THE EFFECTS OF TEXT PRESENTATION: LINEAR AND HYPERTEXT ON ENGLISH LANGUAGE LEARNERS
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Introduction to the Problem

Most of what we know about students and text processing is through the printed words of textbooks, books, magazines and newspapers. We take for granted our ability to take in information from this version of print. Through text students are able to build a coherent mental representation of information involving the processing of individual letters, words, and phrases and how these work and relate to one another. Kintsch (1998) argues that in normal text we can remember what we have read as that “information is still readily retrievable because the succeeding sentence most likely will contain retrieval cues that make it accessible in long-term working memory” (102). While what Kintsch argues may indeed be true in traditional ‘normal’ text, I question whether that these retrieval cues are present on the Internet, where instead there are hypertext links.

The Internet has significantly changed how we read. While students used to read in English primarily through the blackboard or text on paper; they now often do most of their high school and/or college research online. Some databases have full text sites, while others do not. There is material written primarily for the web, some of which comes with a “printer friendly version.” (i.e. a document that may be printed on paper without losing its format) Some students are given instructional support to help them analyze these different Internet structures or to help them think about this media or its many messages.

If negotiating these online learning tools is difficult in one’s first language, it is especially challenging for second language learners. For example, in order to find an article on the Internet to read, students need to search for that article. This search, however, is different from non-computer searches that students may be used to doing. Although many students know how to look up a word in the dictionary, they may not know how to do a search on the Internet. On the Internet students need skills not only to decode, but also skills to search, to retrieve and to organize. Most of what we know about college reading comes from what we know about traditional texts and textbooks. We know little about how text is read on the Internet. The web is designed as a network with a global link of pages. Furthermore, both reading on the web and writing for the web are defined by an expectation of interaction. The Internet, therefore, has complicated the concept of literacy, especially in terms of reading and writing (Bolter, 1998).

My doctoral study investigates the experiences of both native and non-native speakers of English in a college setting and the experiences of English language learners in a high school setting as they read linear or printed text and how they read on the Internet with hypertext. There has been little research in this field, but there is research in the many domains which this study overlaps. As such, the dissertation draws on second language acquisition; technology and its use in education, but primarily in reading; reading in both first
and second languages; schema theory; and cognition.

**Technology and Reading**

While there is research about multimedia support for second language learners, much of it involves the relationship of multimedia to vocabulary. Plass, Chun, Mayer and Leutner (1998) researched the multiple representations of having no annotation, verbal annotations, visual annotations or both types of annotation with 152 English speaking college students in a second year German course. Students read a 762 word German story presented through that of a multimedia computer program. Plass et. al argued that the recall of word translations was worse for students with low verbal recall and those students with low-spatial ability than for those with high verbal and high spatial ability. These results are “consistent with a generative theory of multimedia learning and with cognitive load theory” (221). The implications of this study show that learners should have options for study material that has both a visual and a verbal mode, but that students should not be forced to select and process both types of information. Liu and Reed (1995) investigated the impact of hypermedia-assisted instruction on 63 English-as-second-language (ESL) students' language skills. The students' level of vocabulary improved significantly from pre-test to post-test and to retention when using *Hypermedia-Assisted-Vocabulary-Learning Courseware*. The researchers concluded that this program was effective in enhancing the learning environment.

Text on screen may be referred to in literature reviews as electronic texts (e-texts) or hypertext and consists of on-screen information presented through visual, textual or aural means. While printed text has been a primary literacy tool, hypertext has features and capabilities that are fundamentally different from these. Winklemann (1995) argues that while print is static, e-text or hypertext is “dynamic and malleable.”

Hypertext is traditionally linked to a variety of information in different forms. The meaning of what is read may not be limited to a single closed set of words on that same page, but instead may be linked elsewhere depending on that writer’s and/or designer’s cognitive map or mental representation of space. Reading on the Internet now truly represents Goodman’s (1967) interactive mode and students really do use a “psycholinguistic guessing game” (P. L. Carrell, Devine, Joanne, Eskey, David, E, 1988) as they read these texts.

One area of concern with the use of technology and especially that of hypermedia or the Internet is how English language learners (L2) are able to comprehend these frames of pages. Hypertext and the World Wide Web may foster the cognitive flexibility needed to understand information and to construct knowledge through a broad range of sources. Spiro and Jehng (1990) argue that this flexibility allows us to reshape our knowledge. Reading hypertext, however, also has the possibility of drowning students in information overload.

Kamil (2000) argues that research about the use of technology for reading has had a relatively short history, and has been based primarily on the work of Atkinson and Hansen (1966-1967). In a review of research from 1990-1995 by Kamil and Lane (M. L. Kamil, Lane, D., 1998) only 12 research articles about technology with reading and/or writing was found in four journals. These included: Written Communication, Research in the Teaching of English, Reading Research Quarterly, Journal of Reading Behavior (since changed to Journal of
Literacy Research). It is important to have more research in this field as the Internet is where almost all research is performed for both high school and college students and, this trend can only continue.

The few studies that are useful to my work involve school children not, high school nor college students. Horney and Anderson-Inman (1998) studied school children who found it easier to read on the Internet. Gillingham’s (Gillingham, 1993) research showed just the opposite that hypertext slowed down searching for an answer. Kamil argues there are three separate situations in which hypertext may be seen: the literary version of hypertext where the reader tries to create his or her own unique material; hypertext which allows one to add information by providing readers the opportunity to explore the material in greater depth; and the hypertext which permits students to study. There is only a small body of research on hypertext and hypermedia and very few of the empirical studies which discuss “the cognitive consequences of reading this type of nontraditional text” (p. 773).

One of the problems with reading on the Internet, is the unpredictability of knowing where one will go when choosing the hypertext link. As Kamil and Lane (1998) argue there is no way to predict whether or not this link will be useful. If students do not processes the information correctly through the hypertextual links, then the students cannot put this reading into any form of comprehensible output in their research papers.

The question must be raised as to whether hypertext affects one’s ability to do high school and/or college work. How long does it take students to negotiate the links and remember what they read? Is there a difference between a hypermedia document and the “printer friendly” version? Will we need to teach students how to negotiate the links on the screen, or do students already know how to do it? How does this redefine our concept of literacy?

Summary

English Language Learners in academic settings share the reading challenges listed above with their native English speaking counterparts. But also, they must retrieve information through a second language, adding additional variables that may influence their experience. Research on reading linear text and hypertext must address these issues for both populations. In order to contribute to an understanding of this area, the study proposed here will compare comprehension of linear text versus hypertext for both native and non-native English speakers. The study will address the following questions:

- Is there a difference between comprehension of linear text versus hypertext for native English speakers?
- Is there a difference between comprehension of linear text versus hypertext for English language learners?
- Is the nature of the within group differences in comprehension of the two text types distinctive for native English speakers as compared with English language learners?
Reading Theory

From bottom-up or top-down to the more recent interactive models, researchers argue about which reading model best explains the process of reading comprehension. Bottom-up processes take the form of text based decoding while top down processes are reader driven. Goodman (1996) discusses that these models represent a usable view of the way reading works. Reading comprehension traditionally refers to a reader's complete understanding or full grasp of the meanings in a text. However, this broad definition results in some confusion when different levels of comprehension cannot be appropriately identified and explained.

Early theories maintained that reading was a bottom-up process; in other words, it was viewed as a decoding process where the reader reconstructed meaning from the smallest text unit (P.L. Carrell, 1988). An analysis of decoding skills showed that readers discriminated between sounds and letters, matching phonemes to graphemes for alphabetic systems. This process later became the phonics approach that was popular during the 1950s and 1960s.

Carrell et. al (1988) noted, in her research on L2 readers, that lower proficiency students often relied more heavily on bottom-up, text-based strategies, while more advanced English language learning readers were able to engage top-down processes based on prior knowledge and schemata. These top-down processes include background knowledge and cultural schemata as well as knowledge of formal schemata of different. Carrell's L2 research (1983) on the awareness of text structure, replicated the results of L1 research by Meyer et. al (1980) showing that seeing relations between ideas and between main ideas and details aids L2 readers in recall. Students using text structure to guide their reading show better recall both quantitatively and qualitatively. For L2 readers, whose lack of appropriate culture schemata often puts them at a disadvantage when processing text, there is more need for a basic structure, a skeleton on which to build further structures in their construction of meaning.

The most significant finding, reported by Meyer et al, has suggested that there is no single set of processing strategies that contributes to successful reading. Both readers who score high and those who score low seem to use the same kind of strategies both while reading and answering the questions on either measure. Strategic reading therefore seems to be not so much a matter of knowing which strategy to use but also how to use it successfully.

In a historical perspective, (Van Duzer, 1999) noted that psycholinguists focused on this top down approach to reading during the late 1960s and early 70s. They maintained that meaning is more important and takes the place over structure. While readers do use the sound-letter and syntactic approach, they draw on their schema to predict this meanings of text, and then read to confirm this prediction. Together, these processes work in tandem to show us what successful readers do simultaneously: decode and interpret text as it is read.

One reading theory that considers the background of the reader in response to textual input, is constructivism (Narvaez, 2002). Its proponents argue that knowledge, reader skill, cognitive development, culture, and purpose are the five important aspects about a reader and his or her comprehension level. Based on that of cognitive schema, this theory purports “when
an individual is presented with information, a schema or knowledge structure is activated to interpret the information” (p. 159). Bartlett’s “War of Ghosts” folktale presents these cultural assumptions on which readers may make based on their schema (Bartlett, 1977). When individuals were given a text to read and then asked to recall it, “participants showed an increased distorted recall...making it conform to familiar story schemas” (Narvaez, 2002).

Two leading reading theorists, Goodman (1986) and Kintsch (1998) view reading as an interactive process. In this, readers apply prior knowledge when they read, in order to build a coherent mental model or overall meaning structure of the text. Schema works like a filter in that it lets in what it recognizes, but it blocks irrelevant information. Kintsch maintains that there are three types of mental representation: the surface structure, which determines word order; the propositional text base, in which propositions are presented in a particular organizational structure; and the situational or mental model, or what the text is depicting.

Generally each text element is processed and the new proposition is added to the text and integrated. Kintsch asserts that the integration that takes place at sentence boundaries is of a particular nature as working memory is likely to be filled at this point “and must be cleared to make room for the next sentence. What has been constructed is transferred later to long term memory” (Kintsch, 1998, p. 102). With the exception of those propositions that are retained due to their relevance for further processing, the text that was in working memory is lost from primary memory.

Second Language Reading

Research into second language reading (L2) mainly deals with reading in academic settings by “mature readers who are already fluent readers in their first language” with its concentration on the psychology of reading and English as a foreign language. The direction of the research has followed that of the research of L1 and comprehension (Randall, 1988). The attempts to explore the nature of the process of L2 reading have been conducted primarily through that of reading errors, cloze technique, immediate recall and verbal reports (Weber, 1996).

Some L2 reading research centers high order skills of discourse organization, similar to those of continuous text (Randall, 1988). Bernhardt (1991) indicates that the topics mentioned most often in the 1970s and 80s were that of schema theory and background knowledge, text structure and word recognition. Throughout the 1990s the areas of highest interest were those of affective filters, text structure, syntactic features, word knowledge and instruction and vocabulary.

Cummins (1991) proposed the construct of underlying proficiency that supports second language learning through the transfer of skills from the first language to the second. Knowledge in the first language and how it works is transferred to the second language and enhances its acquisition. Cummins distinguishes between two types of language ability: Basic Interpersonal Communicative Skills (BICS) and Cognitive Academic Language Proficiency (CALP). BICS refers to everyday interpersonal skills such as body language, emotions, and repetition. CALP refers the proficiency is needed to understand language without the support of context. Academic reading of textbooks, class lectures, and/or online journals may be considered
examples of CALP.

Cummins has revised these two constructs to reflect two dimensions: the degree of contextualization and the degree of abstraction of language. If these distinctions of BICS and CALP are not taken into account, bilingual students often make a premature exit from language support programs that they so desperately need. The distinction between BICS and CALP has had a significant impact in North America. Educators often misunderstand the nature of language proficiency which in turn contributes to English language learners’ academic difficulties. Cummins argues that in theory this is likely to remain controversial as “there is no cross-disciplinary consensus regarding the nature of language proficiency and its relationship to academic achievement” (http://www.iteachilearn.com/cummins/bicscalp.html).

While there are many frameworks in which to view the studies of second language reading research, the reading models these are based upon a reader in his or her first language. C.A. Perfetti’s (1988) Verbal Efficiency Theory (VET) is a framework, which takes a comprehensive look at the abilities that are involved in the process of reading. Two major components characterize this theory, that of local text and text-modeling processes. Local text processes include those that are cognitive and that lead to lexical access, for example as when you start up your memory to find the meaning of a word or to put the words together into propositions. Text modeling involves the use of knowledge which is based on the world and linguistic units of meaning.

VET incorporates the information processing theory, in which cognitive systems operate under limited capacity conditions. Here, only a limited amount of elements can remain activated in our short-term memory at a time. One way to get around this limited capacity is to over learn things. In reading, that which has been over learned is automated and so it requires less attention.

The skilled reader, for example, isn’t aware of what is going on while reading because he or she is used to the exposure of letters and words. VET assumes that the ease in which a reader uses to build a text model depends on how easy it is to process the local text. Research on fluent readers shows that expert readers process lexical access independently of context. When you read the word “see”, your mind calls up all the meanings of see, (such as, sea and letter c) as part of connectionist processing. This, however, is not a characteristic of a poor reader.

Anderson (1991) examines individual differences in strategy use by adult L2 learners while taking a standardized reading comprehension test and reading academic texts. He calls to the shift from the focus on the product of reading (a score on a test) to the emphasis on determining the strategies readers use in various reading contexts. His primary research questions are: what are the reading strategies reported by L2 readers while taking a standardized reading comprehension test and during academic reading tasks; what are the individual differences that occur in strategy use in these two reading contexts and what are the good readers doing that distinguish them from poor readers.
Content validity for the research was established by content-area specialists reviewing the passages and questions to determine their appropriateness. (N. J. Anderson, 1991) Individual appointments were set up with each student to administer the Textbook Reading Profile. No time limits were imposed on the participants during this reading task and responses were audiotaped for their analyses. Results showed that the standardized reading comprehension test appeared to be more sensitive to language proficiency than to reading ability. The textbook reading measure, which more closely resembled actual reading tasks expected in an academic setting “did not differentiate among the participants by level of language proficiency” (p. 464). It only accounted for 16% of the variance in total score on the textbook reading measure. A simple regression was performed to determine whether or not there was a statistically significant relationship between the total number of strategies reported and the total score on each reading measure. This regression indicated that there was a significant relationship as participants who reported using more strategies tended to score higher overall. There was not, however, a statistically significant relationship between the number of unique strategies reported and the overall performance of the reading measures.

In their qualitative study, the research suggested there is no single set of processing strategies that significantly contributes to success on the two reading measures. Both readers who scored high and those who scored low seemed to use the same kind of strategies while reading and answering the questions on either measure. “This seems to indicate that strategic reading is not a matter of knowing what strategy to use, but also the reader must know how to use the strategy successfully and orchestrate its use with other strategies” (D. K. Anderson, 1995). The case studies demonstrated that the poorer reader in this study is aware of the right kinds of strategies to use but may not know how to determine if he or she is successful in applying the strategies. Beginning level language learners may know what strategies to use but because of a lack of vocabulary, or other schema related information, they may not have a strong enough language foundation to build on.

The importance of specific aspects of language competence and their effect on reading have been noted by both first and second language researchers. The background knowledge of second language readers has also been the subject of investigation. While background knowledge is generally acknowledged to be a factor in accessing appropriate schema for text interpretation, it may be that doing so through the medium of the second language limits the ability of some readers to make optimal use of previous experience with a particular topic unless a minimum level of language proficiency has been attained (Alderson, 2000).

For L2 students, problems in alphabet-based reading sometimes begin at the decoding or bottom up stage when the learner must identify phoneme/grapheme correspondence. Top-down processing may also be problematic in that the reader may be unfamiliar with a topic intended for native readers, and therefore cannot access appropriate schema or generate supportive predictions (Samuels & Zakaluk, 1988). When students read in a textbook, the story or pages retain the information about the topic that students are reading so that L2 learners may look back and forth in a text as they generate and check possible meaning. Further an English language learner reads a page on the Internet, that student may chose a hypertext link that may take him or her to a page where all the information is new. The student then needs to make inferences about the reading almost from scratch or try to remember the previous page. Hypertext or links change the pages’ information continuously
and instantaneously and may dramatically alter the context of that information.

Reading on the web appears to be different than reading text on paper. Often these frames on the computer are filled with unnecessarily dense paragraphs with periodic links to other pages of information. Unlike many textbook articles, a website is often not read in its entirety or accessed again. For both native speakers and non natives, the aspect of the linguistic attributes of the text, the cognitive demands placed on the performance of such a reading task, and the individual’s reading ability based on his cultural schema might appear to be problematic for students spending long time researching on the Internet.

In English writing are patterns of redundancy that give us a cue to meaning, whereas hypertext may present information differently. These cues help to guide the reader’s processing. These rhetorical cues are sometimes referred to as discourse markers. (Marcu, 1997) In hypertext these cues may be retrievable but not as evident to the reader.

The reading of text off the Internet and the continued use of hypertext links has serious implications for both skilled native speakers and second language learners. A native speaker of English can hold the construction of a paragraph or chapter of a book in his or her mind while reading. A non-native may be able to do this too, however, the cognitive load is increased through guessing words, and the complex grammar structures and rhetorical devices may not all be unknown. Non-native speakers, thus, may jump more quickly to follow hypertext links hoping to clarify the context of what they are reading. The problem is when this clarity isn’t present.

When considering text on the Internet versus printed text it is useful to consider the idea of multiple literacy, including technological and visual literacies (Tyner, 1998). Traditionally we have considered alphabetic literacy when thinking about writing and reading in print. However, these “do not encompass the range of literacy in our times” (p. 62). Conklin (1986) was the first to review the principles and models of hypertext. He defined the essence of hypertext as the structure of nodes and links as a medium of thinking and communication for users. He also identified one of the well known problems of hypertext as being disorientation and cognitive overload.

The key differences between hypertext and traditional print relate to textual boundaries, mobility and navigation. What hypertext changes is the presumption of linearity. Instead, hypertext allows the reader to make the directional choice. Muter (1996) refers to text on paper as “continuous” and defines it as “dense, line-wrap, linearly structured form”.

Researchers have made comparisons between the speed and the comprehension of reading at a computer terminal versus a book. At the Massachusetts Institute of Technology, Mary Potter (MIT, 2002) conducted studies that showed that a sentence can be understood and remembered as quickly as 12 words per second using rapid serial visual presentation (RSVP) of text. In Muter’s study (1996) students spent over two hours reading text on paper versus text on a computer terminal. Results showed that although extended reading from a terminal was possible, it was 28% slower than reading from a page of printed text. There was, however, no significant difference in comprehension.
Kim and Kamel (in press) conducted an exploratory study into the cognitive processes and strategies involved in reading conventional text and hypertext with 12 graduate students from Stanford University. Students completed a background questionnaire, prior knowledge assessments, read two passages (one electronic hypertext and one conventional) and completed written recall of the passage. Think aloud techniques were used to elicit verbal reports. The analysis of this research showed the role of interest and the “distraction in hypertext navigation.” The participants preferred to read conventional text, and the analysis showed a higher recall with conventional versus hypertext.

The Purpose of the Study

Reading on the Web versus print reading is different, and not just because the screen is different from paper. The process changes because of the roles that reading play and the amount of information that can be accessed.

The reading theories discussed above have for the most part been tested only with printed text. As high school, college students and, indeed, all of us, do get more and more of our information from the Internet, I believe we need to know more about reading on the computer so that L2 learners may look back and forth in a text as they generate and check possible meaning. Also, we need to understand the differences between reading printed text and that of reading pages or frames of the Internet with hypertext links. Knowing the differences between these two types of reading will help teachers teach students to do more than just evaluate web pages. And it will also help designers and writers of the Internet to better prepare pages for their audience.

Research Questions

Is there a difference between the level of perceived text comprehensibility and recall in reading linear text versus hypertext for native speakers of English in a high school or college setting?

Is there a difference between the level of perceived text comprehensibility and recall in reading linear text versus hypertext for non-native speakers of English in a high school or college setting?

If there is a within-group difference in perceived comprehensibility and recall of linear text versus hypertext for both groups:

Do natives and non-natives differ in their perceptions of the comprehensibility of linear text versus hypertext?

Do natives and non-natives differ in their recall of each type of text?

Is the level of within-group difference in recall between the two kinds of text significantly different between the groups?
Methodology

Sample:

Power was computed to be at least 85 students. Eighty to one hundred volunteer students from both a high school and a college will be recruited for this study. Of the college group, one half of this group will speak English as their first language (L1) and one-half that will be advanced English language learners (L2). At the high school level the students will be all non native speakers of English.

After permission from the high school and college to distribute flyers is obtained, flyers will be hung in those areas designated by the college and if the college permits be sent by email to all students. As these students will all be deemed capable of comprehending English by the college, having passed First Year Seminar (expository writing), Critical Thinking II (research writing) and Critical Thinking III (public speaking) in English, these flyers will be in English and not the students’ first language. At the high school level, however, the flyers will be translated into the languages that the high school feels are most often used by parents there. All flyers will have my name, telephone number, and email address on them and will explain the purpose of this study.

This project will require access to computers with Internet access. College students will either use laptop computers in the library or a computer lab, or they may do the research study at home if he/or she has a home computer. High school students will do the study in one class period. High school parents will be asked to sign a form giving permission for their son or daughter to take part in the study. Each student, high school and college, will sign a consent form telling him/her the purpose of the study and that all results of the study will be private.

An attempt will be made to try to ensure that students are comfortable using either the laptop or the desktop model that is used for their reading.

Any student may at any time for whatever reason decide to not be part of this study without any effect on his/her grade or standing. No real names will be used in this dissertation nor will the real name of the high school or college be given out. Confidentiality of all student information collected will be assured. The anonymity of participants will be maintained and no attempt will be made to match the random participant’s ID assigned with the student’s actual name. No information will be provided to the instructors of either the college or high school. The results of this dissertation will be presented only in aggregated form and only used for the research described.

Design

Population:

One of the predictor variables will be the type of participant, in other words, the speakers. Native English speakers will be operationally defined as those students born in America whose first spoken language is English. English language learners (historically referred to as ESL students or LEP) will be operationally defined as speaking English as their second language. An attempt will be made to obtain approximately equal distribution
regarding gender, ethnicity, etc.

Readings:

The type of text presentation is either hypertext or linear text. Hypertext (HT) is operationally defined as the presentation of information with links or a linked network of nodes in which readers are free to navigate and choose which link they prefer while linear text (LT) can be followed from beginning to middle to end. Texts will be chosen from an online encyclopedia (such as Encarta) which exists both in a hypertext and printer friendly version. Students often begin their academic research with an online source such as this.

Students will read both the linear text and the hypertext via the monitor. A page with HTML (hypertext markup language) will be designed to represent the encyclopedia site. In this respect both L1 and L2 readers will not be distracted by the advertising that surrounds Encarta sites. A second page with plain text will also be read on a monitor.

Comprehension and Recall:

The dependent variable is comprehension. As previously mentioned the operational definition of comprehension is based on the perceptions of the readers and the number of propositions in the text base produced by students in a cued recall test. Following Plass (2003), each proposition produced will receive one point.

Every attempt will be made in choosing reading material to control for prior knowledge of topic. Researchers have mixed views as to the importance of background knowledge in reading. Grabe, (2002) argues that difficulties arise when students have no background knowledge of material. While a majority of the Bernhardt’s (1991) studies argue that readers’ familiarity has a significant effect on their performance, there is some evidence that background knowledge has no effect (Urquhart, 1998). Rawson and Kintsch’s (2002) research study is based on the quantitative hypothesis which supports the idea that “background information encourages the encoding of more text content” and may improve free recall of text content through the availability of content in memory. The reason for this may be due in part to the organization of the encoded content. Following the research of (Kamhi-Stein, 2003), familiarity with topic will also be verified through a question posed to participants before each reading. And, as previously mentioned both the high school’s and the college’s faculty will help to insure that the students will be capable of comprehending the reading.

Following (Kamhi-Stein, 2003) each student, after having been chosen for the project but prior to reading procedure, will fill out a short information page for demographics. It is estimated that the high school class will take 80 minutes to do their work and that the college students will take 80-120 minutes. After responding to recall questions a small group of students will be randomly chosen from volunteers to be interviewed to determine how they felt about reading the different versions of text and to probe the reasons for the links chosen or not chosen.
To summarize, the design of this project will involve the following:

A. Type of Participant
   a. Native English speakers (L1)
   b. English language learners (L2)

B. Type of Presentation
   a. Linear Text (LT)
   b. Hypertext
      Order of Presentation
      i. Students get Linear Text (LT) and then Hypertext (HT)
      ii. Students get Hypertext (HT) and then Linear text (LT)

C. Dependent Variables
   a. Perceived Comprehension
   b. Cued recall

D. Qualitative data from interviews

Procedure:
As noted above, in order to measure perceived comprehension and cued recall, it is important to ascertain how much prior knowledge the reader has. Each student who signs a consent form will be given a number to log on to the web. This number assures the student’s anonymity. Students will log on to the website on NYU’s server. They will then type into the field (box) the number he or she has been given. Students will be given an online pre-questionnaire to determine familiarity with the text prior to starting the readings. This will follow the Likkert scale:
   5 Very familiar
   4 Somewhat familiar
   3 A little familiar
   2 Not familiar
   1 Not at all familiar

Following the questionnaire, students will be given one of the text selections. The presentation of texts and their ordering effects will be addressed through counterbalancing. As previously mentioned, each group will first either read a version of linear text or a hypertext version on the computer. That group will be will then either get the other reading in the alternative text format. In other words, the participants will be assigned one of the 4 formats below: (LT= Linear Text; HT= Hypertext; RA= Reading A; RB= Reading B)

<table>
<thead>
<tr>
<th>Text</th>
<th>Text</th>
</tr>
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<tbody>
<tr>
<td>Group 1 Linear Reading A</td>
<td>Group 1 Hypertext Reading A</td>
</tr>
<tr>
<td>Group 2 Linear Reading B</td>
<td>Group 2 Linear Reading A</td>
</tr>
<tr>
<td>Group 3 Hypertext A</td>
<td>Group 3 Linear Reading B</td>
</tr>
<tr>
<td>Group 4 Hypertext B</td>
<td>Group 4 Hypertext Reading A</td>
</tr>
</tbody>
</table>

Students will read the series of texts. They will report their perceptions of the
comprehensibility of the text and will answer cued recall questions (Wallen, 2003). Perceived comprehensibility will be reported on a Likert Scale as follows:

1 = not at all difficult to understand (I think I understood everything);
2 = a bit difficult to understand (I think I understood most of it);
3 = somewhat difficult to understand (I think I understood some);
4 = difficult to understand (I think I did not understand a lot);
5 = very difficult to understand (I think I understood almost nothing).

Following Plass et. al. (2003), the cued recall test will be measured giving one point for each proposition of the text base produced by each participant in response to the cues provided.

Interviews:

Interviews have the ability to produce meaning that addresses issues relating to a particular research concern. Rather than a minimalist passive interview, active interviews are deemed to be best by Holstein (1995) and others. The objective in an active interview is to “provide an environment conducive to the production of the range and complexity of meanings that address relevant issues, and not be confined by predetermined (italics mine) agendas. In such an active interview, the student will feel free to express his/her thought process while reading different text presentations. Interviews allow researchers to have a better understanding of what participants really ‘know’. Interviews allow researchers to grasp a respondent’s reality. The exchange acknowledges that the respondent is a constructor of knowledge in “collaboration with interviewers” (Holstein, 1995).

In order to achieve a genuine and open response from participants, I will plan to pose neutral, open ended questions to interviewees. Beyond that, I will be guided by the goal of eliciting their perspectives in depth. As the interview evolves, I will ask probing questions to encourage them to clarify and enrich the ideas and insights they generate. Interviews will be tape recorded (audio tape) and transcribed. Themes will be developed through a recursive process that will include checking with participants and experts to triangulate data interpretation.

Treatment of Data:

This study uses a mixed design. The within subjects variable is the text type, linear or hypertext. The between subjects variable is the speaker type, Native English speaker or English language learner. The dependent variable is text comprehension. Comprehension is operationally defined as the score received on the cued recall task.

I will control for the possible influence of background knowledge, first through choice of passages likely to be of equal familiarity to participants, and second by checking the level of familiarity of participants at the time of the reading. (If necessary, background knowledge may be treated as a covariate.)

Before conducting the main analysis, the results of the two orders of presentation will be examined and, if appropriate, these will be merged. A 2x2 analysis of variance (Speaker Type by Text Type) will be performed for perceived comprehension and recall. Of particular interest is a possible interaction effect. If the interaction between the speaker and text type is statistically significant, a test of simple effects will be performed. One test will compare native English (L1) comprehension of the two types of text: linear text (LT) and hypertext (HT). A
second test will be conducted to compare LT and HT comprehension for English language learners. If there is no statistically significant interaction, the main effects will be examined. All statistical tests will be performed at a .05 significance level. The interview data will also be analyzed. Burns (1999) argues that data collection methods are mostly multi-dimensional. This allows a variety of data collection tools and methods. This will allow in my study for data to be triangulated or to come from various sources which can be tested against each other.

Interviews will be transcribed in their entirety. I will listen to each recording as many times as necessary to be sure the transcription is accurate. The interview transcriptions will be dated; the pages and lines of the transcriptions numbered. As stated in the consent form to the participants, I am the only person who will listen to the recorded interviews. Based on theses texts, I will first seek to identify themes as they occur in the data. I will review texts recursively, until I am satisfied that all major themes have been identified (Ely, 1991).

I will triangulate my insights with participants and an expert in reading and technology. I will make every effort to accurately reflect the views of participants regarding the different reading formats and their experiences with them both with respect to the experimental task and their real world usage of the two reading formats.

**Trustworthiness:**
I am fully aware of the need to keep my research project credible. I am currently an adjunct instructor at the college where the research will be done and I have visited the high school often where I will do my study. This will help me provide insights into the lives and experiences of the high school and college students participating in the study.

I will maintain distance by following the requirements of the Human Subjects Committee at the College, New York City’s Board of Education, and that of New York University’s. I will reassure all participants of their anonymity and their right to leave the study at any time without penalty.

**Completion of the Study:**
When the study has been completed the results of the dissertation will be shared with the high school and the college and with the students involved in the study. I will store all data in a locked box for a period of five years.
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