" thus rings true in relation to Web materials (McLuhan, Fiore, & Agel, 1967). Pure forms,

containing only movies or alphabetic text, rarely exist. Even when they do, the web site reader senses that something is missing, that the web site is boring or that the web site lacks the integrity of its natural elements. This point lends credence to the idea that hypertext is a multi-literacy form.

Reader purpose also dictates level of processing. In the current study, depending on grade level, teacher participants proposed that the pedagogical task may involve either skimming to locate specific information or more careful, "in-depth reading" in order to collect information for student research projects. Teachers also suggested that motivation was a factor that influenced whether or not they assigned web site reading. Using technology for the purpose of motivating students appears to invoke less "in-depth reading" and results in greater dependence on headlines, visual language, and content behaviours. However, whether processing takes place at a superficial level, as in skimming, or at more in-depth levels, processing remains multi-referential in the sense that all medias are present and available for cueing.

Pedagogical Goals

Pedagogical goals determined how teachers used web sites. As suggested in the discussions, teachers encouraged surfing, suggesting that educators have students use the Web on a casual basis. At the same time, students might always be returning to the same favourite sites. According to Nielsen (2000b): "Some web sites engender sufficient loyalty that users return frequently and begin using them on a daily basis" (p. 2).

Although a major purpose of the Web associated with academic goals is to make contact with or participate in global dialogue, some of the educators in this study

appeared to reject the idea of communicating with a larger audience. Most web sites evaluated in this study were also restricted, allowing few links to other sites and limited exchange of information with no provision for e-mail dialogue. The reason for the lack of interaction was obvious; web authors simply did not appear to have the time, financial means, or perhaps the technical skills to develop their web sites fully. This was made obvious when the web sites used in this study were viewed six months later. Nearly all web authors had improved their interaction, usability, and content.

Discussions revealed that teachers were ambivalent about the use of web sites for tutoring. While some saw the advantage of training centers and tutoring villages in theory, most were concerned that web tutoring would usurp classroom instruction. In their view tutoring could divert instructional focus, change lesson purpose, or even derail some of the in-class work connected to the topic. Mathematics or science teachers may have a different view than ELA teachers, however.

Teachers did agree that Web hypertext could be described as a combined collage-like form where both aesthetic and efferent transactions facilitate the integration of materials and navigation decisions. There was agreement that web navigation should be natural and easily understood, thus confirming Nielsen's (2000c) observation that the Web favours novice users. Accordingly, a great deal of responsibility for web site comprehensibility lies in the hands of web site authors.

Writing. More technologically experienced teachers suggested that web sites authored by other students added to the useability of the hypertext. The purpose underlying the choice of some web sites was that their own students could see what other students were writing and could compare and contrast their work with that of other

students, leading to better web site authoring. This suggests that, as an authentic assignment, web authoring should be encouraged. Reading and writing web materials could be a mutually reinforcing process that ultimately improves web site comprehensibility. The goal of hypertext reading, at least as suggested by the participants in this study, is to motivate the search for additional material in order to enrich instruction and enhance meaning-making.

Instructional Implications

Terminology

Recommendations to enhance hypertext reading can be synthesized from both the information gathered in the literature review and the data collected in this study. First, the terminology of web sites must be taught. In this study a major problem with discussing web sites was the lack of a mutually understandable language. Minimum expectations for terminology related to hypertext may enhance hypertext processing. Some participants for example, who rated themselves as near technophobic or technophobic, had difficulty understanding terminology at first but soon related to all aspects of the blueprint once the descriptors were understood. Terminology serves as a bridge to new literacies.

The term "hypertrails" is a case in point. Hypertrails are the possible information paths constructed by web authors. The concept of hypertrails is important to understand because hypertrails indicate the variety of ways that information can be organized, linked, and managed (Horn, 1989; Joyce, 1995). Although hypertext gives the appearance that one can travel at will in Web hypertext, the paths are only as willful as the construction

allows. This holds true both within and between web sites. Thus, there are more paths constructed in hypertext than there are in book text, but there are still only a numbered set of paths. The notion of hypertrails was not addressed in the final blueprint. A hypertrails category may be considered in a later revision.

Visual Language

In this study, both experts and teachers failed to recognize the intermediality of cultural media texts. Visual language features that enhanced comprehensibility appeared to be less well understood than the features of alphabetic text that facilitate learning. For example, in one web site connections were made with other movies such as *West Side Story,* which is a retelling of *Romeo and Juliet.* Teacher participants did not realize that this comparison could lead to better understanding of the topic.

Also, a schema for graphic design basics seemed elusive. Serifs, for instance, guide readers' eyes and facilitate reading, but this was not part of participants' understanding. It was clear that terminology for media and visual literacy would have to be developed and taught for there to be any future, equitable comparison between the importance of hypertext visual elements in relation to alphabetic text. Thus, the final blueprint undervalues visual design elements because participants generally possessed little critical visual literacy skill and could not competently evaluate the effect of visuals.

On the other hand, most book readers do not know the basics of graphic design and they still manage to read with clarity and coherence. Narrowing down the graphic elements within the blueprint did not, therefore, seem as critical as first appeared. Rather,

the role of visual elements in the comprehensibility of hypertext requires more study. The participants demonstrated that they were biased toward visual or alphabetic elements depending on their pedagogical purpose.

The Social Construction of Knowledge

What often occurs in classroom web site use is that there is limited talk before, no talk during, and no talk afterward (Smith, 1999b). The sustained talk of a socially constructed classroom is interrupted if students use computers in isolation. Unless classroom talk is sustained in the computer environment and extended into the global talk of the Web, students learn from the Web on an incidental basis only. Comprehension involves making connections between the new and what is already known. Both teacher scaffolding and student intersection are required.

Many teachers have taken for granted that students know as much or more about technology than they do. Using technology for research and inquiry is often self-regulatory and does not involve the teacher. Classroom talk about visual, multi-media, and media literacy is secondary in favour of talk related to conventional text. Therefore, pedagogy associated with technology is distanced from socially constructed classroom learning, primarily because of lack of teacher knowledge, lack of student knowledge, and logistics that take away from classroom talk and put students in isolated contact with a screen. The teacher is necessary to any definition of the socially constructed classroom.

Computers take students' attention away from the teacher, thus breaking down the interaction in a socially constructed classroom. Regarding the value of talk in the socially

constructed classroom, Piaget (1968) held that students come to know and understand through sustained talk. Vygotsky (1978) noted that classroom talk that engaged students in active learning most improved the ability to know and understand. The blueprint in this study is an instrument that could add value to classroom talk in the presence of technology, and through the art of teaching lead, in turn, to enhanced hypertext comprehensibility.

Agency

The elements and rhetorical structures that appear in hypertext advanced teachers' conceptions about how readers process reading materials on the Web. The blueprint performs two functions: (1) obliges teachers to examine how students will read electronic text, and (2) diagrams the multiple elements of hypertext. Though teachers indicated that their reaction to the blueprint would be different at different grade levels, and that different pedagogical goals combined with different types of web site materials might change their responses, certain elements in their view, such as "interactive elements are self-explanatory" would remain.

With the variety of materials that the Web had to offer, some types of web materials were simply rejected. It follows that certain sections within web sites may simply not be read and may eventually disappear or become transformed into a more readable form, readers and writers shaping the Web dialogically. Hence, the social construction of web sites is taking place at a subconscious cultural level, readers not being aware of their own agency in the evolution of the Web. Educators can respond to this social construction either by letting the Web unfold as it may or by having students

become part of Web dialogue, staking a claim in regard to student participation as hypertext readers.

Critical Literacy

Although filters are important to prevent pornographic materials from appearing, filters may distort critical analysis. They may block out such search words as "love" and "loyalty", for example, that are associated with *Romeo and Juliet*. Further, Nielsen (2000) claims that the Web as a source of free information is slowly being quantified commercially. Web sites that previously had a lot of traffic because they contained "free" information that many users wanted are now selling that information. On the other hand, advertisers are also realizing that ads placed on a web site do not receive the expected attention because users simply ignore the ads as cognitive overhead. The results of this study show that ads are not even part of the readability question, since all teachers scored them as 1's or 2's. Perhaps these same ads, often represented as banners on web sites, become part of the collective subconscious of the web, present and competing for attention, but not related to reader purpose.

Limitations and Assumptions

This study was limited by the inability to capture the vastness of the Web. It may not be possible to show the entire scope of hypertext in relationship to curriculum content within a given topic. Furthermore, it may not be possible to provide a selection of resources that will remain coherent with the selected topic since the Web itself is dynamic in nature.

The blueprint that resulted from teacher responses is more generic than the expert user may desire. The blueprint may also be too complex for the complete luddite. However, the intention of this study was to begin the process of negotiating a new form of rhetoric now being created on the Web, a combination of text and visuals or rather a morph of communication that occurs when these two elements have equal or supporting responsibilities in enhancing comprehensibility.

This study is limited by the computer literacy skills of the participants. Consequently, a participant may be intimidated by the technology itself rather than by the comprehensibility of the hypertext. Either limited prior knowledge of hypertext construction, or limited Internet experience may have affected how participants responded to the hypertext. It is assumed in this study that the participants had a range of hypertext knowledge from novice to expert.

A major assumption of this study was that educators actually use the Internet for locating instructional resources. As stated at the beginning of this paper, this does not always appear to have been the case. This assumption, though not congruent with the evidence from two exploratory studies, (Smith, 1999a, Smith, 1999b) was necessary for the study to take place and seems to be commensurate with current teaching practices.

Implications for Further Research

This study merely lays a foundation that frames hypertext comprehensibility. The study raises questions about further data collection that would show trends as many more participants rate the readability of elements. Another next step in this research would be to involve students in a follow-up analysis of web sites in order to verify teacher

predictions. Observing students processing hypertexts online would be necessary. Observations of eyetracking would also help to profile cueing systems that are used in multi-medial reading. The question of whether hypertext reading enhances comprehensibility is also important. Comprehension performance measured immediately after reading alphabetic text compared to comprehension performance measured immediately after reading hypertext should be part of follow-up research. The questions that follow could direct future research:

(1) How can visual language and graphic design hierarchies for attention getting and impact be compared heuristically?

(2) Do students that use hypertext sources know more? What do they know?

(3) Do students have the same biases that teachers have?

(4) Do students go back again and again to particular web sites, the way that expert users do?

(5) How will educators know when students know how-to-read with multi-media cueing systems? Redefine a "good" reader.

(6) How can the speed of comprehension in terms of both scanning for meaning and deep reading, which is somewhere between 26 frames (movies) and 4 fixations per second (reading), be tested?

(7) What should educators teach about hypertext processing at each grade level?

(8) What would be an appropriate list of tips for hypertext teacher intervention, considering intervention possibilities that extend from classroom practice to online education?

(9) What intermedial meanings do elements share when they appear side by side?

This research also leaves educators with a broader set of important questions to answer related to purpose:

1. Do educators want students to be multi-media processors? What is achieved by this? What is lost?
2. Will teaching multi-media processing promote learning and serve the purposes of future hypertext reading?
3. How does multi-media reading change learning-to-read and reading-to-learn?
4. How do educators want the Web to change learning-to-read and reading-to-learn?
5. What do educators want the next vision of the Web to be?

Nielsen (2000b) reports that the pendulum between the focus on novice users as opposed to expert users has swung back and forth decade by decade. The 1970s focused on geeks or experts, the 1980s focused on novice users and until the middle of the 1990s, the focus was on expert users. Then, when the Web entered the picture, the focus was again on the novice user. That pendulum, he states, is sure to swing again in favour of the expert user. Currently, the focus is on novice users since governments and industry are looking for ways to connect everyone to the Internet. But as users become adept at Web use, they will place greater demands on Web content and functions, thus producing the need for expert use of the Web. It is time for educators to take action to promote literacy on the Internet.

The broad picture of the nature of hypertext on the Web is characterized by widely different views from both expert and novice users. Further experience with the Web may not close the gap between these groups since the more progress is made, the more the Web itself develops. Further to this, teachers may want to consider the agency they have on the Web, that ownership of hypertext comprehensibility is in their hands. How it develops depends on how they wish to present it to their students.

Conclusion

In the beginning when the web sites for this study were selected, it seemed possible to take a snapshot of the web sites and to analyze them within certain parameters. It was surprising to go back to those same web sites at the end of the study and find that all of them had changed in significant ways within less than a year. Five of the sites moved and several others changed their appearance entirely. Therefore, long-term solutions for defining hypertext comprehensibility may not be possible by taking snap-shots of the materials and then formulating those elements into numbers for handy reference. Somehow, web site rhetoric must be made visible.

Defining hypertext comprehensibility is not a matter of identifying separate literacies such as alphabetic media or computer literacy and analyzing their critical domains. Instead, as suggested, these literacies converge on web sites to become a meaning together. New rules for reading hypertext might include:

- Read with peripheral vision like driving a car, being aware of the surroundings but keeping eyes on the road, focused on reader purpose.
- Prepare to reject information and be aware of rejected material.

- Read for different purposes, being aware of multiple audiences for the material.
- Redefine cues to facilitate meaning-making.
- Balance cues for meaning. Use more than visual literacy cues for web site entry and navigation.
- Remember that you are defining the Web as you read.

New rules for reading on the World Wide Web might suggest that literacy has changed and that a redefinition of literacy should be made, yet, if educators reflect the ideas of theorists of the last century, it is clear that hypertext is not only an expression of social construction (Snyder, 1996), but also an expression of the act of using language to learn and communicate. The main differences are that society has not yet internalized hypertext and negotiated its place in a literate world. The constraints of text in the Gutenberg era provided structure to literacy in the form of books. This was a structure that schools could embrace because in economic terms, books served the needs of multiple learners and educators alike. Traditional, alphabetic book text was efficient and logical for the educational system of the time.

The Web may change that, but has not, as yet. The cracks in current literacy instruction are evident since the issue of how literacy educators will embrace hypertext reading and writing has not yet been resolved. The solution may present itself on the Web someday as online education develops, but until then teachers, in this study at least, inform us that regardless of technology, they can teach better in the classroom, face-to-

face with students. The Web remains outside the conversation of classroom dialogue. Web use in classrooms is more about the casual user than the expert.

Nonetheless, Web use is encouraged in education. Society demands that students be computer literate. Web literacy will continue to manifest itself as multi-medial, global, dialogic, and specialized. The technology will then change recursively to suit participants who are both novice and expert users. Ownership can take place on the Web, and educators can take their place in the dialogue. The nature of that dialogue shapes the nature of hypertext.

In summary, predicting hypertext comprehensibility cannot be a static process either for the reader or the teacher. Student engagement with new Web elements is an important and ongoing feature of the task related to predicting hypertext difficulty. Although the elements of hypertext can be deconstructed, the process of reading in a dynamic navigational environment requires an equally dynamic approach to research. New literacy, even for novice or functional readers, is expanded beyond former definitions associated with reading alphabetic text. New reading skills require the coherent decoding of multiple texts including alphabetic text, visual text, and movements within these texts. Readers must not only casually view and assimilate alphabetic and visual texts, they must also participate in the manipulation of these texts for both navigation and meaning-making.

It is the goal of this investigator to develop a broader base for the future of this research, to conduct some of it on the Web, and to dialogue with other communities of learners in order to foster better hypertext comprehensibility for students. Kamil and Lane (1998) claim that "We need to accelerate the pace of our research in literacy

problems before the opportunities to answer the questions are swept away by the quickened pace of technological innovation" (p. 332). To facilitate the acceleration of research, the results of this study will be posted on an interactive web site to gather further data.

EPILOGUE

Considering paradigm shifts as I did at the beginning, I thought about the future of the Web while conducting this study, especially when I found that the web site elements had changed in the space of one month. I began to wonder if my results would matter in six months. As well, many of those that responded to the results of my study suggested that the future of the Web would entail talking into the computer, so much so that keyboarding would eventually disappear from the list of computer skills. Essentially, an oral culture would re-emerge from the use of the Internet, Plato's Dilemma (Gee, 1991) in reverse.

Plato scorned the value of the written word and objected to the fact that memory, so necessary in an oral culture, would count less and less in a written culture. He claimed that the precision and clarity of language was lost in the rhetoric of the written word. He posed the question, "What do you mean?" to force rhetoricians to break into prose (Tyner, 1998). Today, however, Plato's Dilemma (Gee's term) itself is lost in the many choices and forms available within Web hypertext. One can ask the writer, what do you mean, by e-mail or by speaking into the computer. These choices are not likely to disappear since they are valued in terms of the clarity of communication. Together, they form the intermediality of hypertext.

The Internet does not have at its axis the same time restrictions of either an oral or a written culture. Instead, both asynchronous and synchronous language relationships exist on the Internet, sometimes within the same web site. Synchronous language relationships are those that occur at the same time, as in a conference call or a MUD. Asynchronous language relationships are those that occur through response to web sites,

but not in a conversational manner, as in e-mail that can be read at a later date or articles that can be perused when the reader chooses. Also, the advantage of surfing through multiple web pages in an asynchronous manner, not having to engage in any text but that commensurate with reading purpose, would be slowed by having to talk to the computer. Thus, there is purpose in navigation as well as purpose in reading response. The reader of the Web has choices not offered in oral or written cultures, choices that do not depend on stabilization of the medium, but depend rather on the ability of the reader to process at multi-levels and become an active participant in a new culture emerging from both oral and written traditions. As well, Web readers are, on occasion, nomads in search of web sites to revisit time and time again in order to argue their case, purchase goods, or glean information.

So, forget the vastness of the Web. It is like trying to comprehend infinity. Instead, concentrate on reader purpose and background knowledge to support hypertext comprehensibility. It is time to talk to our students and to engage in the Web as true social constructivist educators.

References

Applebee, A.N. (1996). *Curriculum as conversation: Transforming traditions of teaching and learning.* Chicago, IL: University of Chicago Press.

Bangert-Drowns, R.L. (1993). The word processor as an instructional tool: A meta-analysis of word processing. *Review of Educational Research 63*(1), *Spring,* 69-93.

Bangert-Drowns, R.L. & Pyke, C. (1999). Technology in schools: Can we make it work? *EnglishUpdate, Winter*, 2-3.

Bolter, J.D. (1991). *Writing space: The computer, hypertext, and the history of writing.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Bolter, J.D. (1998). Hypertext and the question of visual literacy. In D. Reinking, M.C. McKenna, L.D. Labbo, & R.D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 3-13). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Bolter, J.D. (1999). Information technologies and the future of the book. In D.A. Wagner, R.L. Venesky, and B.V. Street (Eds.) *Literacy: An international handbook* (pp. 457-461). Boulder, CO: Westview.

Bormuth, J.R. (1977). *Readability formulas and the literacy production function.* Chicago, IL: University of Chicago.

Brosnan, M. (1998). *Technophobia: The psychological impact of information technology.* New York, NY: Routledge.

Bush, V. (1945). As we may think. *Atlantic Monthly 176*(1)(July 1945) 101-108.

Burke, K. (1989). *On symbols and society: The heritage of sociology.* Chicago: University of Chicago Press.

Carbone, N. (1999). The need for making rhetoric visible as an evaluative standard for Internet information. *NCTE Conversations.* Conference on College Compositiosn and Communication CCCC/99 archive [Online]. URL: http://lamar.colostate.edu/~ncarbone/cccc/Carbone3972.htm.

Cleveland State University (1990). *Passages to information literacy: Your key to success. A report on the goals and objectives for information literacy.* (21 September). Cleveland, OH: CSU Library.

Conklin, J. (1987). Hypertext: An introduction and survey. *IEEE Computer 20*(9) (September), 17-41.

Craven, M.L. (2000). *Inter-related considerations for the 'writing' of successful argumentative hypertext on the Web.* Paper presented at Inkshed 2000 for the Canadian Association for the Study of Language and Learning. Bowen Island, BC.

Cubitt, S. (1998). *Digital aesthetics.* Thousand Oaks, CA: Sage.

Debes, J.L., & Williams, C.M. (1978). Some history of visual literacy. *Visual Literacy Languaging, and Learning.* Provocative Paper Series #1, Visual Literacy Center. URL: http://www.asu.edu/lib/archives/vlhist.htm.

Diamondstone, J. & Smith, M.W. (1999). *Teaching literature and composition in secondary schools.* In L.B. Gambrell, L.M. Morrow, S.B. Neuman, & M. Pressley (Eds.) Best Practices in Literacy Instruction (pp. 193-209). New York, NY: Guilford.

Dillon, A. (1996). Myths, misconceptions, and an alternative perspective on information usage and the electronic medium. In J. Rouet, J. Levonen, A. Dillon, & R. Spiro (Eds.) *Hypertext and cognition* (pp. 25-42). Mahwah, NJ: Lawrence Erlbaum Associates.

Duchastel, P. (1989). ICAI systems: Issues in computer tutoring. *Computers and Education, 13*(1), 95-100.

Downing, D., Covington, M., & Covington, M.M. (Eds.) (1998). *Dictionary of computer and Internet terms (6th ed.)*. Hauppauge, NY: Barron's.

Duin, A.H. & Hansen, C.J. (1996). *Nonacademic writing: Social theory and technology*. Mahwah, NJ: Lawrence Erlbaum Associates.

Eager, B. (1994). *Using the Internet: The user-friendly reference*. Indianapolis, IN: Que Corporation.

Fisher, M. & Solliday-McRoy, B.S. (1999). The European computer driving license: A model for teacher education. *J. Educational Technology Systems, 23*(3), 225-230.

Flower, L. & Hayes, J.R. (1994). A cognitive process theory of writing. In R.B. Ruddell, MR. Ruddell, & H. Singer (Eds.), *Theoretical models and processes of reading*, (4th ed.), (pp. 928-950). Newark, DE: International Reading Association.

Foltz, P.W. (1996). Comprehension, coherence, and strategies in hypertext and linear text. In J. Rouet, J. Levonen, A. Dillon, & R. Spiro (Eds.) *Hypertext and cognition* (pp. 109-136). Mahwah, NJ: Lawrence Erlbaum Associates.

Fry, E. (1977). Fry's readability graph: Clarification, validity, and extension to level 17. *Journal of Reading, 21*, 242-252.

Garner, R. & Gillingham, M.G. (1998). The Internet in the classroom: Is it the end of transmission-oriented pedagogy? In D. Reinking, M.C. McKenna, L.D. Labbo, & R.D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 221-233). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Gee, J.P. (1991). The legacies of literacy: From Plato to Freire through Harvey Graff. In M. Minami & B.P. Kennedy (Eds.), *Language issues in literacy and bilingual/multicultural education, Reprint Series No. 22* (pp. 266-285). Cambridge, MA: Harvard University Press.

Gillingham, M. (1993). Effects of question complexity and reader strategies on adults' hypertext comprehension. *Journal of Research on Computing in Education, 26,* 1-15.

Glazer, B.G., & Strauss, A. (1967). The *discovery of grounded theory: strategies for qualitative research.* Chicago: Aldine.

Gourley, J.W. (1984). Discourse structure: Expectations of beginning readers and readability of text, *Journal of Reading Behaviour,* 16, 169-188.

Haas, C. (1989). Seeing it on the screen isn't really seeing it: Computer writers' reading problems. In G.E. Hawisher and C.L Selfe (Eds.), *Critical perspectives on computers and composition instruction* (pp.16-29). New York, NY: Teachers College Press.

Horn, R.E. (1989). *Mapping hypertext: Analysis, linkage, and display of knowledge in the next generation of on-line text and graphics.* Lexington, MA: Lexington Institute.

Horn, R.E. (1989). *Visual language: Global communication for the 21st century.* Bainbridge Island, WA: MacroVU.

Horton, J. (1982). A need for a theory of visual literacy. *Reading Improvement, 19*, 257-267.

Irwin, J.W. & Davis, C.A. (1980). Assessing readability: The checklist approach. *Journal of Reading, 24(2),* 124-130.

Jacob, E. (1992). Culture, context, and cognition. In M.D. Lecompte, W.L. Milroy, & J. Preissie (Eds.), *The handbook of qualitative research in education* (pp. 293-335). San Diego, CA: Academic Press.

Johnson, K. (1998) *Readability: Measuring the reading age of books and other reading matter.* [Online]. URL: <http://www.timetabler.com/reading.html>

Kamil, M.L. & Lane, D.M. (1998). Researching the relation between technology and literacy: An agenda for the 21st century. In D. Reinking, M.C. McKenna, L.D. Labbo, & R.D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world (*pp. 15-43). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Kincaid, J.P., Aagard, J.A., & O'Hara, J.W. (1980) *Development and test of a computer readability editing system* (CRES) (TAEG report No. 83). U.S. Navy Training Analysis and Evaluation Group, Orlando, FLA.

Kincaid, J.P., Aagard, J.A., O'Hara, J.W., & Cottrell, L.K. (1981). Computer readability editing system. *IEEE Transactions on Professional Communications*, March.

Kintsch, W. & van Dijk, T.A. (1978). Toward a model of text comprehension and prediction, *Psychology Review, 85,* 363-394.

Krathwohl, D.R. (1998). *Methods of educational & social science research: An integrated approach* (2nd ed.). New York, NY: Addison-Wesley.

Kristeva, J. (1986). Word, dialogue, and novel. In T. Moi (Ed.) *The Kristeva Reader* (pp. 35-61). New York: Columbia.

Kuskie, L.D., & Kuskie, M.M. (1999). A learning styles instrument to enhance learning in technology. *The Journal of Technology Studies, (25)*1, 77-81.

Labbo, L. & Reinking, D. (1999). Negotiating the multiple realities of technology in literacy research and instruction. *Reading Research Quarterly, (34)*4, 478-500.

Langer, J.A. (1995). *Envisioning literature: Literary understanding and literature instruction.* Newark, DE: International Reading Association.

Lanham, R. A. (1995) *The electronic word.* Chicago, IL: University of Chicago.

Laubach, R.S. & Koschnick, K. (1977). *Using readability*. Syracuse, NY: Reader's Press.

Laurillard, D. (1993). *Rethinking university teaching: A framework for the effective use of educational technology*. London, UK: Routledge.

Lehner, F. (1993). Quality control in software documentation based on measurement of text comprehension and text comprehensibility. *Information Processing & Management, 29*(5), 551-568.

Lewenstein, M. (2000). *Eyetracking.* The Stanford Poynter Project. [Online].URL: http://www.poynter.org/eyetrack2000/

Lewis, C. & Polson, P.G. (1990). Theory-based design for easily learned interfaces. *HCI, 5,* 191-220.

Liberty, J. (1999). *A complete idiot's guide a career in computer programming.* Indianapolis, IN: Que.

Lincoln, Y.S. & Guba, E.G. (1985), Naturalistic inquiry. Newberry Park, CA: Sage.

Lunin, L.R. & Rada, R. (1989). Hypertext: Introduction and overview. *Journal of the American Society for Information Science, 40*, 159-163.

Manitoba Education and Training (1996). *Success for all learners: A handbook on differentiating instruction*. Winnipeg, MB: Author.

Manitoba Education and Training (1997). *Senior I English Language Arts: A foundation for implementation*. Winnipeg, MB: Author.

Manitoba Education and Training (1999). *Strategic planning framework for the integration of information technologies in Manitoba's education and training system.* Winnipeg, MB: Author.

Marginson, S. (1997) *Markets in education*. St. Lenards, AU: Allen & Unwin.

McKenna, M.C. (1998). Afterword to 20th century literacy: Prospects at the millennium. *Peabody Journal of Education, 73*(3&4), 376-386.

McLuhan, M., Fiore, Q., & Agel, J. (1967). The medium is the message: An inventory of effects. New York: Bantam.

Mitchell, W.J. (1999). Replacing space. In P. Lunenfeld (Ed.) *The Digital Dialectic: New Essays on New Media* (p. 112-129). Cambridge, MA: The MIT Press.

Mosenthal, P. (1993). Understanding agenda setting in reading research. In A.P. Sweet & I. Anderson (Eds.), *Reading Research into the Year 2000* (pp. 115-128). Hillsdale, NJ: Lawrence Erlbaum Associates.

Negroponte, N. (1995). *Being digital.* New York: Alfred A. Knopf.

Nelson, T. H. (1990). *Literary machines*. Sausalito, CA: Mindful.

The New London Group (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review 66*(1), 60-92.

Newman, D. (1990). Opportunities for research on the organization impact of school computers. *Educational Researcher, 19*(3), 8-13.

Nielsen, J. & Landauer, T.K.(1993). A mathematical model of the finding of usability problems, *Proceedings of ACM INTERCHI'93 Conference (Amsterdam, The Netherlands, 24-29 April 1993), pp.206-213.*

Nielsen, J. (2000a). *Eyetracking study of web readers.* In J. Nielsen Alertbox, May 14. URL: http://www.useit.com/alertbox/20000514.html.

Nielsen, J. (2000b). *Novice versus expert users.* In J. Nielsen Alertbox, May 14. URL: http://www.useit.com/alertbox/20000206.html.

Nielsen, J. (2000c). *Designing web usability.* Indianapolis, IN: New Riders.

Ontario Ministry of Education (1989). *Media literacy resource guide: Intermediate and senior divisions 1989.* Toronto, ON: Author.

Park, O. (1992). Instructional applications of hypermedia: Functional feature, limitation, and research issues. *Computers in Human Behavior, 8*, 259-272.

Perfetti, C.A. (1996). Text and hypertext. In J. Rouet, J. Levonen, A. Dillon, & R. Spiro (Eds.) *Hypertext and cognition* (pp. 157-161). Mahwah, NJ: Lawrence Erlbaum Associates.

Pungente, J. (1996). The second spring: Media literacy in Canada's Schools. In W.G. Garrett-Petts and Donald Lawrence (Eds.) *Integrating Visual and Verbal Literacies* (pp. 153-164). Winnipeg, MB: Inkshed.

Rabinowitz, P. (1987). *Before reading.* Ithaca. NY: Cornell University Press.

Rabinowitz, P. & Smith M.W. (1998). *Authorizing readers: Resistance and respect in the teaching of literature*. New York, NY: Teachers College Press.

Rada, R. (1989). Writing and reading hypertext: An overview. *Journal of the American Society for Information Science 40*, 164-171.

Reinking, D. (1997). Me and my hypertext:) A multiple digression analysis of technology and literacy (sic). *The Reading Teacher, 50*(8), 626-643.

Reinking, D. & Walkins, J. (2000). A formative experiment investigating the use of multimedia book review to increase elementary students' independent reading. *Reading Research Quarterly 35*(3). 384-414.

Rosenblatt, L.M. (1994). The transactional theory of reading and writing. In R.B Ruddell, MR. Ruddell, & H. Singer (Eds.) *Theoretical Models and Processes of Reading*, (4th ed.), (pp. 1057-1092). Newark, DE: International Reading Association.

Rouet, J. & Levanon, J. (1996). Studying and learning with hypertext: Empirical studies and their implications. In J. Rouet, J. Levonen, A. Dillon, & R. Spiro (Eds.) *Hypertext and cognition* (pp. 9-24). Mahwah, NJ: Lawrence Erlbaum Associates.

Ruffini, M.F. (2000). Systematic planning in the design of an educational web site. *Educational Technology, XL*(2), 58-64.

Sadoski, M. & Paivio, A. (1994). A dual coding view of imagery and verbal processes in reading comprehension. In R.B. Ruddell, MR. Ruddell, & H. Singer (Eds.) *Theoretical Models and Processes of Reading*, (4th ed.), (pp. 582-601). Newark, DE: International Reading Association.

Semali, L.M., & Pailliotet, A.W. (1999). Introduction: What is intermediality and why study it in U.S. classroom? In L.M. Semali & A.W. Pailliotet (Eds.) *Intermediality: The teachers' handbook of critical media literacy* (pp. 1-29). New York: Longman.

Schrock, K. (2001). *Guide for educators: Critical evaluation surveys.* [Online] URL: wysiwyg://57/http://school:discovery.com/schrockguide/eval.html.

Silber, K.H. (1981). Some implications of the history of educational technology: We're all in this together. In J.W. Brown & S.N. Brown (Eds.), *Education Media Yearbook 1981* (pp. 18-28). Littleton, CO: Libraries Unlimited.

Sinatra, R. (1986). *Visual literacy connections to thinking, reading and writing.* Springfield, IL: Charles C. Thomas.

Smith, A.G. (1997). Testing the surf: Criteria for evaluating internet information resources. *The Public-Access Computer Systems Review* 8(3), [Online] URL: http://info.lib.uh,edu/pr/v8/n3smit8n3.html

Smith, F. (1985). *Reading without nonsense* (2nd ed.). New York, NY: Teachers College Press.

Smith, K.E. (1999a). *Website readability and who is a Canadian?* Proceedings of the Faculty of Education Graduate Students' Symposium. Winnipeg, MB: University of Manitoba.

Smith, K.E. (1999b). *Student dialogue in the computer room.* Unpublished paper. Winnipeg, MB: University of Manitoba.

Snyder, I. (1996). *Hypertext: The electronic labyrinth.* Victoria, AU: Melbourne University Press.

Snyder, I. (1999). Integrating computers into the literacy curriculum: More difficult than we first imagined. In J. Hancock (Ed.), *Teaching literacy using information technology* (pp. 11-30). Newark, DE: International Reading Association.

Straw, S.B. (1990). Challenging communication: Readers reading for actualization. In D. Bogdan and S.B. Straw (Eds.) *Beyond Communication (67- 90).* Portsmouth, NH: Heinemann.

Sutton, S.A. (1994). *Information literacy initiative. Part 1: Problem analyses and statement of purpose* (September 30). San Jose, CA: The San Jose University Library.

Tapscott, D. (1998). *Growing up digital: The rise of the net generation.* New York, NY: McGraw-Hill.

Taylor, S.J. & Bogdan, R. (1998). Introduction to qualitative research methods: A guidebook and resource (Third edition), Toronto, ON: John Wiley & Sons.

Tierney, R.J. (1994). Dissension, tensions, and the models of literacy. In R.B. Ruddell, M.R. Ruddell, & H. Singer (Eds.) *Theoretical Models and Processes of Reading*, (4th ed.), (pp. 1162-1202). Newark, DE: International Reading Association.

Tyner, K. (1998). *Literacy in a digital world: Teaching and learning in the age of information.* Maywah, NJ: Lawrence Erlbaum.

Ulmer, G. (1998). Foreward/forward (into electracy). In T. Taylor & I. Ward (Eds.), *Literacy theory in the age of the Internet* (pp. ix-xiii). New York: Columbia University Press.

Usher, T., & Edwards, R. (1994). *Postmodernism and education.* New York, NY: Routledge.

Vacca, R.T. & Vacca, J.L. (1999). *Content area reading: Literacy and learning across the curriculum* (Sixth edition). New York: Addison-Wesley.

van Dijk, T., & Kintsch, W. (1983). *Strategies of discourse comprehension.* New York, NY: Academic Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.). Cambridge, MA: Harvard University Press.

Ware, C. (2000). *Information visualization: Perception for design.* San Diego, CA: Academic.

Williams, P.O. (1979). Determining the reading difficulty level of vocational materials. *Florida Vocational Journal, 4*(5), 16-19.

Wilhelm, J. (1995). Reading is seeing: Using visual response to improve the literary reading of reluctant readers. *Journal of Reading Behavior, 27*(4), 467-503.

Wimmer, R.D. & Dominick, J.R. (1994). *Mass media research.* Belmont, CA: Wadsworth.

Zakaluk, B.L. (1985). *Toward a new approach to predicting text comprehensibility using inside- and outside-the-head information and a nomograph.* Unpublished doctoral dissertation. University of Minnesota.

Zakaluk, B.L., & Samuels, S.J. (1988). *Readability: Its past, present, & future.* Newark, DE: International Reading Association.

Zakaluk, B.L., & Samuels, S.J. (1996). Issues related to text comprehensibility: The future of readability. *Québécoise de linguistique, 25*(1), 41-89.

APPENDICES

Appendix A. Profile of Expert Group Categories of Analysis

EXPERT	PREFERRED:	DISLIKED:
1	• Broad background information • Lesson plans • Field-tested information • Have variety • Have highly student-oriented information	• Web sites that were inferior to student work • Ranking, takes too long • Ranking, 20 was too difficult because the web sites were all so different • Commercialism • Out-dated web sites
2	• Were student-oriented • Pre-study activities • Have many visuals • Questions	• Mildly disliked web sites that were only resource-based • Ranking, without a given lesson purpose was too cumbersome
3	• Engaging rather than entertaining, • Motivating • Academic and complete • Have variety • Many links • Have good layout, formal structure • Show process of knowledge and connections to learning • Are good examples for student web site writing	• Ranking, takes too long • Too much glitz will turn off the highly academic students
4	• Preferred ranking web sites using a pre-set provincial protocols • More use for students than teachers	• Ranking, takes too long • Variety of and within web sites makes ranking artificial, cursory
5	• Gain student attention • Have many links • Have great visuals and glitz • Have cultural links (current movies) • Variety (texts, pictures, tests) • Equal interest for both teachers and students • Were models for potential student web site writing	• Information falsely presented • Commercialism • Difficult to read, stuffy, text • Show prejudice toward ethnic/intelligence groups

Appendix B. Expert Group Web Site Ranking

Summary Sheet

Web Site Ranking Form (1=best, 20=worst) Na shows expert could not access web site or was unable to rank it.	1	2	3	4	5
1. http://www.romeoandjuliet.com/	Na	18	7	14	3
2. http://www.roughcut.com/whats/alive/romeojuliet.html	Na	19	14	4	17
3. http://members.tripod.com/~Romeo_79/index.html	Na	17	15	10	16
4. http://tlc.ai.org/shakespe.htm	3	3	1	18	1
5. http://www.geocities.com/Hollywood/9251/rj1968.html	4	10	16	19	14
6. http://starbuck.com/shakespeare/Romeoandhall/wwwboard.html	Na	Na	13	15	11
7. http://members.aol.com/RJuliet1/index.html	Na	13	12	8	15
8. http://cwis.kub.nl/~fdl/gids/97-1/jongj1/romjul/	Na	Na	18	16	13
9. http://www.mwsc.edu/~eng368/summer97/submit/7.24.97-11.59.12.html	Na	7	3	17	4
10. http://www.jetlink.net/~massij/wssq/rj.htm	Na	19	17	6	6
11. http://educ.queensu.ca/~qbell/update/tint/rj/	Na	16	5	20	10
12. http://www.wsu.edu:8080/~brians/love-in-the-arts/romeo.html	Na	20	11	12	5
13. http://www.phila.k12.pa.us/clusters/clusterpages/ne_cluster/shakes.html	1	15	Na	11	12
14. http://www.markthis.com/cliffnotes/romeo/	5	14	10	3	20
15. http://www.gradesaver.com/ClassicNotes/Titles/romeoandjuliet.html	4	4	Na	1	2
16. http://www.yale.edu/ynhti/curriculum/units/1986/1/86.01.06.x.html	Na	13	2	2	9
17. http://daphne.palomar.edu/shakespeare/lambtales/LAMBTALE.HTM	Na	9	6	7	8
18. http://library.thinkquest.org/19539/front.htm	Na	12	4	9	19
19. http://www.jetlink.net/~massij/shakes/	2	11	9	5	7
20. http://moose.uvm.edu/~mmcampbe/index.html	Na	8	8	13	18

Appendix C. Summary of Blueprint Modifications

Part A – Functional Semantics of Content

Added	Deleted	Moved	Revised
Accessibility – Content Behaviours • Contains interactive elements • Long text has scroll bar • Contains a variety of automatic multi-media elements that make site more accessible (e.g., film clip starts automatically, animated figures) Coherence – Content Behaviours • Loading speed does not interfere with ability to access interactive elements • Interactive elements are self-explanatory Authority - Text • Shows that web site is made by another student • Text names connections and associations with other authorities in the field • Author's biography is included • Funding source is included • Shows that web site is made by another teacher Aesthetics - Text • Text blocks are well organized/placed on the web pages • Text size is easy to read Aesthetics – Visual Language • Visual elements coordinate well with text • Plain background and dark text/visual • Very active backgrounds and visual do not interfere with text reading	Accessibility – Content Behaviours • Loading is slow and/or interferes with ability to access interactive elements • Individual elements are easy to manipulate and operate Coherence – Visual Language • Shows what cannot be seen (e.g., Opening page visual help make the rest of the web site's organization obvious) Aesthetics – Visual Language • Overall "look" of the web site stimulates interest	Accessibility – Text • Text lists information • Text includes questions Accessibility – Content Behaviours • Contains buttons/icons that move the reader through multi-media, text, or visual elements	Accessibility – Text • Web page and theme assignment(s) uses the same vocabulary. Text facilitates transfer (has similarities) Accessibility – Visual Language • Shows ads (ads could be for products such as books related to subject) Coherence – Content Behaviours • Students must be taught or have prior experience using web sites' interactive elements (e.g., chat center, MOOs, MUDS, avatars) Authority – Content Behaviours • Web site is well designed for interactivity (e.g., mini-tutoring sessions, interactive speech) Aesthetics – Content Behaviours Technical qualities will impress students

Part B – Functional Semantics of Rhetoric

Added	Deleted	Moved	Revised
Accessibility – Text • Text orients the reader to topic(s) • There is a lot of text Accessibility – Visual Language • There are a lot of visuals Accessibility – Content Behaviours • Links to a wide variety of web sites outside content of class • There are a lot of interactive elements Coherence - Text • Associated ideas are located together • Web site is self-explanatory Authority - Text • Text can be verified through paper sources Aesthetics - Text • Headlines motivate students to look through web site Aesthetics – Visual Language • Photos/charts/symbols motivate students to look through web site Aesthetics – Content Behaviours Interactive elements present a challenge to users	Accessibility – Text • Shows context of concepts (i.e., web site does a bit of tutoring) Accessibility – Visual Language • Shows context of concepts (i.e., web sites does a bit of visual tutoring) Coherence - Text • Students must have read the play Coherence – Visual Language • Shows contents of concept (e.g., thumbnail of what is in the next/other sections(s)) Authority - Text • Text names connections and association with other authorities in the field Authority – Interactive Elements • Authority of the site in its strong multi-media elements Aesthetics – Visual Language • Individual sites need a media culture tie-in (e.g., scenes from *Shakespeare in Love*)	Authority - Text • Connections – The web site links and connections have similar groupings Authority – Visual Language • Connections – The web site visuals have logical groupings, associated ideas are located together	Accessibility – Text • Text guides readers through document Accessibility – Visual Language • Visual elements guide readers through document (e.g., arrows, lines, images) • Key visual concepts focus attentions on theme Accessibility – Content Behaviours • Pop-up windows do not obscure view of text or visuals Authority – Content Behaviours • Web site gives the impression that it is reputable (i.e., Looks like web site is not made by an amateur) Aesthetics – Visual Language • Increases impact (e.g., Visual elements add impact to text or content behaviours) Aesthetics – Content Behaviours • Has high level interaction allowing a high level of student participation (e.g., avatar, texts with auto-feedback, responses to student questions)

Appendix D. Blue Print Used to Rank Importance of Categories

BLUEPRINT Part A

Functional Semantics of Content

"Functional semantics /n/ - The study of the purpose for the inclusion of each element in a visual language communication unit. Hence, the study of what job each unit it doing" (Horn, 1998).

Circle a number that represents the importance of the item to students' ability to read the web site, 1= least and 5= most important. No response = not important or irrelevant.

ACCESSIBILITY: *Outside-the-head* (Zakaluk, 1985) elements of web site	**Least**				**Most**
TEXT					
❑ Web site is readable at Senior 2 reading level (e.g. as determined by analyzing the text using Fry or Flesch-Kincaid readability measures)	1	2	3	4	5
❑ Text lists information	1	2	3	4	5
❑ Web page and theme assignment(s) uses the same vocabulary. Text compares for transfer (has similarities)	1	2	3	4	5
❑ Text is expository	1	2	3	4	5
❑ Text is narrative	1	2	3	4	5
❑ Text includes questions	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows who (e.g. Picture of Shakespeare)	1	2	3	4	5
❑ Shows where	1	2	3	4	5
❑ Shows when	1	2	3	4	5
❑ Shows examples	1	2	3	4	5
❑ Shows comparisons	1	2	3	4	5
❑ Shows ads (ads could be for products such as books related to subject)	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Contains interactive elements	1	2	3	4	5
❑ Contains links to other sites	1	2	3	4	5
❑ Long text has scroll bar	1	2	3	4	5
❑ Contains a variety of automatic multi-media elements that make site more accessible (e.g. film clip starts automatically, animated figures)	1	2	3	4	5
COHERENCE: *Inside-the-head* (Zakaluk, 1985), cognitive artifacts and prior knowledge required negotiate a particular web site	**Least**				**Most**
TEXT					
❑ Flexibility - That is, site is broad enough in textual content to connect to a diverse range of students	1	2	3	4	5

❑ Connections - Student must be able to relate the web page and theme/assignment(s)	1	2	3	4	5
❑ Background - Student must have seen or be familiar with books or stories closely related to this play	1	2	3	4	5
❑ Student must have read the play or parts of it	1	2	3	4	5
VISUAL LANGUAGE					
❑ Flexibility – That is, site is broad enough in visual content to connect to a diverse range of students	1	2	3	4	5
❑ Connections - Student must be able to visually relate web page and theme/assignments (i.e. Blocks of text and visuals have something in common with other class materials.)	1	2	3	4	5
❑ Background - Student must have seen or be familiar with related TV or movies to connect with ideas (e.g., West Side Story)	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Interactive elements meet the needs of a diverse range of students	1	2	3	4	5
❑ Student must be taught or have prior experience using web sites' interactive elements (e.g. chat center, MOOs, MUDs, avatars)	1	2	3	4	5
❑ Loading speed does not interfere with ability to access to interactive elements	1	2	3	4	5
❑ Interactive elements are self explanatory	1	2	3	4	5
AUTHORITY: Critical literacy elements	**Least**				**Most**
TEXT					
❑ Shows that web site is made by another teacher	1	2	3	4	5
❑ Shows that web site is made by another student	1	2	3	4	5
❑ Web site names web author who is connected to a reputable institution (e.g., Dept of Education, University)	1	2	3	4	5
❑ Text names connections and associations with other authorities in the field	1	2	3	4	5
❑ Author's biography is included	1	2	3	4	5
❑ Funding source is included	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows symbol or picture of web author/institution that is well recognized as reputable	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Web site is well designed for interactivity (e.g. mini tutoring sessions, interactive speech)	1	2	3	4	5
❑ Authority of the site is in its sophisticated multi-media elements (More sophisticated multi-media elements, more authority)	1	2	3	4	5
AESTHETICS: design/appeal	**Least**				**Most**
TEXT					
❑ Text blocks are well organized/placed on the web pages	1	2	3	4	5
❑ Text size is easy to read	1	2	3	4	5

VISUAL LANGUAGE					
❑ Visual elements coordinate well with text	1	2	3	4	5
❑ Plain background and dark text/visuals	1	2	3	4	5
❑ Very active backgrounds and visuals do not interfere with reading text	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Technical qualities will impress students	1	2	3	4	5
❑ Content behaviours are limited to only a few (i.e. selected to be minimal)	1	2	3	4	5

BLUEPRINT Part B

Functional Semantics of Rhetoric

"Rhetorical Functions /n/ - Those parts and properties of a communication unit that communicate direction, instruction, organization message, or emphasis and tone to a reader" (Horn, 1998).

"Rhetoric /n/ - 1. originally, the study of the means of persuasion in verbal discourse. 2. the study of methods and means of communication." (Horn, 1998)

ACCESSIBILITY: Inside-the-head (Zakaluk, 1985)	**Least**				**Most**
TEXT					
❑ Text guides readers through document	1	2	3	4	5
❑ Text orients the reader to topic(s)	1	2	3	4	5
❑ Keywords and related words focus attention on concepts	1	2	3	4	5
❑ There is a lot of text	1	2	3	4	5
VISUAL LANGUAGE					
❑ Visual elements guide readers through document (e.g. arrows, lines, images)	1	2	3	4	5
❑ Visuals orient the reader to topic(s)	1	2	3	4	5
❑ Key visual concepts focus attention on theme	1	2	3	4	5
❑ There are a lot of visuals	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Contains buttons/icons that move the reader through multi-media, text, or visual elements	1	2	3	4	5
❑ Interactive elements cue the reader on how to act within the web site	1	2	3	4	5
❑ Individual elements are easy to manipulate and operate	1	2	3	4	5
❑ Pop-up windows do not obscure view of text or visuals	1	2	3	4	5
❑ Links to a wide variety of web sites outside content of class	1	2	3	4	5
❑ There are a lot of interactive elements	1	2	3	4	5
COHERENCE: *Inside-the-head* (Zakaluk, 1985), cognitive artifacts and prior knowledge required to negotiate a particular web site	**Least**				**Most**
TEXT					
❑ Connections – The web site links and connections have similar groupings.	1	2	3	4	5
❑ Student must have prior knowledge of keywords and related words to choose links within the site	1	2	3	4	5

❑ Web author has regard for audience and knows which links/text connect to student background knowledge at this grade level	1	2	3	4	5
❑ Associated ideas are located together	1	2	3	4	5
❑ Web site is self explanatory	1	2	3	4	5
VISUAL LANGUAGE					
❑ Clusters visual and verbal elements (e.g. time line or web diagram)	1	2	3	4	5
❑ Shows overall organization of the web site on opening and/or subsequent pages (e.g. graphic organizer)	1	2	3	4	5
❑ Connections – The web site visuals have logical groupings, associated ideas are located together	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Web site performs like a tutor (e.g., interactive speech and response/answer commands)	1	2	3	4	5
❑ Student needs previous experience with similar web sites to recognize where the functions of interactivity will lead	1	2	3	4	5
❑ Student needs a sophisticated level of computer skills to negotiate the web site (i.e. Or they might get lost in cyberspace)	1	2	3	4	5
❑ Allows student to be in touch with a broader community	1	2	3	4	5
AUTHORITY: Critical literacy aspects that provide clues to authority of the writing	**Least**				**Most**
TEXT					
❑ Web site includes recent date (e.g. "Updated January, 2001". There is certain amount of authority in the web site being current.)	1	2	3	4	5
❑ Text can be verified through paper resources	1	2	3	4	5
VISUAL LANGUAGE					
❑ Shows movies, pictures, and other visuals associated with other authorities in the field	1	2	3	4	5
❑ Shows award won by web site	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Web site shows number of visitors and is interactive when student become a new visitor (More visitors, more authority)	1	2	3	4	5
❑ Web site gives the impression that it is reputable (i.e. Looks like web site is not made by an amateur.)	1	2	3	4	5
AESTHETICS: design/appeal	**Least**				**Most**
TEXT					
❑ Headlines motivate students to look through web site	1	2	3	4	5
❑ Text provides lightness, humor and/or irony	1	2	3	4	5
❑ Supplies a variety of interpretations of the play's elements	1	2	3	4	5

VISUAL LANGUAGE					
❑ Photos/charts/symbols motivate students to look through web site	1	2	3	4	5
❑ Pictures provide lightness, humor and/or irony	1	2	3	4	5
❑ Increases impact (e.g. Visual elements add impact to text or content behaviours)	1	2	3	4	5
CONTENT BEHAVIOURS (INTERACTIVE ELEMENTS)					
❑ Has high level interaction allowing a high level of student participation (e.g., avatar, tests with auto-feedback, responses to student questions)	1	2	3	4	5
❑ Interactive elements present a challenge to users	1	2	3	4	5
❑ Interactive elements allow students to express their viewpoint (e.g. chat center)	1	2	3	4	5

SUMMARY RATING

Circle one choice for each item.

I rate my own computer skill as: technophobic 1 - 2 - 3 - 4 - 5 - 6 - 7 web author/expert user

I rate my students' computer skill as: technophobic 1 - 2 - 3 - 4 - 5 - 6 - 7 web author /expert user

I mostly use web sites to: motivate students / supplement research materials.

My teaching style with web sites is mostly: student directed / teacher directed / shared.

My teaching style is best complemented by web sites strong in textual / visual language / content behaviours.

My students will be most interested in web sites focused on textual / visual language / content behaviours.

I am most concerned with web site: accessibility / coherence/ critical literacy / aesthetics.

I am least concerned with web site: accessibility / coherence/ critical literacy / aesthetics.

STATEMENT OF STRENGTHS:

STATEMENT OF WEAKNESSES:

Appendix E. Blue Print Checklist

FUNCTIONAL SEMANTICS OF CONTENT

Web Site Number:

Part A	ACCESSIBILITY	COHERENCE	CRITICAL LITERACY	AESTHETICS
TEXT	❑ Web site is readable at Senior 2 reading level (e.g. as determined by analyzing the text using Fry or Flesch-Kincaid readability measures) ❑ Text lists information ❑ Web page and theme assignment(s) use the same vocabulary. Text compares for transfer (has similarities) ❑ Text is expository ❑ Text is narrative ❑ Text includes questions	❑ Flexibility - That is, site is broad enough in textual content to connect to a diverse range of students ❑ Connections - Student must be able to relate the web page and theme/assignment(s) ❑ Background - Student must have seen or be familiar with books or stories closely related to this play ❑ Student must have read the play or parts of it	❑ Shows that web site is made by another teacher ❑ Shows that web site is made by another student ❑ Web site names web author who is connected to a reputable institution (e.g., Department of Education, Harvard) ❑ Text names connections and associations with other authorities in the field ❑ Author's biography is included ❑ Funding source is included	❑ Text blocks are well organized/placed on the web pages ❑ Text size is easy to read
VISUAL LANGUAGE	❑ Shows who (e.g. Picture of Shakespeare) ❑ Shows where ❑ Shows when ❑ Shows examples ❑ Shows comparisons ❑ Shows ads (ads could be for products such as books related to subject)	❑ Flexibility – That is, site is broad enough in visual content to connect to a diverse range of students ❑ Connections - Student must be able to visually relate web page and theme/assignments (i.e., Blocks of text and visuals have something in common with other class materials.) ❑ Background - Student must have seen or be familiar with related TV or movies to connect with ideas (e.g., West Side Story)	❑ Shows symbol or picture of web author who is connected to a reputable institution	❑ Visual elements coordinate well with text (i.e., visually balance) ❑ Good contrast in visuals (e.g., plain background and dark text) ❑ Very active backgrounds and visuals do not interfere with reading text
CONTENT BEHAVIORS	❑ Contains interactive elements ❑ Contains links to other sites ❑ Long text has scroll bar ❑ Contains a variety of automatic multi-media elements that make site more accessible (e.g. film clip starts automatically, animated figures)	❑ Interactive elements meet the needs of a diverse range of students ❑ Student must be taught or have prior experience using web sites' interactive elements (e.g. chat center, MOOs, MUDs, avatars) ❑ Loading speed does not interfere with ability to access to interactive elements ❑ Interactive elements are self-explanatory	❑ Web site is well designed for interactivity (e.g. mini tutoring sessions, interactive speech) ❑ Authority of the site is in its sophisticated multi-media elements (More sophisticated multi-media elements, more authority)	❑ Technical qualities will impress students ❑ Content behaviours are judiciously selected to balance with text and visuals (i..e., Not just a media circus)

FUNCTIONAL SEMANTICS OF RHETORIC

Web Site Number:

Part B	ACCESSIBILITY	COHERENCE	CRITICAL LITERACY	AESTHETICS
TEXT	❑ Text guides readers through document ❑ Text orients the reader to topic(s) ❑ Keywords and related words focus attention on concepts ❑ There is a lot of text	❑ Connections – The web site links and connections have similar groupings (i.e., logical associations) ❑ Student must have prior knowledge of keywords and related words to choose links within the site ❑ Web author has regard for audience and knows which links/text connect to student background knowledge at this grade level ❑ Web site is self-explanatory	❑ Web site includes recent date (e.g., "Updated January, 2000". There is certain amount of authority in the web site being current.) ❑ Text can be verified through paper resources	❑ Headlines motivate students to look through web site ❑ Text provides lightness, humor and/or irony ❑ Supplies interesting interpretations of the play's elements
VISUAL LANGUAGE	❑ Visual elements guide readers through document (e.g. arrows, lines, images) ❑ Visuals orient the reader to topic(s) ❑ Key visual concepts focus attention on theme ❑ There are a lot of visuals	❑ Clusters visual and verbal elements (e.g. time line or web diagram) ❑ Shows overall organization of the web site on opening and/or subsequent pages (e.g., graphic organizer, what cannot be seen) ❑ Connections – The web site visuals have logical groupings, associated ideas are located together	❑ Shows movies, pictures, and other visuals associated with other authorities in the field ❑ Shows award won by web site	❑ Photos/charts/symbols motivate students to look through web site ❑ Pictures provide lightness, humor and/or irony ❑ Increases impact (e.g., Visual elements add impact to text or content behaviours.)
CONTENT BEHAVIORS	❑ Contains buttons/icons that move the reader through multi-media, text, or visual elements ❑ Interactive elements cue the reader on how to act within the web site ❑ Individual elements are easy to manipulate and operate ❑ Pop-up windows do not obscure view of text or visuals ❑ Links to a wide variety of web sites outside content of class ❑ There are a lot of interactive elements	❑ Web site performs like a tutor (e.g., interactive speech and response/answer commands) ❑ Student needs previous experience with similar web sites to recognize where the functions of interactivity will lead ❑ Student needs a sophisticated level of computer skills to negotiate the web site (i.e., Or they might get lost in cyberspace) ❑ Allows student to communicate with a broader community	❑ Web site shows number of visitors and is interactive when student become a new visitor (More visitors, more authority) ❑ Web site gives the impression that it is reputable (i.e., Looks like web site is not made by an amateur.)	❑ Has high-level interaction allowing a high level of student participation (e.g., Avatar, tests with auto-feedback, responses to student questions) ❑ Interactive elements present a challenge to readers ❑ Interactive elements allow students to express their viewpoint (e.g., Chat center)

SUMMARY RATING

Circle one choice for each item.

I rate my own computer skill as: technophobic 1 - 2 - 3 - 4 - 5 - 6 - 7 web author/expert user

I rate my students' computer skill as: technophobic 1 - 2 - 3 - 4 - 5 - 6 - 7 web author /expert user

I mostly use web sites to: motivate students / supplement research materials.

My teaching style with web sites is mostly: student directed / teacher directed / shared.

My teaching style is best complemented by web sites strong in textual / visual language / content behaviours.

My students will be most interested in web sites focused on textual / visual language / content behaviours.

I am most concerned with web site: accessibility / coherence/ critical literacy / aesthetics.

I am least concerned with web site: accessibility / coherence/ critical literacy / aesthetics.

STATEMENT OF STRENGTHS:

STATEMENT OF WEAKNESSES:

Appendix F. Shakespeare Web Sites

Web Site Ranking Form (1=best, 20=worst)	
http://www.romeoandjuliet.com/	
http://www.roughcut.com/whats/alive/romeojuliet.html	
http://www.geocities.com/Hollywood/Lot/2080/	
http://tlc.ai.org/shakespe.htm	
http://www.geocities.com/Hollywood/9251/rj1968.html	
http://starbuck.com/shakespeare/Romeoandhall/wwwboard.html	
http://pages.prodigy.com/romeoandjuliet/home.htm	
http://cwis.kub.nl/~fdl/gids/97-1/jongj1/romjul/	
http://www.mwsc.edu/~eng368/summer97/submit/7.24.97-11.59.12.html	
http://www.jetlink.net/~massij/wssq/rj.htm	
http://educ.queensu.ca/~qbell/update/tint/rj/	
http://www.wsu.edu:8080/~brians/love-in-the-arts/romeo.html	
http://www.phila.k12.pa.us/clusters/clusterpages/ne_cluster/shakes.html	
http://www.shakespeare.uiuc.edu/	
http://www.ardenshakespeare.com/main/welcome.html	
http://www.yale.edu/ynhti/curriculum/units/1986/1/86.01.06.x.html	
http://daphne.palomar.edu/shakespeare/lambtales/LAMBTALE.HTM	
http://library.thinkquest.org/19539/front.htm	
http://www.jetlink.net/~massij/shakes/	
http://www.starbuck.com/shakespeare/Romeoandhall/wwwboard.html	

Appendix G. Web-Based Resources Evaluation, Manitoba Education and Training

For Online Web-Based Resources Only (Additional elements regarding authorship, accuracy, currency, objectivity, and technical and instructional design)	**YES**	**NO**	**N/A**
W1 Site is technically superior, facilitating easy access and user control • The site loads quickly • The site is compatible with commonly used browsers (Netscape, Explorer) • Lengthy text or large graphics are available through links or thumbnails • Organization is clearly shown through a directory, map, or other visual locator that indicates the hierarchy of page structure • The site is accessible without a secondary viewer (Java, Acrobat), or clear pointers for installation are provided • Audio and video can be accessed without additional software, or clear pointers for installation are provided • Multiple entry points are provided • Information may be downloaded and printed • Return links are provided • Lengthy text can be read without excessive vertical or horizontal scrolling • The site is stable and reliable technically W2 Site is interactive • Users can interact with site in an audio or visual format • Users can interact with others through e-mail, chat, bulletin board, etc. • Provides for and encourages student to student interaction. • Users can submit information to the site • Users can e-mail the author and/or webmaster • User inputs are monitored and appropriate responses are provided • Virtual field trips, mentorships, collaborative projects are facilitated through internal or external links • The site allows internal searches of indexes, databases • The site contains a Frequently Asked Questions area or Ask the Expert area • Chat areas or Multiple User Dimensions are closely monitored W3 Web design is appropriate for the intended audience • The site includes appropriate visuals, audio, video clips • Headings, sub-headings, font, background colour are suitable W4 Authorship, affiliation, and purpose are clearly stated • Author's credentials and sponsoring organization are described • Copyright date is provided			

• Bias or philosophical stance are clearly stated. • Controversial issues are dealt with in a balanced presentation W5 The site is free from excessive advertising • Advertising is separated from the main text W6 The site contains current information and perspectives • Copyright is clearly indicated • Date of latest update is provided • Information is based on the most recent information available W7 Information in the site is well-researched, free from error, and follows appropriate norms of writing • Research sources are acknowledged • Written and audiovisual texts are free from error and at an appropriate level of sophistication W8 Coverage of the topic or issue is adequate • The site provides sufficient depth and richness of information • Links to other quality sites are included when appropriate • Suggestions are made for off-line extensions			
Web Site Only Rating			