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Applied Cognition in Reading: An Analysis of Reading Comprehension in Secondary School Students

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ACCEPTANCE

This dissertation, APPLIED COGNITION IN READING: AN ANALYSIS OF READING COMPREHENSION IN SECONDARY SCHOOL STUDENTS, by JOSHUA A. CUEVAS, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in the partial fulfillment of the requirements for the degree Doctor of Philosophy in the College of Education, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chair, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty. The Dean of the College of Education concurs.

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APPLIED COGNITION IN READING: AN ANALYSIS OF READING COMPREHENSION IN SECONDARY SCHOOL STUDENTS

by
Joshua A. Cuevas

ABSTRACT

This research sought to add to a body of knowledge that is severely underrepresented in the scientific literature, reading comprehension in secondary students. Chapter 1 examines the current state of literacy in the nation's public schools and the consequences that arise if students leave high school with inadequate reading skills. It discusses the neurological processes involved with reading and posits that independent silent reading (ISR) combined with scaffolding techniques may prove to be an effective method for addressing reading comprehension. The review also analyzes the components believed to be essential to reading, including vocabulary development, prior knowledge and background information, inferencing and prediction, and cognitive and metacognitive strategies. It argues that technological tools may have the potential to address these components within the framework of ISR. Chapter 2 details the experiment that tested these hypotheses. The study implemented an ISR program across a 5-month semester in a public high school and included 145 participants from nine 10th grade literature classes. The control group took part in no ISR, one treatment group participated in weekly ISR read from a textbook, and another treatment group participated in weekly ISR read from a computer module designed to address the components of reading comprehension. Students were measured on multiple achievement and motivational assessments. Results indicated that students from the ISR groups made greater gains than the control group in total reading ability, reading comprehension, end-of-course reading scores, and

success/ability attribution, but no differences emerged on the vocabulary assessment. The computer module ISR group performed similarly in most respects to the textbook ISR group, but students in the computer module ISR group increased in their reading motivation and scored better on the individual reading assignments, suggesting the cognitive tools assisted them in understanding specific material at hand. This research offers much needed data on secondary students' reading achievement and motivation, and provides evidence for one method, ISR, that has the potential to address development in these areas.

APPLIED COGNITION IN READING: AN ANALYSIS OF READING COMPREHENSION IN SECONDARY SCHOOL STUDENTS

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A Dissertation

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LIST OF ABBREVIATIONS

AMRS: Adult Motivation for Reading Survey

AYP: Adequate Yearly Progress

EOCT: End-of-Course Test

ISR: Independent Silent Reading

MRQ: Motivation for Reading Questionnaire

SAS: Sydney Attribution Scale

CHAPTER 1

AN EXAMINATION OF READING COMPREHENSION IN SECONDARY SCHOOL STUDENTS AND METHODS FOR ADDRESSING ITS DEVELOPMENT: INDEPENDENT SILENT READING, SCAFFOLDING, AND TECHNOLOGY

While some in the field of literacy contend that there is no literacy crisis in the United States (Gee, 2008), the statistics point to stagnation and should at least be cause for serious concern. Consider that 90 million adults are functionally literate at best (Collins, 2006). Those 90 million adults comprise nearly half of the adults in the United States, and they score in the two lowest levels of functional literacy (Hock & Mellard, 2005). Sixty percent of the Americans who fall into this category are between 16 and 55 years old and make up a large portion of the nation's workforce. This trend has been noted by businesses, post-secondary institutions, and on both national and international assessments, all of which have determined that recent high school graduates cannot sufficiently comprehend complex written information (Hasselbring & Goin, 2004).

The limited literacy levels of such a vast swath of the nation's people are associated with a number of social ills. According to the United Nations Human Poverty Index, of all the countries in the Western world, the United States has the highest level of

poverty and income inequality, and one of the primary determining factors of the Poverty Index is the percentage of adults lacking functional literacy skills (Feng, 2006). In addition, 75% of adult prison inmates are functionally illiterate (Collins, 2006). The implications of this information seem clear: A great number of Americans today reach only marginal literacy levels; the lack of sufficient literacy skills can limit employment opportunities, leading to greater poverty; and those with the lowest literacy levels and least economic opportunity are more likely to ultimately be incarcerated.

Students are simply not acquiring the necessary reading skills before they leave high school, regardless of whether they drop out or graduate. One estimation is that 20% of all 17-year-olds in America are functionally illiterate and 44% of all high school students are only semi-literate (Hasselbring & Goin, 2004). Another study noted that by the 10th grade, only one third of U.S. students read proficiently, with nearly half of all 17-year-olds unable to read at the 9th grade level (Moss, 2005). Mainstream high school students often do not have the higher order cognitive skills for comprehending advanced texts, with more than 90% of them functioning below the advanced level in reading (Alfassi, 2004). While the problem is widespread within regular education, poor literacy levels also fuel the increase in students relegated to special education classrooms, with 80% of all special education students placed in the program primarily because they have not learned how to read (Collins, 2006).

Decoding is an essential basic skill that must be mastered before more fluent comprehension can occur, and many elementary level readers struggle with it (Hasselbring & Goin, 2004). However, it appears most students have mastered decoding by the time they reach secondary schools, as it was not found to be a major source of

comprehension problems in high school students (Cromley & Azevedo, 2007; Kozminsky & Kozminsky, 2001). Instead, the two greatest effects on reading comprehension were from vocabulary and background knowledge, and other more complex cognitive skills appear to be increasingly necessary as readers advance to the secondary level. At the secondary level it becomes necessary for students to pool all of their cognitive resources since the material is more sophisticated and they are expected to learn through reading in each content area, usually without any assistance in reading comprehension.

The current situation in the United States provides good reason to study literacy development or lack thereof in public school students. If students cannot read it limits their capacity to learn academic material across the content areas and can undermine the development of certain higher order intellectual skills. This, in turn, may limit their ability to function self-sufficiently and productively in modern society. However, while empirical studies on elementary students and college students are abundant, there are far fewer on high school students, who present a different problem. Elementary instruction entails basic functions such as decoding, and elementary students' abilities are more similar, as variation certainly increases with age. On the other hand, college students tend to be more motivated since their schooling is not compulsory, and their reading ability is more highly developed. In contrast, secondary students' reading ability varies widely; they are taking part in compulsory schooling, often show low levels of motivation, and yet are expected to develop complex reading skills. For many of these students, high school is the last time in their lives they will have the opportunity to systematically improve their limited ability to read.

Theoretical Models and Neuroscience

One theoretical basis for addressing reading comprehension may be traced back nearly 2,500 years to Plato's Mental Discipline Theory, which asserts that the mind is like a muscle that must be exercised in order to become strong and function optimally (Tracey & Morrow, 2006). This would place cognitive development in the experiential realm, based primarily on environmental factors that reinforce skills. According to this model, inherent verbal intelligence would be less important than repetition and practice. Students who read more often and who read more material overall would perform better as their associated cognitive functions improved due to practice. If Mental Discipline Theory is in fact an accurate model, it provides hope for millions of students and teachers because it suggests shortcomings in literacy can be addressed through resiliency and perseverance.

However, the premise of Mental Discipline Theory lies in stark contrast to that of Cognitive Efficiency Theory, which suggests that language facility is not as influenced by experiential factors as previously believed (Cunningham & Stanovich, 1997). According to Cognitive Efficiency Theory, it is not solely exposure to vocabulary and text that promotes literacy, but instead, an inherent biological element drives the pace and breadth of all language development. Those individuals who have higher IQs process language more efficiently during all stages of life, and therefore their abilities compound and build to a point that they surpass other less talented students in every linguistic area. Students with strong early verbal ability would learn more vocabulary and concepts early, which would in turn allow them to continually integrate newer and more advanced

material while others still struggled with basic language development, and the gap would consistently widen.

Both Mental Discipline Theory and Cognitive Efficiency Theory may be accurate models and may work in tandem to advance or impede literacy acquisition. For instance, if a student has a limited IQ and limited verbal intelligence, that student may need extra practice just to reach a literacy level equivalent to another student with higher functions in those areas. But for the first student, a low IQ and low verbal intelligence may be motivating factors to become *less* engaged in literary activities, thereby expanding the chasm between the two students. A combination of high-level inherent traits and willingness to read in some students, and low-level inherent traits and reluctance to read in others would produce the massive discrepancies in academic achievement we commonly see today.

Evidence for Cognitive Efficiency Theory emerged when Cunningham and Stanovich (1997) conducted an extensive longitudinal study over the course of 10 years and found that 1st grade reading performance was a significant predictor of later comprehension. Essentially, the students who showed high performance very early in school increasingly showed higher performance through the 11th grade. This biological model provides less hope that students can substantially improve their literacy levels over time. However, in the same study, the researchers found an equally important factor in reading comprehension: Reading amount, or exposure to print over time, was also a strong predictor of comprehension, declarative knowledge, and verbal ability. This was the case even after general ability had been controlled for statistically. So while it appears that children who have high IQs and substantial verbal ability early in life do indeed have

a distinct advantage throughout schooling, exposure to text can have a vital impact and may help to mitigate the effects of early reading difficulties.

Still another theoretical model, the Parallel Distributed Processing Model, draws on neuroscience and lends support to both Mental Discipline Theory and Cognitive Efficiency Theory (Tracey & Morrow, 2006). This model holds that as the frequency of connections between functioning parts of the brain increases, so does the strength of the connection. The occipital, temporal, and parietal lobes of the cerebral cortex work together to perform reading tasks. As they function repetitively to perform similar tasks, it should increase efficiency and the ability to complete those tasks. The result of this would be increased fluidity, and ultimately, improved comprehension over time.

In recent years neuroimaging techniques such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) have provided a more precise explanation of the processes that take place in the brain during reading and other language processing. Language functions, including memory of words and verbal encoding, occur predominantly in the left hemisphere of the cerebral cortex (Narmore & Hopper, 1997; Schacter, 1999). The occipital lobe controls vision and would be the first cerebral area activated during the reading process, since graphemic symbols must be visually translated into words and sentences before meaning can be understood. The left parietal lobe allows words to be held in working memory while the individual strives for comprehension (Schacter, 1999). The left temporal lobe is activated when words are encoded into long term memory. These three lobes work together in a circular manner to continually absorb, process, and encode information so that new information can be captured while previous information is simultaneously being integrated and stored.

While this process had been thought to be primarily related to decoding, a recent study on secondary students showed that it makes a more significant contribution to syntactic processing, and therefore comprehension (Holsgrove & Garton, 2006). Sixty 13-year-old students were administered a battery of standardized assessments designed to measure reading comprehension, phonological processing, syntactic processing, and working memory. Earlier theoretical models suggested that working memory functioned with the left occipital, parietal, and temporal lobes during reading to allow for phonological processing, essentially to hold visual symbols and sounds in mind while other symbols were being processed. However, the researchers found that working memory significantly predicted syntactic processing, but had no relationship with phonological processing. Additionally, both phonological processing and syntactic processing predicted comprehension, but syntactic processing contributed a greater proportion. This implies that working memory plays a limited role in decoding but a much stronger role in syntactic processing, and consequently reading comprehension. It also raises the troubling proposition that deficiencies in working memory are at the heart of some students' comprehension problems. While it appears that mnemonic strategies can increase working memory capacity in limited, isolated scenarios such as remembering strings of numbers, for the most part working memory function is believed to be a fixed ability (Parker, Cahill, & McGaugh, 2006).

Ultimately, in the left cerebral hemisphere, three areas, the occipital, parietal, and temporal lobes, work together to allow reading to transpire. Then many other areas in the brain are activated depending on the content of the text and the concepts and images it triggers. The Parallel Distributed Processing Model asserts that as these cerebral regions

are repeatedly activated in unison, the biological, chemical, electrical, and cognitive connections between them improve and efficiency increases, making the process easier and more fluid over time (Tracey & Morrow, 2006).

A number of studies have supported Mental Discipline Theory and the Parallel Distributed Processing Model as they relate to literacy and the extent to which repeated cognitive activity can improve comprehension. Hasselbring and Goin (2004) found that the factor that correlates most directly with reading comprehension level is the number of books read and the amount of time spent reading. Guthrie, Wigfield, Metsala, and Cox (1999) conducted a study with 3rd, 5th, 8th, and 10th graders to examine the effects of reading amount and motivation on text comprehension. In order to isolate the variables of interest, they controlled for two factors: previous levels of achievement and prior knowledge. After controlling for these critical covariates, they found that motivation positively correlates with the amount of text students read and that the amount of time spent reading outside of school positively correlates with text comprehension. To date, reading practice, especially practice in different genres, has consistently been associated with high literacy achievement in adults (Tracey & Morrow, 2006).

Independent Silent Reading

While having students increase their time spent reading would appear to be an obvious way to address literacy shortcomings, the caveat lies in ensuring that students follow through with their reading. There is overwhelming evidence that the vast majority of students do not and will not read at home (Moss 2005). Yet in an extensive observational study, Goodlad (1984) came to the conclusion that there was a shockingly small amount of time in school that students were engaged in actual reading and writing.

More than 20 year later, Moss (2005) noted that students continue to do little textbook reading in school. If this is true, it would help to explain the current stagnation in literacy levels; students are simply not reading, either at home or in school, and they are not strengthening the connections in the brain that are activated during reading. Under any of the three previously mentioned theoretical models this would cause profound stagnation in language and literacy development and lead to less learning in most academic areas, since almost all content areas rely heavily on reading.

Many experts in the field contend that in-school reading can be used to help increase reading ability (Burke, 2000; Connor, Morrison, and Petrella, 2004; Garan & DeVoogd, 2008; Guthrie, et al., 1999; Ivey & Broaddus, 2001; Kelley & Clausen-Grace, 2006; Tracey & Morrow, 2006; Trudel, 2007). Younger students are more likely to take part in sustained silent reading (SSR), a method that allows them to choose their own reading material and read silently in class for a set amount of class time. Traditionally there is no assessment component to SSR, and the freedom afforded to students during the process is thought to increase motivation, and by extension, reading ability. In later grades, when subject matter becomes more specific and students are required to study the same material, a more content-oriented form of independent silent reading (ISR) is more likely to take place. In this method students read independently and silently in class, but they normally read the same assigned material which relates to a broader thematic unit that in turn ties into the larger curriculum. Assessment components are more common at this level, as the reading material is often tied to specific curricular standards. ISR is the more general term of the two because it may take place with assigned readings or with readings chosen by students and there may or may not be an assessment component,

whereas SSR is predominantly a free-reading period with no assessment, and as such is more narrowly defined. Therefore, the term ISR will be used in the subsequent discussion because its more general definition encompasses both methods.

Burke (2000) describes ISR as one of the most effective means of improving students' reading capacity at any grade level. Moss (2005) maintains that involving students in ISR time has been shown to increase achievement. There is support that increased in-school reading, particularly silent reading, has a large effect on subsequent text comprehension ability. As noted, in both elementary and high school students, amount of reading time significantly predicted and positively correlated with reading comprehension, even when previous achievement and prior knowledge were controlled for (Guthrie, et al., 1999). In another study, Kelley and Clausen-Grace (2006) focused on ISR in 3rd grade classrooms and found that there was a strong correlation between time spent reading and reading achievement levels. Time spent reading in school was linked to higher performance on standardized measures of reading comprehension.

The potential benefit associated with increased reading time is promising from the perspective of neuroanatomy as well. fMRIs, which measure brain activity by gauging blood flow in active regions, have indicated that once reading centers of the brain that previously had limited function are stimulated and activated, the results are long lasting and those areas continue to function well years later (Tracey & Morrow, 2006). Essentially, when those centers are "turned on" they tend to stay on. This would suggest that experiential factors such as consistent reading activity may have positive long-term biological effects on the brain.

While there is support in the literature for the benefits of increased exposure to text and sustained reading over time, it should be noted that many of the scholarly articles and chapters on ISR are observational in nature, essentially the testimonials and reports of practitioners and experts in higher education. Relatively few true experiments on in-class sustained reading have been published and even fewer that deal with ISR at the high school level, and this has been a source of controversy. A number of educators have taken issue with the influential National Reading Panel (NRP) report released in 2000 (Garan & DeVoogd, 2008; Trudel, 2007). The report determined that there was not sufficient scientific evidence to conclude that ISR is an effective intervention strategy. The following is an excerpt from the report that describes the status of empirical research on independent silent reading (NRP; National Institute of Child Health and Human Development, 2000, p. 13):

> …there is still not sufficient research evidence obtained from studies of high methodological quality to support the idea that such efforts reliably increase how much students read or that such programs result in improved reading skills. Given the extensive use of these techniques, it is important that such research be conducted.
>
> It should be made clear that these findings do not negate the positive influence that independent silent reading *may* have on reading fluency, nor do the findings negate the possibility that wide independent reading significantly influences vocabulary development and reading comprehension. Rather, there are simply not sufficient data from well-designed studies capable of testing questions of causation to substantiate causal claims… In sum, methodologically rigorous research designed to assess the specific influences that independent silent reading practices have on reading fluency and other reading skills and the motivation to read has not yet been conducted.

Garan and Devoogd (2008) and Trudel (2007) argue that the NRP's findings have been misinterpreted to mean that ISR is not beneficial to students, when in fact, the report explicitly stated that there have not been enough experimental studies on ISR to make a

sound determination of its effects. The implication was that more studies are necessary, not that a conclusion had been reached. Due to this misinterpretation, some school districts have come to abandon the method without sufficient cause, despite some empirical evidence and much observational evidence that shows a positive correlation between time spent reading and improved comprehension.

Both Garan and Devoogd (2008) and the authors of the NRP report acknowledge the methodological difficulties of conducting longitudinal action research in public school classrooms with the litany of variables involved. Ethical issues also arise if researchers must make the choice to deny a control group access to in-class reading time. It would seem irresponsible to create a scenario in which some students were directed to read *less*. However, if the nation's struggles with reading comprehension are to be addressed, experimental studies using quantitative measures must be conducted with promising intervention methods. One solution may be to use classes that do not normally engage in ISR as part of their regular instruction as the control groups. It would not be difficult to locate such classes because most secondary teachers do not use ISR as an instructional strategy since high school language arts teachers tend to be content specialists who focus on literature and devote limited energy, if any, to reading instruction (Jones, 2006).

Students also appear to favor ISR. Ivey and Broaddus (2001) conducted a survey with a massive sample of 1,765 middle school students to ascertain what their preferences were for literacy instruction. A solid majority of the students (65%) felt that silent reading worked best. In spite of this, students reported that text-based extension activities far outweighed time spent actually reading. Considering these findings that students also

see ISR as a productive activity and that other research has shown a link between increased reading amount and comprehension, one would have to ask why the method is not used more consistently by language arts teachers. Since in-school, silent reading holds the potential to have a substantial impact on literacy development for millions of students in public schools, there is great need for empirical experimentation on the technique. Longitudinal studies that measure the long-term effects that ISR can have on global comprehension would be invaluable to the field.

Scaffolding and Layered Instruction

Another theoretical device that may assist in developing reading comprehension is the use of scaffolding (Vygotsky, 1986) or added layers of cognitive tools to assist in learning. Cognitive tools are defined by a number of functions: They are instruments or techniques that enhance cognition, guide cognitive processes, extend intelligence, assist learners in accomplishing complex cognitive tasks, act as intellectual partners with the user, engage the learner, and facilitate critical thinking and higher-order learning (Liu & Bera, 2005). According to Vygotsky (1986), the greatest amount of learning occurs within the zone of proximal development. This is an area that students function in when they work to complete tasks that would normally be outside of their ability level, but that can be accomplished with the aid of others or additional learning apparatuses. Once students are able to accomplish the tasks on their own, the helping devices are removed, as they are no longer needed, and other scaffolds are put in place for even higher level tasks. Any strategies, techniques, or devices that students are taught, encouraged to use, or supplied with qualify as cognitive tools and scaffolding mechanisms.

Combining strategies during in-class reading in an attempt to create layers of cognitive tools was shown to be beneficial in improving the level of complexity of reading comprehension in mainstream 9th and 10th grade students (Alfassi, 2004). Students in the treatment group were taught to utilize a combination of four strategies: generating questions, summarizing, clarification of word meanings, and prediction. The dependent variables were comprehension performance on classroom-style and standardized reading tests that assessed text-explicit, text-implicit, and script implicit understanding. Text explicit questions measured knowledge level comprehension; text implicit questions measured higher order thinking, such as inferences that related different parts of the text; and script implicit questions measured higher order thinking that necessitated the use of inferences to relate prior knowledge to the text. Ultimately, the treatment group showed significant improvement on both the standardized and classroom assessments, as well as all three levels of understanding.

If a combination of intervention techniques can benefit students, then the question becomes, what scaffolding layers should be used? A deeper look into the various components of reading comprehension relevant to high school students appears to be warranted. Since decoding has not been found to be a major source of comprehension problems in high school students (Cromley & Azevedo, 2007; Kozminsky & Kozminsky, 2001), instruction should target higher level comprehension skills. Cromley and Azevedo (2007) conducted an extensive analysis of recent studies in order to create a theoretical model for reading comprehension. That model was then tested in a varied sample of 177 high school students. While other factors that will be discussed later did have significant direct effects on comprehension, basic decoding did not, a finding consistent with other

literature. Instead, the two greatest effects on reading comprehension were from reading vocabulary and background knowledge.

Cromley and Azevedo's (2007) model is important because it was created as a result of a meta-review before being used to test five central variables of reading ability: background knowledge, inferencing, cognitive and metacognitive strategy use, reading vocabulary, and word reading. They found that these variables did have a substantial impact on reading, but while the correlation between word reading and comprehension decreased with age, the correlation between background knowledge and comprehension increased with age. This would suggest that decoding ability among students equalizes to some extent as they increase in grade level, but that other factors emerge which are essential to their ability to understand text at those levels. So while students with less proficient reading ability appear to catch up in some basic areas, they continue to lag behind in the more sophisticated requirements that surface in high school.

There is broad support in the literature for four of the factors Cromley and Azevedo (2007) examined, which are very similar to those tested by Alfassi (2004). The following are widely believed to be essential to improving reading comprehension in adolescents and adults: 1) improving vocabulary (Alfassi, 2004; Cromley & Azevedo, 2007; Leone, Krezmien, Mason, & Meisel, 2005); 2) prior knowledge and background information (Cromley & Azevedo, 2007; Snapp & Glover, 1990; Thompson, 1997; Thompson, 1998; Tracey & Morrow, 2006; Tyler, Delaney, & Kinnucan, 1983); 3) inferencing and prediction (Alfassi, 2004; Cromley & Azevedo, 2007; Dewitz & Dewitz, 2003; Hock & Mellard, 2005; Klin, Murray, Levine, & Guzman, 1999; Kozminsky & Kozminsky, 2001; Lea, Mulligan, & Walton, 2005); 4) cognitive and metacognitive

strategies such as generating questions, answering questions, summarizing, and paraphrasing (Alfassi, 2004; Cromley & Azevedo, 2007; Dewitz & Dewitz, 2003; Dunlosky & Lipko, 2007; Guthrie, et al., 1999; Hock & Mellard, 2005; Kozminsky & Kozminsky, 2001; Snapp & Glover, 1990).

These four components correspond with the three levels of text representation widely thought to be involved in text comprehension: the surface structure, textbase, and situational model (Holsgrove & Garton, 2006; Salmeron, Kintsch, & Fajardo, 2005; Thiede, Anderson, & Therriault, 2003; Wolfe, 2005; Zwaan, 1994). The surface structure is associated with the exact form of the text, including wording and syntactic features, and relates to the specific vocabulary of a text. The textbase entails the direct meaning of the text- the literal, overt semantics represented- and can be accessed through summarizing, paraphrasing, and questioning. The situational model involves a broad, complex view that includes the reader's knowledge base and cultural perspective. Prior knowledge, inferencing, and prediction apply to the situational model. Therefore, if a scaffolding model could be developed that encompassed the four components (vocabulary, prior knowledge, inferencing, and cognitive strategies), it would also address the three levels of text representation.

Vocabulary

Vocabulary, the first of the four components, would seem to have an obvious effect on comprehension; if the readers do not know the meaning of the words, it would be difficult for them to understand the larger meaning of the text, even if they are skilled at decoding words (Beck, Perfetti, & McKeown, 1982; Connor, et al., 2004). But the effect seems to be reciprocal. When students increase their amount of reading, their

vocabulary also appears to expand, and students with a more expansive vocabulary tend to read more often and read more difficult material, thereby expanding their vocabulary to an even greater extent (Joshi, 2005). Alfassi (2004) used a vocabulary component as one of four instructional strategies to improve reading comprehension on both in-class assessments and standardized tests with high school students. She was able to show that when combined with the other strategies, emphasis on vocabulary expansion increased student reading achievement on both types of measures.

In a study with elementary students, Connor, et al. (2004) found that there was a positive correlation between vocabulary and reading comprehension level. More importantly, these two factors also predicted later comprehension levels, indicating that not only may the two be linked in current achievement, but current vocabulary may have strong influence in future learning as well. In addition, the authors noted that students benefited more in their vocabulary development when instruction shifted from teacher-centered explicit instruction towards student-centered implicit instruction, which in this case was accomplished through sustained independent silent reading. Given that the study was conducted with elementary students, it is likely that high school students, who are far more adept at decoding, would benefit in vocabulary development through SSR to an even greater extent than the younger children did.

In another study with elementary students, Ouellette (2006) examined whether breadth and depth of vocabulary predicted reading comprehension. Breadth was judged to be the general expansiveness of vocabulary, while depth was the familiarity students had with vocabulary that was highly specific to particular texts. The results indicated that both breadth and depth of vocabulary directly predicted reading comprehension.

Likewise, in an earlier study, Beck, et al. (1982) found that improvements in vocabulary led to gains in comprehension in elementary students. Given this dynamic, improving vocabulary seems crucial to improving comprehension. It is also important to note that vocabulary is best learned within the context of a text, as opposed to in isolation (Leone et al., 2005). Both third and fifth grade students showed significant gains in reading comprehension when vocabulary was addressed through contextually-based instruction (Nelson & Stage, 2007). Students performed better when vocabulary instruction was linked to the meaning of the text rather than from an isolated list of words, which is still a common practice.

Prior Knowledge and Background Information

Encouraging student learning by connecting new information to prior knowledge, the second of the four essential components for comprehension, draws on Associationism, another model dating to the time of the ancient Greeks (Tracey & Morrow, 2006). This model contends that learning takes place when new ideas are associated with existing ones, either by contrast, comparison, or through simultaneous occurrence. A later incarnation of Association is Schema Theory, which asserts that knowledge is organized in the brain in sophisticated, interrelated structures, with all knowledge about a given topic being interconnected in a web-like fashion (Kozminsky & Kozminsky, 2001; Merriam et al., 2007; Tracey & Morrow, 2006). Without existing schemas in place, it is believed to be more difficult to learn new material, as the level of abstraction is much greater in this circumstance. The learner has no previous framework on which to anchor the new concepts. In contrast, when students have comprehended text and learning has occurred, it suggests that they have successfully incorporated and

attached the new concepts to some existing schemata (Kozminsky & Kozminsky, 2001). Prior knowledge and increased background information, which function in the form of schemata, have been shown to consistently predict and correlate with increased text comprehension (Dinnel & Glover, 1985; Guthrie, et al., 1999; Kozminsky & Kozminsky, 2001; Snapp & Glover, 1990; Tracey & Morrow, 2006).

Background knowledge was found to be an essential component in reading comprehension in a recent study on secondary students. Kozminsky and Kozminsky (2001) conducted research with 205 high school students to examine the effects of background knowledge and strategy use on text comprehension. The students were from four different academic tracks: academic, semi-academic, vocational, and special education. They were tested on four different assessments, including general knowledge, reading strategies, and two reading comprehension tests. The test questions required them to be able to summarize, generate questions, clarify knowledge, and predict events.

Prior knowledge played a role in comprehension for all the groups, and it explained a significant portion of the gaps between the groups (Kozminsky & Kozminsky, 2001). For instance, with more prior knowledge, it appears that the semi-academic group would have performed at a similar level to the academic group. With more prior knowledge, the vocational group would have performed similarly to the semi-academic group and so on. It is notable, however, that while prior knowledge was important to all groups, the lower the level of the group, the more substantial and varied the deficiencies were. The academic group had the most prior knowledge and used all the strategies at their disposal; the semi-academic group used strategies but lacked background knowledge; the vocational group lacked extensive background knowledge

and used few strategies, as did the special education students, who also had difficulties beyond the scope of the study. Regardless, it was clear that background knowledge was a major factor in text comprehension, which should improve if background knowledge can be extended.

Advance organizers help to supply background knowledge and create schemata by providing a conceptual framework and scaffolding information. This allows the reader to anchor and organize information cognitively, which in turn makes the information more meaningful (Thompson, 1998). This is particularly important for poor readers who are slower and less efficient at encoding verbal information and who have difficulties in organizing information, filtering out irrelevant information, and isolating the most important elements (Thompson, 1998; Tyler et al., 1983). The advance organizer helps to focus attention on the aspects of the text that relate to theme or to bits of information that can be synthesized to reveal the greater purpose of a passage. It can also provide definitions and information on cultural aspects that may be essential to understanding. For this reason, interventions designed to assist in schema creation are likely to be most beneficial to adults of limited verbal ability (Thompson, 1997).

Advance organizers precede more extensive information and are defined as having a high level of abstraction, generality, and inclusiveness and as acting as a scaffold for the incorporation and retention of more detailed information (Snapp & Glover, 1990). It is important that the advance organizer help to focus attention on the material at hand, because unrelated prior knowledge the reader already retains can distort comprehension when existing schemas override the processing of new information from the text (Kozminsky & Kozminsky, 2001; Dewitz & Dewitz, 2003; Thompson, 1998). In

a case study conducted on a boy who could decode effectively but had very poor reading comprehension, Dewitz and Dewitz (2003) used a Piaget-like qualitative method to ascertain *why* he came to the incorrect conclusions he did. They found that he had difficulty with relational inferences, or cause and effect, and with integrating information from different parts of a text. When the boy struggled to make these connections, he would fall back on unrelated prior knowledge and elaborate excessively, ultimately generating scenarios that were plausible but highly inaccurate. After this finding, the researchers used the same method with nine other children who were having difficulties with reading comprehension and concluded that they were processing text in a similar fashion. All would rely on irrelevant prior knowledge, which would divert their attention and hinder more accurate interpretations.

Similarly, other researchers have found that introductory passages and simple summaries can actually impair comprehension if they distract the reader from the central conceptual framework of the main passage. In a study on college undergraduates, students who read only a main passage with no prior information outperformed those who read a marginally relevant introductory passage (Thompson, 1998). Students who read a true advance organizer before the main passage showed the best performance, but the point here is that some background knowledge can indeed be detrimental. In an earlier study using advance material with undergraduates, Tyler et al. (1983) found that poor readers tended to recall details at the expense of gist and that simple advance summaries where not effective in mitigating this problem. However, advance organizers meant to target gist did appear to be beneficial to the same readers. This would suggest that prior knowledge can be a hindrance as well as an asset and that it is essential for the

student and instructor to link the text with the right prior knowledge. An effective scaffolding strategy would help steer the reader towards the schemata that legitimately relate to the fundamental premise of the text.

Advance organizers have been shown to be effective in assisting with comprehension in a number of studies. In a pair of experiments, Dinnel and Glover (1985) assessed college undergraduates on a 1300-word passage and a longer 5000-word passage using a range of different introductory passages and advance organizers. On both passages, the students who read the true advance organizer prior to reading the passage recalled the most information and showed the best comprehension. Similarly, in a series of three experiments on middle school and college level students, results indicated that subjects who read and paraphrased an advance organizer prior to reading a main passage showed higher performance on reading comprehension tests (Snapp & Glover, 1990). Students from the treatment group were able to answer both lower order and higher order adjunct questions more accurately and more thoroughly.

In a series of three experiments on college level students using both prose and diagrammatic advance organizers, or graphic organizers, the organizers were shown to have positive effects on both high and low level readers (Tyler et al., 1983). High level readers, who tended to comprehend gist regardless of conditions, recalled more details after the use of advance organizers. Low levels readers also recalled more details, but if the organizer previewed the structure of the main passage, it helped them to capture the gist as well. In addition, advance organizers have been shown to be advantageous to adults of various ages, especially individuals with low verbal ability (Thompson, 1998). College aged adults performed better on recall tasks after reading an advance organizer

and main passage, while older adults performed better on recognition tasks under the same circumstances. Both young and older adults with low verbal ability seemed to benefit from the use of an advance organizer, suggesting the effects are not age specific and would apply to high school students with low verbal ability as well.

Inferencing and Prediction

Constructivism addresses the third reading component, inferencing and predicting, because it posits that learning results through inferencing, the process of mentally filling in gaps in information (Tracey & Morrow, 2006). Psycholinguistic Theory also regards prediction as an integral function of reading, as readers make and test hypotheses while they process text. Essentially, everyone must make mental connections as they read, usually unconsciously, and those connections may be stimulated either explicitly or implicitly by the text. These connections differ from schema in that schema connect to existing knowledge outside the scope of the text while inferences connect concepts within the text or generate from the text. Inferences were shown to be more likely to occur and to assist in comprehension more when researchers created conditions that were conducive to the creation of predictive inferences (Allbritton, 2004; Klin, et al., 1999).

Lea, et al. (2005) studied the effects of causal inferences, predictive inferences, and the span between scenario and inference as independent variables on college students' comprehension while they read brief narrative passages. A causal inference is carried out when a set of circumstances is presented within a text and the reader must infer what has taken place because there is some ambiguity concerning the outcome. It is after the fact. A predictive or forward inference is carried out when a set of circumstances

is presented and the reader must infer what will happen next. The distance in a text between the relevant information and the point at which the reader must construct the inference was examined for its influence. The researchers found that causal inferences had a greater positive effect on reading comprehension when the inference stimuli and the related situation were close together in the text. Distant inferences also had an impact, but only when they were aided by contextual cues that triggered a latent recollection of a possible scenario.

In the same study (Lea, et al. 2005), predictive or forward inferences appeared to offer a wider range of possibilities, because instead of the readers drawing from a limited number of conclusions based on prior evidence, they looked forward to a broad range of events that may unfold in the future. For instance, causal inference questions tend to be closed-ended: either one specific scenario transpired or another specific scenario transpired, but the range is narrow and the parameters are already defined. On the other hand, predictive inferences are dependent on the reader's imagination and are open-ended in nature. The researchers found that predictive inferences were influential at greater distances, concluding that the inference became a part of the readers' mental representation of the text and were carried forward in the general conceptualization of the passage, rather than in memory.

Essentially, a predictive inference becomes part of how the reader perceives the text. It is also important to note the distinction between memory and inference. Recall of a concept is dependent upon an explicit statement of it. Recall of text is necessary in order to make an accurate inference, but an inference is a constructive process because the reader is using logic to create new prospects that did not previously exist. However, it

must be cautioned that predictive inferences also offer the possibility for distorted comprehension. If the inference alters the reader's representation of the text, but the inference is highly incongruent with the actual narrative of the text, the reader's ultimate perception may be equally imprecise (Dewitz & Dewitz, 2003).

It is likely that inferences are generated spontaneously during reading. In a series of four experiments, Klin, et al. (1999) showed that forward inferences may be more readily drawn than previously believed, even when the inference is not explicitly apparent. Researchers tested a total of 154 college undergraduates who read passages that required inferences to be made. The conclusions to the passages were either predictable and consistent with likely inferences the students had made previously, neutral in regard to predictability and consistency with the text, or implausible and contradictory to likely inferences. Previously, some psychologists believed that inferences were held only briefly in working memory during reading and would not be applicable if there was extensive distance in the text between the point of inference and the consequence of the situation.

This study (Klin, et al., 1999) demonstrated that the inferences were held in mind for longer than a moment and were carried forward beyond what would be regarded as the normal capacity of working memory. In some cases the inferences were maintained in working memory and also encoded into long term memory where they became part of the readers' mental representation of the text. This is significant because it suggests that inferences shape understanding of the text as a whole. In addition, inferences were drawn rather easily and appeared in neutral situations, as well as predictable ones. So readers appeared to draw inferences on their own regardless of circumstance or prompting, not

just when the situations were obvious and spelled out for the reader. Inferences were also a factor in the contradictory situations, as the participants showed hesitation at the surprising incongruence when their early predictive inferences did not match the conclusion. At the point of the inference, the reader has not encountered information to devote to memory, but instead has constructed a model and made it part of his or her understanding of the text (Lea, et al., 2005). That construction appears to be a powerful feature in how a reader cognitively processes the text.

Cognitive and Metacognitive Strategies

The last of the four components includes cognitive and metacognitive strategies such as generating questions, answering questions, summarizing, and paraphrasing. Paraphrasing has been shown to assist with encoding information (Dinnel & Glover, 1985; Snapp & Glover, 1990). In two experiments with college students, Dinnel and Glover (1985) found that advance organizers were more effective for reading comprehension when the subjects were asked to paraphrase the information in the advance organizer before reading the main passage. In order for students to access the prior knowledge made available through the advance organizer, students must learn and remember the information so they can make use of it when the time comes. Paraphrasing was believed to help the subjects encode the information, which in turn assisted with comprehension, because once the students encoded the information securely they had schemata in place to attach the new concepts from the text to.

While Dinnel and Glover (1985) used paraphrasing to help students encode information *prior* to reading a text, Thiede, et al. (2003) used an abbreviated form of paraphrasing to assist students with learning *after* they had read a passage. Thiede et al.

(2003) had students read passages and then generate key words associated with the main ideas of the text, essentially a truncated version of the paraphrasing process. The students who generated key words after a slight delay were better able to monitor their own comprehension and reread for clarity and showed better performance on subsequent reading comprehension tests. In sum, the students who read and then paraphrased main ideas by generating keywords after a delay showed superior metacognitive monitoring, metacomprehension, and achievement as measured on reading comprehension tests.

A multidisciplinary team of six experts in adult literacy was recently assembled from the fields of special education, speech disorders, language development, hearing, psychology, and educational research (Hock & Mellard, 2005). These content specialists were given two goals: 1) to identify the reading comprehension skills that are most important to adults, and 2) to identify the intervention strategies that research has shown have been successful in adolescents and were most likely to be effective for adult learning. The panelists identified strategy types and the applications of those strategies before conducting a content analysis of items from common standardized tests, such as the CASAS, GED, and NAEP. Then they determined which strategies were most likely to assist readers in meeting the cognitive requirements necessary to process the particular information. The consensus of the participants was that the most important strategies for promoting positive learning outcomes for adult readers were summarizing, paraphrasing, self-questioning, and drawing inferences, although it can be debated whether drawing inferences qualifies as a strategy since it is often done spontaneously and unconsciously. These strategies were believed to be so effective because they provided broad application possibilities and could be of use to readers with a variety of reading impairments.

Similarly, the quality of students' answers to adjunct or reading comprehension questions has been shown to have a bearing on whether students meet course objectives (Snapp & Glover, 1990). The quality of students' answers to adjunct questions is often a reflection of their learning, so the higher the quality of the answers, the more they are likely to have learned. Adjunct questions may help focus attention on relevant information and serve to emulate self-generated questions that high level readers would normally spontaneously generate, but that lower level readers often do not. In addition, adjunct questions will frequently ask students to summarize concepts from the text, and summarization has been shown to improve overall understanding and metacognition, essentially encouraging the reader to focus on his or her own comprehension of the text (Dunlosky & Lipko, 2007). If adjunct questions can stimulate metacognition, they should have an impact on achievement since metacognition is considered so essential to the learning process (Thiede, et al. 2003, Zabrucky, Agler, & Moore, 2008).

It should also be noted that a major limitation of the traditional SSR method is that it does not include accountability measures or assessments (Kelley & Clausen-Grace, 2006; Trudel, 2007). Students are able to read whichever texts they want and often choose texts that are below their reading level. They recognize that no assessments will follow to verify their reading and often fail to follow through with it, especially if the text is at or above their reading level. In both Kelley and Clausen-Grace's and Trudel's studies students were observed either engaging in other activities besides reading or pretending to read during SSR time. This could cause stagnation in their comprehension development because the result of such a circumstance is that the students would only read texts below their reading level.

In order to address the fact that students were not following through with their reading, Kelley and Clausen-Grace (2006) introduced accountability measures in the form of adjunct questions that required paraphrasing or summarizing to the SSR program for elementary students. They measured the two factors they deemed the most important in reading development, engagement and comprehension, and found that students were more likely to read and understand the material when accountability procedures were in place. Their conclusion was that the presence of some form of assessment helped to stimulate self regulation and ensure that the students followed through with their reading. Trudel (2007) observed similar positive results in comprehension and motivation when reading conferences were added as a form of informal assessment in elementary classrooms. In addition, Guthrie et al. (1999) found that when teacher-assigned grades are used as a measure, intrinsic motivation was higher. It is debatable whether teacher-assigned grades should qualify as being associated with intrinsic motivation, but regardless of the classification, motivation to read did appear to increase when assessment was introduced. And when motivation increases, then amount of reading and reading achievement should follow.

Summary of Components

Ultimately, there is substantial evidence for a wide array of instructional strategies, cognitive approaches, and intervention techniques that have the potential to benefit secondary readers. The four discussed here, emphasis on vocabulary, prior knowledge, inferencing and predicting, and cognitive and metacognitive strategies, are broad areas of inquiry, each with its own particular facets and nuances. Indeed, one could argue that they should be paired down into more finite constructs. But this says as much

about learners as it does about empirical methods. Fletcher (2006) and Kozminsky and Kozminsky (2001) argue that reading is such a multifaceted skill that no one approach can suffice, yet most measures, and therefore interventions, target a single component, one that can never fully capture the broad spectrum of cognitive skills necessary to process written text.

Add the great variety of text genres and levels to the complexity of the cognitive requirements of reading, and a very convoluted picture emerges. It is no wonder that the country's large scale literacy challenges seem such an insurmountable task enveloped by enduring questions. As students grow older and advance in some traits but not others, each student will have his or her own increasingly complex blend of strengths and needs. For instance, one high school student may have acquired proficiency in vocabulary and/or prior knowledge, yet lack the metacognitive monitoring to generate the questions or summarizations that would lead to better comprehension. The student in the next seat may lack the vocabulary and prior knowledge, but readily generate inferences, although they may be inaccurate inferences due to the lack of prior knowledge. And the 28 other students in class will each have their own combination of skills and challenges to navigate.

Because of the many years and many layers of these different forces at work in the reading ability of secondary students, it is not prudent to argue that any single intervention strategy could possibly address the variety of student needs. A combined approach seems necessary (Alfassi, 2004; Connor; 2004; Cromley & Azevedo, 2007; Kozminsky & Kozminsky, 2001). Fortunately, in recent years possibilities have emerged

for a broad instructional method that may allow students to use only the scaffolding devices that are specifically advantageous to his or her individual needs.

Technological Applications

The use of technology offers new ways to address the four components of reading comprehension discussed here. Technology can act as a cognitive tool to provide scaffolding, guide cognitive processes, amplify cognitive functions, engage the learner, and extend intelligence, leading to more sophisticated levels of thinking, particularly for learners with limited skills (Liu & Bera, 2005). Computer-based reading scaffolding interventions may be developed to allow readers to access the cognitive tools that fit their unique learning needs. A number of studies have been conducted that suggest that students can use technological devices to control and expand their own learning.

Technology has been shown to be effective as a scaffolding tool to assist students in functioning in their zone of proximal development (Salomon, Globerson, & Guterman, 1989). Junior high school students read from a computer that provided "metacognitivelike" guidance as they read. The program presented the readers with questions meant to encourage summarizing, inferences, visualization, and the identification of key concepts. The researchers hoped that the program would not only increase performance on the task at hand, but also stimulate the students to internalize the strategies so that they would use the metacognitive techniques later in the absence of the scaffolding program. As they had hoped, the researchers found that the use of technology as a cognitive tool not only improved performance on the immediate passages, but students developed transferable skills that generalized to other reading tasks and even to writing, suggesting a broad improvement in literacy.

In another study on middle school students, Liu and Bera (2005) found that readers were able to use technological cognitive tools as scaffolding devices to assist in their own learning. The format was meant to increase active reasoning, motivation, engagement, and learner control and consisted of various instructional layers. The module was set up similarly to a game in which students navigated through the program and made use of various tools that helped them solve problems. At first students navigated the program in a haphazard manner until they conceptualized the problem, and then they made use of the appropriate tools, discarding them when they had mastered the problem and moving up to more sophisticated scaffolding tools on their own. In this case the technology both assisted in accessing students' zone of proximal development and in increasing metacognition and executive control, functions believed to be central to enhanced learning (Zabrucky, et al., 2008).

Guthrie, et al. (2006) noted that properties of texts can serve to increase interest, especially if the format is designed specifically to appeal to students. By introducing stimulating tasks, situational interest, defined as the immediate and temporary interest within a particular environment, can be increased. If situational interest in reading tasks is repeatedly triggered through the use of stimulating tasks, novel formats, and hands-on activities, a more generalized, global, long-term individual interest in reading may develop and comprehension should increase as long as the stimulating tasks are academically relevant and strongly related to the content of study. Modern students are accustomed to sensory stimulation through technology and the media, so they often may not respond well to traditional lectures and textbooks. If students are presented with

electronic mediums for reading, their interest and motivation may be stimulated in ways that are not possible with paper text.

The use of technology can be particularly effective when employed to support learning for otherwise disaffected students. Howard, Ellis, and Rasmussen (2004) showed that college undergraduates with low reading levels made greater gains than students with higher reading levels through the use of a self-paced hypermedia program designed to enhance student interest. The program included graphics and movie-like features and moved from general to specific information. The students were tested after completing the module and no differences were found between the high and low skilled groups, suggesting that the module had allowed the less skilled students to close the performance gap that had originally been present between themselves and the more skilled readers. Learner control was thought to be a major benefit of the technology because the learner was able to manipulate the information to his or her preference, which is particularly conducive to learning. Likewise, increased engagement, which has been associated with increased achievement, was also believed to be important to the students' outcome.

The use of technology may also make it possible to provide task variability that has been shown to be beneficial to some students' motivation and learning. African American students have been found to exhibit more extrinsic and less intrinsic reading motivation than European American students (Mucherah & Yoder, 2008) and show poorer performance in achievement (Bailey & Boykin, 2001). One reason for this may be that African Americans' home environments are often dissimilar to the environments they are expected to learn in at school (Bailey & Boykin, 2001). Their home environments have been characterized as having high levels of activity and physical

stimulation, while school environments are more often expected to be more subdued and display greater uniformity. African American students may perform better in school environments that include greater task variability because those conditions may be more conducive to their sociocultural schema.

Bailey and Boykin (2001) presented African American elementary students with vocabulary, spelling, math, and picture sequencing tasks in a variety of different orders, some with low variability and more uniformity, and others with high variability and less uniformity. The researchers measured academic performance and task motivation as dependent variables. They found that the students displayed greater motivation in the high variability formats, showing more interest and exerting more effort and task persistence. In addition, their academic performance was significantly better in the high variability context as well. These results suggest that there may be a range of benefits to some students if material can be presented in a less constricted fashion. Technological reading applications can introduce an environment of greater variability than paper texts can offer. A computer reading module may allow students to click on various instructional devices of interest and to alter the pace and format of their journey through the text. Importantly, technological applications of this sort would allow students who preferred a more uniform presentation to access information that way, while students who preferred a more highly variable structure could format the information to their liking, allowing for another aspect central to reading motivation, choice.

Allowing students to access information in a fashion that meets their preference has been shown to be beneficial to older students as well. In two experiments involving learning via an electronic textbase, researchers found that readers were able to use the

technological scaffolding available to them to increase their comprehension of the material (Salmeron, et al., 2005). A hypertext reading module was tested with college undergraduates. Students read passages and answered a combination of text-based (knowledge level) questions and inference questions that required them to synthesize information from different parts of the module. They were able to access whichever instructional nodes they desired and were able to do so in whichever order they desired.

High knowledge readers were able to learn the material by skipping around, without accessing all of the instructional nodes, because they could use inference to bridge the gaps in information (Salmeron, et al., 2005). Interestingly, the high knowledge readers actually learned successfully with a less coherent reading framework, possibly because it stimulated a more active mental process; they were essentially forced to cognitively engage the material in order to make the connections, instead of passively consuming it. Low knowledge readers, on the other hand, learned better when they chose to read in a more linear fashion and read every instructional node. They were not as successful in using inferences to fill in missing information, so those who read the most material and covered all the intricate support were better able to understand the larger purpose and themes of the text. These low knowledge readers were able to use the module as a cognitive tool to assist with the cognitive processes that they were less skilled at, and with this help, their performance approached the performance level of the high knowledge readers.

Based on two experiments on college level students, the use of technology appeared to improve comprehension by encouraging predictive inferences that would have been difficult to prompt solely through text-based readings (Allbritton, 2004).

Participants read through passages on a computer screen one sentence at a time, clicking through at their own pace. At certain strategic locations, probe words meant to trigger inferences would appear on the screen. While the researchers found that readers will readily draw inferences on their own, they showed that inferences can also be encouraged. The technology created a format that guided the readers to generate inferences at specific intervals. This cognitive tool improved comprehension in situations where the prompted inference was consistent with the outcome of the text.

A pair of experiments conducted on college students compared comprehension performance after SERT, a paper-based reading instruction program, and iSTART, its computer-based counterpart (Magliano, et al., 2005). Not only did the computer program produce similar positive results, it also produced some positive results that the paper-based program did not. Readers used more effective reading strategies after the computer based training. The computer program's unique functions allowed for increased scaffolding that was thought to be responsible for these added effects. This is encouraging because it would suggest that not only did the program assist on immediate reading comprehension tasks, but the students acquired strategies that could be used to increase comprehension on future tasks. Taken together, this information suggests there are promising possibilities for developing and improving instructional methods through the use of technology.

Future Research

Ultimately, consistent with Mental Discipline Theory and the Parallel Distributed Processing Model, there is reason to believe that increasing text exposure, especially in class, can help students improve their reading comprehension. A profound gap exists in

the literature due to the dearth of experimental studies on the effects of ISR in the classroom, particularly at the high school level. However, four essential components of comprehension have been verified in the literature, and they address the three levels of text representation involved in text comprehension: the surface structure, textbase, and situational model.

Vocabulary development has been shown to have a high correlation with reading comprehension. Consistent with Associationism and Schema Theory, increasing background knowledge, especially through the use of advance organizers, has been shown to be beneficial to reading comprehension as well. Congruent with Constructivist Theory and Psycholinguistic Theory, inferencing and predicting assist students with constructing knowledge and making mental connections, which can lead to increased understanding of text. Various cognitive and metacognitive strategies have also been shown to play a major role in reading comprehension and are thought to be applicable to a wide variety of texts and genres. The inclusion of a form of assessment such as adjunct questions can motivate students to follow through with their in-class reading, emulate self-questioning, and provide an opportunity to display learning outcomes, as well as encourage elements of paraphrasing and summarizing that may be essential to encoding.

It may be possible to combine all of these elements into a single technological package that addresses each as a scaffolding level while at the same time increasing learner control, student engagement, and reading motivation. There are commercial products on the market that attempt to combine reading strategies in a technological package, such as Read 180, but they are costly, running $30,000 per classroom (Scholastic Inc., 2009). They also necessitate an extensive technological and instructional

support network for the teachers involved. This can make these products unattainable for the poorest school districts whose students are in most need of reading interventions. Schools are in need of effective classroom interventions that can be implemented by any teacher at little or no cost and a minimum of technological training.

The central question to be answered is whether repeated, in-class exposure to text, along with scaffolding devices meant to address the essential components of comprehension, can act to improve students' global comprehension and vocabulary over time. The components need not be tested in isolation, as there is already sound empirical support for each one. Rather, a combination should be tested that will allow students to utilize whichever cognitive tool meets their needs in a given circumstance. The technological aspect may increase learner control and engagement, and also allow for manipulation of the components that may not be possible or practical with printed text. This package could be fitted with literature from a variety of cultural perspectives and texts of varying grade level.

To date, the vast majority of empirical research in the area has been conducted with college level, middle school, or elementary subjects, with far fewer studies being conducted with high school students. High school students present a rather unique dynamic in comparison to the other sample populations. Their cognitive functions (Merriam et al., 2007; Tennant, 2002) and reading comprehension levels (Cromley & Azevedo, 2007) resemble and are classified with adults', but they are taking part in compulsory schooling. This is a very different situation than that of college students who attend school by choice and therefore would logically be more receptive to new material and academic work in general. The dearth of data on high school subjects and their

distinctive place in the educational hierarchy speak to the need for research in the area. For many students at this level, high school will be the last formal education they will receive in their lifetimes, so it is essential to identify methods that are effective in producing gains in literacy at such a pivotal time in the lives of these students.

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CHAPTER 2

GETTING THEM TO READ: TESTING THE EFFECTS OF INDEPENDENT SILENT READING AND COGNITIVE TOOLS ON SECONDARY STUDENTS' ACHIEVEMENT AND MOTIVATION

Reading is one of the most essential components of learning. From elementary school through college, every content area relies on students' ability to read and process text as the main vehicle for transmitting information. Indeed, the bulk of human knowledge that has been passed down through the millennia has relied on someone's ability to record it in writing and another's ability to read, understand, and pass along that information. Yet despite how essential reading is to learning in general, there are troubling trends within education in the United States regarding literacy.

Nearly three decades ago, in an extensive and influential observational study on the state of public education in the nation, Goodlad (1984) concluded public school students were spending alarmingly little time engaged in actual reading during the hours they spent in school. Little appears to have changed in this regard since then. In 2005, Moss argued that students continued to do little textbook reading either in school or at home, which corresponds with the anecdotal reports of teachers who contend that many students will not read academic material. If this is indeed the case, the consequences would be profound, because students who do not read regularly would be unlikely to improve their skills in any meaningful way, and as a consequence, their learning across the content areas would likely be stifled.

Recent statistics support the notion that literacy levels in this country should cause concern. Studies indicate that 20% of all high school students are functionally illiterate (Hasselbring & Goin, 2004), nearly half are only semi-literate (Hasselbring & Goin, 2004; Moss, 2005), and more than 90% of them function below the advanced level in reading (Alfassi, 2004). The increase in students assigned to special education classrooms is due in large part to poor literacy, with 80% of all special education students placed in the program because they are reading well below grade level (Collins, 2006).

High school is the last formal education for millions of Americans, and a student's inability to read sufficiently is likely to follow them into adulthood. Ninety million Americans, nearly half of the country's adult workforce, are no more than functionally literate (Collins, 2006; Hock & Mellard, 2005). At a time when the nation is transitioning away from the blue collar factory work that dominated the 20th century and towards an economy that places a premium on communication skills, universities, businesses, and both national and international assessments have noted that a great number of students leaving American high schools cannot adequately comprehend sophisticated text (Hasselbring & Goin, 2004). This does not bode well for a nation struggling to maintain its economic and intellectual dominance in the modern world.

Poor literacy levels can contribute to significant internal social strife within the country as well. According to the United Nations Human Poverty Index, the United States has the highest level of poverty and income inequality in the Western world (Feng, 2006). One of the principal determining factors of that index is the percentage of adults lacking functional literacy skills, and the data indicates a high correlation between poverty and illiteracy. Unfortunately, the United States outpaces most developed

countries in both areas. Additionally, both have also been linked to incarceration rates, and one estimate is that 75% of American inmates are functionally illiterate (Collins, 2006). So while poor literacy levels amongst the American workforce appear to create a ceiling to gainful employment at the upper half of the economic sphere, illiteracy is having a devastating effect at the bottom of it as well. In light of these troubling findings, it is worthwhile to engage in research to identify intervention methods that can address literacy issues before students leave high school and enter adult society.

Independent Silent Reading

A variety of studies have found indirect support for the premise that repeated cognitive activity in reading can improve comprehension. Hasselbring and Goin (2004) discovered that the variables that correlated most strongly with reading comprehension ability were the number of books read and the amount of time spent reading. Guthrie, Wigfield, Metsala, and Cox (1999) studied reading in 3rd, 5th, 8th, and 10th grade students, and after controlling for initial skill levels, found that the amount of time spent reading positively and consistently correlated with text comprehension. In a longitudinal study that tracked students from 1st though 11th grade, Cunningham and Stanovich (1997) showed that exposure to print was consistently a significant predictor of reading ability after controlling for general ability. Similar findings have emerged in research on adults, which has shown reading practice to be reliably associated with higher literacy achievement (Tracey & Morrow, 2006). As a consequence, it is essential that we identify and test methods that can be successful in increasing students' reading amount, and subsequently, the development of reading skills across the general population of public school students in the U.S.

Having students read more is an obvious remedy to improve literacy, yet the problem lies in ensuring that students actually follow through with their reading. Teachers have almost no control over students' activities outside of school, and the tumultuous home lives of many students, particularly the poorest readers from disadvantaged socioeconomic backgrounds, do not create an environment that is conducive to highly focused reading practice. In light of this, in-school reading is advocated by wide range of experts in the field (Burke, 2000; Garan & DeVoogd, 2008; Guthrie, et al., 1999; Ivey & Broaddus, 2001; Kelley & Clausen-Grace, 2006; Moss, 2005; Tracey & Morrow, 2006; Trudel, 2007). In-school reading most often takes the form of sustained silent reading (SSR), a method used predominantly in elementary schools that allows students to choose their own reading material and read silently in class for a set period of time, usually 20-30 minutes. Traditionally, there is no assessment component to SSR, and the freedom students have during the process is believed to increase motivation, and by extension, reading ability. But in high schools the subject matter becomes more specific and the curriculum has prescribed standards, so traditional SSR where students choose their own reading material is a less practical option, and often not possible given the constraints in place.

Instead, independent silent reading (ISR) may be used, a method similar to SSR, except that ISR may take place with assigned readings or with readings chosen by students and there may be an assessment component, whereas SSR is predominantly a free-reading period with no assessment, and as such is more narrowly defined. ISR can be more content-oriented than SSR, and students could be assigned material relating to a broader thematic unit tied into the larger curriculum, often a necessity in a high school

classroom. While having students read assigned material would be less likely to enhance reading motivation than would a program that allowed them to choose their own books, the benefits should be the same as long as each student regularly experiences the stimulation and engagement in the cognitive processes associated with reading. Assessments could also be introduced with ISR, which may be required to verify whether students were meeting the curricular standards with their reading. Additionally, Kelley and Clausen-Grace (2006) and Trudel (2007) found that students' reading achievement increased when assessment components were added to the standard SSR model. The researchers surmised that the assessments motivated the students who had previously failed to complete their reading to actually do so. Because ISR is a more general term than SSR and can encompass a wider range of methods, in the subsequent discussion ISR will be used to refer to all in-class reading techniques.

Many experts in the field of literacy have argued for the efficacy of ISR. Burke (2000) has described ISR as one of the most effective means of improving students' reading skills at any grade level, while Moss (2005) contends that ISR has consistently been linked to increases in achievement. Guthrie, et al. (1999) and Kelley and Clausen-Grace (2006) found that time spent reading in school was highly correlated with comprehension ability. Ivey and Broaddus (2001) surveyed middle school students on their preferences for literacy instruction and found that the majority of them preferred ISR over any other method. A number of other researchers have argued that there is compelling support in the scientific literature for the benefits of ISR (Krashen, 2000; Marzano, 2004; Pilgreen, 2000).

However, these assertions are not without controversy. It must be noted that many of the scholarly articles, chapters, and books directly relating to ISR have been observational in nature, with relatively few true or quasi experiments having been published. Indeed, the highly influential National Reading Panel (NRP) concluded that there was "not sufficient research evidence obtained from studies of high methodological quality to support the idea that such efforts [ISR] reliably increase how much students read or that such programs result in improved reading skills" (NRP; National Institute of Child Health and Human Development [NICHHD], 2000, p. 13). The Panel explicitly argued that rigorous, methodologically sound studies were still necessary in order to test the effects that ISR may have on reading comprehension and vocabulary development.

Scaffolding and Technological Applications

There is the possibility that ISR can be paired with scaffolding techniques, which are believed to assist with language development (Vygotsky, 1986) and could be instrumental in stimulating gains in literacy. Cognitive tools serve as scaffolding devices to enhance cognition, guide cognitive processes, extend intelligence, assist learners in accomplishing complex cognitive tasks, engage the learner, and facilitate higher-order learning (Liu & Bera, 2005). There may be ways to combine cognitive tools with the ISR method to address various components that appear to contribute to reading development. There is strong support in the literature for four factors widely believed to be essential to improving reading comprehension in adolescents and adults: 1) improving vocabulary; 2) prior knowledge and background information; 3) inferencing and prediction; 4) and cognitive and metacognitive strategies.

Vocabulary has consistently been shown to have a strong relationship with reading comprehension, one that is often reciprocal. Gains in vocabulary have been associated with gains in comprehension, while gains in comprehension have accompanied gains in vocabulary (Alfassi, 2004; Beck, Perfetti, & McKeown, 1982; Connor, Morrison, & Petrella, 2004; Cromley & Azevedo, 2007; Leone et al., 2005; Nelson & Stage, 2007; Ouellette, 2006), and both have been linked to reading amount (Joshi, 2005). Schema theory suggests that background information and prior knowledge are essential to learning in general (Marzano, 2004; Merriam, Caffarella, & Baumgartner, 2007) and text comprehension in particular (Tracey & Morrow, 2006). A number of researchers have shown that schema-related knowledge made significant contributions to reading ability (Cromley & Azevedo, 2007; Dewitz & Dewitz, 2003; Dinnel & Glover, 1985; Guthrie, et al., 1999; Kozminsky & Kozminsky, 2001; Snapp & Glover, 1990), often through the use of advance organizers, which help focus attention on material at hand by activating prior knowledge and providing background information relevant to the text (Dinnel & Glover, 1985; Snapp & Glover, 1990; Thompson, 1997; Thompson, 1998; Tyler, Delaney, & Kinnucan, 1983). Likewise, aspects of Constructivism and Psycholinguistic Theory suggest that inferencing and prediction are critical to the reading process (Tracey & Morrow, 2006), and empirical research has supported those claims (Allbritton, 2004; Dewitz & Dewitz, 2003; Hock & Mellard, 2005; Klin, Murray, Levine, & Guzman, 1999; Lea, Mulligan, & Walton, 2005). Finally, cognitive and metacognitive strategies such as generating questions, answering questions, summarizing, and paraphrasing have been shown to affect comprehension by assisting with the encoding of information (Dinnel & Glover, 1985; Snapp & Glover, 1990; Thiede, Anderson, &

Therriault, 2003) and possibly by improving metacognition and in turn metacomprehension (Dunlosky & Lipko, 2007; Hock & Mellard, 2005).

The use of technology may offer an efficient and effective delivery system that can address these four components of reading comprehension within the context of ISR. A number of studies on computer-assisted reading programs have shown promising results. Salomon, Globerson, and Guterman (1989) found that technology could be used as a scaffolding tool to assist students in functioning in their zone of proximal development as well as provide "metacognitivelike" guidance as they read, and students appeared to develop transferable skills that generalized to other reading tasks, suggesting a broad improvement in literacy. Liu and Bera (2005) created a multilayered instructional package meant to increase motivation, engagement, and learner control which was shown to benefit students' metacognition and executive control.

Likewise, Salmeron, Kintsch, and Fajardo (2005) used technological scaffolding to help readers increase their comprehension by allowing them freedom to access only the cognitive tools they chose. The students were able to concentrate on specific areas that they lacked knowledge in, and therefore improved performance overall. In another study, the use of technology appeared to improve comprehension by encouraging predictive inferences that would have been difficult to prompt solely through text-based readings (Allbritton, 2004). Similarly, Magliano, et al. (2005) compared a paper-based reading instruction program to its computer-based counterpart and found that the two programs produced similar positive results, but the latter also appeared to induce students to use more effective reading strategies which could be transferred to future reading tasks.

Importantly, computer-based reading programs have the potential to impact reading motivation, which in turn could fuel later gains in reading comprehension. Motivation is a central issue in reading comprehension, and by extension all learning, yet little empirical research has been published on the academic adaptations of older adolescents and high school students, so there is an urgency to gather information in the area. The NRP noted that there have not been a sufficient number of studies examining the effects of ISR on motivation (NICHHD, 2000). Yet some evidence does exist from the field of instructional technology. Guthrie, et al. (2006) noted that formats designed specifically to appeal to students can create situational interest, and if situational interest in reading tasks is repeatedly triggered through the use of stimulating tasks, novel formats, and hands-on activities, a more generalized, global, long-term interest in reading may develop. Modern students may respond better to sensory stimulation through technology than to textbooks, particularly in the areas of interest and motivation. Howard, Ellis, and Rasmussen (2004) found that the use of technology was particularly effective when implemented to support learning for otherwise disaffected students, with lower level readers making greater gains than high level readers through the use of a self-paced hypermedia program designed to enhance student interest.

The use of technology may also make it possible to provide task variability, which can be beneficial to students' motivation and learning. African American students have been found to exhibit less intrinsic reading motivation than European American students (Mucherah & Yoder, 2008) and display poorer reading performance (Bailey & Boykin, 2001). Bailey and Boykin found that African American students displayed greater motivation in high variability formats, showing more interest and exerting more effort

and task persistence, which in turn translated to higher academic performance. In all, if students increase their amount of reading through ISR, and the ISR time could be accomplished through the use of a computer-based reading program designed to address the four components of comprehension, there is the potential to affect gains in two essential areas: First, additional growth in reading comprehension may be stimulated beyond what would be expected from ISR alone. Also, situational interest could translate into long term gains in reading motivation which may then develop into later academic success.

Current Study

The design of this study was intended to meet the methodological criteria employed by the NRP for scientific reading studies (NICHHD, 2000): It was quasi-experimental in nature, focused on secondary school students, assessed multiple groups, included a control group, included a pretest, and statistically controlled for possible nonequivalence of the participants. Meeting these criteria was an essential aspect of the design, particularly considering that in 2000 the NRP did not find a sufficient number of studies on the use of ISR that met these qualifications, and since that time, there has not been an influx of experimental research in the area.

To date, the vast majority of empirical research in reading has been conducted with college level, middle school, or elementary subjects, with far fewer studies being conducted with high school students. High school students present a rather unique dynamic in comparison to the other sample populations. Their cognitive functions (Merriam et al., 2007; Tennant, 2002) and reading comprehension levels (Cromley & Azevedo, 2007) resemble and are classified with adults', but they are taking part in

compulsory schooling. This is a very different situation from that of college students who attend school by choice and therefore would logically be more receptive to new material and academic work in general. The dearth of data on high school subjects and their distinctive place in the educational hierarchy speak to the need for research in the area. For many students at this level, high school will be the last formal education they will receive in their lifetimes, so it is essential to identify methods that are effective in producing gains in literacy at such a pivotal time in their lives.

There is reason to believe that increasing text exposure, especially in class, can help students improve their reading comprehension. A gap exists in the literature due to the dearth of experimental studies on the effects of ISR in the classroom, particularly at the high school level. Therefore, the first question this study will attempt to answer is whether in-class independent silent reading combined with a simple accountability measure can positively impact students' overall reading ability and its component parts: vocabulary and comprehension. In other words, will students who perform weekly ISR in school over the course of one semester show greater gains in reading than students in a control group who do not participate in ISR in class?

A single intervention strategy may not be sufficient to address the variety of student needs in secondary school because it is likely that the compounding environmental factors they have experienced over the years have created great differences in their abilities. Instead, a combination of student-centered strategies may lead to better outcomes. To this end, a computer reading module package was developed by the researchers that would allow students to participate in ISR while also offering them scaffolding tools designed to address vocabulary, prior knowledge, inferencing and

predicting, and cognitive and metacognitive strategies. The purpose of these cognitive tools was to increase learner control, student engagement, and reading motivation by providing an appealing format in which students could access the scaffolding devices that met their particular cognitive needs. Therefore, the second research question was whether ISR could be combined with scaffolding tools to influence students' reading ability and reading motivation to a greater extent than traditional ISR or the methods employed with the control group.

The greatest change in reading ability was expected to be between the control group and the two treatment groups, or between the no-ISR group and the two ISR groups, with the treatment groups showing more improvement. This is where the difference in the amount of material read and the time spent reading over the course of the semester would be most pronounced, so the academic and cognitive effects should also be most distinct here. It was also predicted that a difference in reading skills might appear between the two ISR groups, with the computer reading module group showing more growth if the cognitive tools were indeed effective. Theoretically, there was no reason to predict a change in reading motivation between the no-ISR control group and the textbook ISR group. However, a change on the motivation variables was expected to emerge between the computer module ISR group and the other groups, due to the module's predicted ability to stimulate interest and engagement.

Method

Participants

The study was conducted at a large public high school of approximately 2,200 students located 35 miles east of Atlanta, Georgia. The school serves students in 9th

through 12th grade and currently qualifies as a Title I school. The students live primarily in urban communities, although some live in rural and suburban areas as well. The vast majority come from working class and lower middle class socioeconomic backgrounds, with 60% of the school's students qualifying for free or reduced meals (The Governor's Office of Student Achievement, 2010). At the conclusion of the 2008-2009 school year, the year prior to the study, the school had a graduation rate of 78.6%, slightly lower than the state average of 78.9%. As of 2010, it had met AYP requirements for two of the previous four years. Current racial demographics of the school are as follows: 73% African American, 19% Caucasian, with 8% comprised of other minorities such as Hispanic, Asian, and Multiracial students.

Initially, the participants consisted of 155 students from nine 10th grade American literature courses, although ten students transferred out or dropped out during the semester so that data from 145 students was used in the final analysis. All students were between 15 and 17 years of age. The racial makeup of the participants closely mirrored that of the school and was as follows: 76% African American, 21% Caucasian, and 3% other. Females comprised 46% of the final sample. No special education students or English language learners were included in the sample. Three conditions were used in the study, and the final data was derived from 70 students in the control group, 45 in the first treatment group, and 30 in the second treatment group. A more detailed explanation of the groups will follow below in the procedures section.

All classes were from the college prep level, which is the general academic level for courses at the high school. Because all students must take and pass a language arts course for each year they attend high school, language arts courses are the first assigned

to students when their schedules are created, and the school randomly assigned those students to the classes in this study. All regular college prep level students who took American literature at the school during the winter/spring semester participated in the study. Since the college prep program encompasses the vast majority of the school's students, a wide range of literacy levels were represented, with students from the final sample initially reading between a 5.7 grade level and college level at the beginning of the semester according to the Gates-MacGinitie pretest.

Materials/Measures

Reading Materials

Fourteen canonical passages from American literature were selected as the reading material for the weekly interventions. Of these, ten were converted to electronic format to be read during weekly ISR sessions by the second treatment group via school computers. A detailed list can be found below in Appendix A. All were chosen from the standard course textbook and all can be commonly found in American literature textbooks throughout public schools in the U.S. The passages ranged from 1,618 to 7,096 words with a mean of 3,582 words. The Flesch-Kincaid grade level for the passages ranged from 4.7 to 12.0 with a mean grade level of 7.86. It should be noted, however, that the Flesch-Kincaid grade level score uses word length and sentence length as the primary measures without taking into account the complexity of the content or the extent of the schema necessary to comprehend the material. In fact, most of the authors and selections from this study are also regularly assigned in university literature programs.

A number of considerations were made in choosing the particular passages: First, their status as standard canon conformed to course requirements so that if any potential

benefits of the interventions were found, the method could be replicated in other classrooms without diverging from the state curriculum. Another main consideration was that students had to be able to read each selection in a single class period, so passages were relegated to those that students could reasonably be expected to read in approximately 60 minutes. Culturally diverse literature was included as well with four selections by African American authors. Ten of the passages were narratives, three were essays, and one was a public document.

Achievement Measures

The Gates-MacGinitie Reading Skills Test, Level 10/12, Fourth Edition, Form S was used as a pre assessment to gauge baseline reading comprehension, vocabulary, and total reading ability levels at the beginning of the semester. This commonly employed test is designed to assess students from 10^{th} grade through 12^{th} grade and takes approximately 75 minutes to administer. The vocabulary subsection consists of 45 questions, while the reading comprehension subsection consists of 48 questions. The scores from the two subsections are combined to create a score for overall reading ability. Raw scores from each subsection and the total reading score were converted to extended scale scores, which were used in the statistical analysis. The purpose of the extended scale scores is to provide a common metric with equivalent intervals to compare group means. Students from all groups were assessed within the first two weeks of the semester. Student scores from Form S served as the covariate in subsequent ANCOVA analyses in order to statistically control for possible nonequivalence of the participants.

The Gates-MacGinitie Reading Skills Test, Level 10/12, Fourth Edition, Form T was used as a post assessment and was administered during the final two weeks of class

for this 18-week course (Form S was designed and vetted as the pretest during the norming process, and Form T was designed and vetted as the posttest). Each subsection for Form T had the same number of questions as the subsections for Form S, and just as with Form S, the raw scores were converted into equivalent extended scale scores. For each subsection and for total reading, the extended scale score from Form S served as the covariate in the statistical analysis to control for initial levels, and its counterpart from Form T served as the dependent variable.

Another achievement measure was comprised of a series of text-specific reading assessments. While the main purpose of the study was not aimed at gauging student performance on individual reading assignments, four reading comprehension tests based on the specific reading assignments were developed by the researchers in order to ascertain whether any of the groups outperformed the others on those assignments. These assessments were given during the 5^{th}, 8^{th}, 12^{th} and 13^{th} of fourteen total interventions, which were administered on the 6^{th}, 10^{th}, 14^{th}, and 15^{th} weeks of the 18-week semester, respectively. Each reading test consisted of 20 multiple choice questions made up of a combination of knowledge level and high order questions. The assessments were administered to all groups the day following the particular reading assignment.

The final achievement measure, and possibly most important measure in practical terms, was the students' scores on the state mandated End-Of-Course Test (EOCT) for American literature. The EOCT was created by the state of Georgia to measure essential course objectives and accounted for 15% of each student's final grade for the course, so it is crucial in determining whether students actually pass the course and have acquired the necessary skills. The EOCT is comprised of four sections: 1) Reading and American

Literature; 2) Reading, Listening, and Speaking Across the Curriculum; 3) Writing; 4) Conventions. For the purpose of this study, only the first section, Reading and American Literature, was directly relevant to the interventions so this section was used as another dependent variable. For the analyses associated with the reading subsection of the EOCT, the pretest scores for total reading ability from Form S of the Gates-MacGinitie were entered as the covariate to control for initial nonequivalency.

Disposition Measures

Two motivation scales, described in detail below, have been shown to be reliable with either middle school students or adults, so both were employed due to their potential to provide beneficial data with secondary-aged populations. The Motivation for Reading Questionnaire (MRQ), developed by Wigfield and Guthrie in 1997, has provided a great deal of the current information we now possess on reading motivation (Mucherah & Yoder, 2008). The MRQ gauges overall reading motivation and assesses eleven dimensions associated with motivation. It has been found to be reliable with both elementary and middle school students. When Mucherah and Yoder tested the scale with 8th graders, they found internal consistency reliabilities on the subscales ranging from .63 to .81. The MRQ consists of 54 questions on a 4-point Likert scale. It presents each question, such as “I like to read about new things” and then asks the student to choose from a range of answers from “Very Different From Me” to “A Lot Like Me”. For the purpose of this research, only the level of overall reading motivation was analyzed.

Schutte and Malouff (2007) recently developed a motivation scale specifically for adult readers, the Adult Motivation for Reading Survey (AMRS), which is a theoretical extension of the MRQ. The AMRS tests overall reading motivation and four component

dimensions believed to contribute to global reading motivation. The AMRS is comprised of 21 questions scored on a 5-point Likert scale, from “Strongly Disagree” to “Strongly Agree”. The authors found strong internal consistency for the 21 items, which revealed a Cronbach’s alpha of .85. As with the MRQ, the AMRS was analyzed only for overall reading motivation in this study. Operationally, there appears to be an important difference between these two motivation scales: The MRQ tends to measure self-concept, or how students feel about themselves in regard to reading. The AMRS tends to measure attitudes *about* reading, directing attention externally, instead of focusing on internal identity issues. Because the cognitive functions (Merriam et al., 2007; Tennant, 2002) and literacy skills (Cromley & Azevedo, 2007) of high school students resemble and are often classified with those of adults, the AMRS may be a more appropriate tool than the MRQ for assessing reading motivation at the secondary level. However, the MRQ has been found to be reliable with 8th grade students, who are relatively close in age, maturity, and cognitive ability to the 10th graders who participated in this study.

The final disposition measure applied in this study was the Sydney Attribution Scale (SAS), an assessment developed to ascertain the perceived causes that students use to explain their academic successes and failures (Marsh, 1984). The original scale consisted of 24 brief scenarios and asked the students to place themselves in each situation and then make a judgment on the possible cause of the academic success or failure. However, of those 24 original scenarios, 12 were content-specific to mathematics, so for this study the scale was abridged to include only the 12 scenarios that were content-specific to reading. Each of the 12 questions was followed by three plausible causes for the outcome, and students responded to each on a 5-point response scale

spanning from *false* (1) to *true* (5). The scale measured six different dimensions of attribution stemming primarily from locus of control research- 1) success/ability, 2) success/effort, 3) success/external, 4) failure/ability, 5) failure/effort, 6) failure/external. The original complete SAS scale was found to be reliable with a mean coefficient alpha of .78. The mean coefficient alpha of the reading scales used in this study was .81. As with the achievement measures, the SAS and both motivation surveys were administered twice, once during the first two weeks of the semester and once during the final two weeks of the semester.

Procedures

Three groups of 10th grade college prep level students from nine different American literature classes taught by three different teachers took part in the study- a control group, treatment 1, and treatment 2. For the sake of clarity, the first treatment group will subsequently be referred to as the "textbook ISR" group, and the second treatment group will be referred to as the "module ISR" group. The students in each class were randomly assigned to those classes by the school. The classes that comprised the module ISR group were assigned based on the availability of the computer labs, which was necessary due to the limited accessibility to computers at the school. The groups were selected so that the conditions were dispersed between the teachers, with each teacher teaching two different conditions in order to control for teacher effects: teacher 1 taught a control condition and a textbook ISR condition, teacher 2 taught a control condition and a module ISR condition, and teacher 3 taught a textbook ISR condition and a module ISR condition. The research was conceived through a collaboration between an educational psychologist and instructional technologist, and the educational psychologist

served as one of the three high school teachers in the study. This was deemed appropriate in this case because the interventions were structured so that the teachers did no more than proctor a reading test each week and did not take part in any reading instruction, either direct or indirect, with the students.

All classes from all groups followed the same curriculum and pacing guides. All groups studied selections from the same textbook, the Holt *Elements of Literature Fifth Course, Essentials of American Literature*. The curriculum for the course dealt with literature written by American authors and spanned the literary periods from the 1600's to present. The literary periods covered included Puritan literature, the Revolutionary Period, Romanticism, Transcendentalism, Realism, Modernism, the Harlem Renaissance, and contemporary literature. The course involved a variety of genres, including essays and narratives, fiction and nonfiction, poetry, and public documents.

The instruction for all classes conformed to the Georgia Performance Standards, which set guidelines for the content of the course, and all students took a standardized, state-mandated EOCT at the conclusion of the semester. All students' reading comprehension performance, vocabulary, and reading motivation were measured longitudinally across a single semester on a block schedule. The block schedule condenses a year's worth of instruction and material into a single semester by extending class time to a full hour and a half each day, so theoretically, the students were assessed for a full school year's content delivered over the span of five months. The semester was comprised of 18 weeks, but due to some weeks being shortened for activities like staff development and other weeks that included midterms, finals, and the EOCT, 14 interventions occurred across the semester.

Control Group

The control group covered the same reading material each week as the two treatment groups, and did so in a fashion that the teachers normally employed in previous years. Each teacher used a variety of methods to cover the material with the control classes but did not have the classes engage in ISR. The methods included student read-alouds, teacher read-alouds, short readings paired with teacher led discussions, and small group readings such as pair-share (two students) and reading circles (more than two students). The researchers' hypothesis was that activities such as these may help students to learn the material, but that many students would learn via listening rather than reading, and fewer students would read consistently throughout the semester, leading to less uniform gains in reading comprehension than those students in the classes that took part in methodical ISR. The control classes functioned more like traditional literature classes with instructional time often devoted towards historical context and the aesthetic qualities of the literature, but with less time devoted to having each individual student read for prolonged periods. Therefore, if reading amount outside of school was similar across students in all groups, which is likely considering the students were randomly assigned to the classes, each student in the control group would read less frequently and less overall than those in the treatment groups.

Treatment Groups: ISR

Both treatment groups took part in weekly in-class ISR paired with an accountability measure. The method was structured like an assessment with students reading independently and silently, while the teacher had limited interaction with the students during the process, with the exception of classroom management procedures.

The method was entirely student centered except for the use of the adjunct questions, which were assessed after the completion of each intervention. All teacher-student interaction regarding the literature occurred post-intervention, when reading comprehension and vocabulary could no longer be affected by the teacher for that particular selection. This ISR process was designed to foster active engagement in reading on the part of each and every student. The treatment groups devoted more uniform time to reading than those in the control group, ensuring that all students in class consistently read for themselves. Therefore, during this study, the amount of time students spent engaged in active reading differed primarily according to the amount of independent reading they did in class, which in turn differed according to condition.

Treatment Group 1: Textbook ISR Group

The students in the textbook ISR group read silently from the standard American literature textbook for approximately one hour in a single sitting each week. They answered open-book adjunct questions as they read so that their reading could be verified. The questions were open-ended and consisted of a combination of knowledge-based and higher order questions. Open ended questions were considered necessary because if multiple choice questions were used, it would have allowed those students who did not want to read the option to guess instead. The questions required short answer responses that asked students to summarize, paraphrase, and make inferences. These questions may have served to stimulate metacognition or to help the readers emulate the self-questioning that high functioning readers do spontaneously. Researchers have found improved reading performance when measures of accountability were introduced alongside silent reading (Kelley & Clausen-Grace, 2006; Trudel, 2007), while others

have noted the importance of having additional supports to ensure participants attend to the intervention (Thompson, 1997). In traditional SSR students recognize that no assessments will follow to verify their reading and often fail to follow through with it, especially if the text is at or above their reading level. When accountability measures such as adjunct questions or verbal summarizing were introduced, students were more likely to read and understand the material.

Treatment Group 2: Module ISR Group

The module ISR group read the same literary selections as the control group and the textbook ISR group but did most of their reading on computers rather than from the textbook. Like the textbook ISR group, the module ISR group read silently for approximately one hour each week and answered the same open-book adjunct questions while they read. However, the module ISR group received additional intervention layers delivered via a computer module format designed specifically to assist with comprehension. Like the control and textbook ISR groups, the module ISR group read on fourteen different weeks, but nine of the assignments were completed with the use of the computer module, while five were text-based interventions identical to those administered to the textbook ISR group. Initially, ten computer module interventions had been scheduled, but one was cancelled due to a computer lab scheduling conflict within the school.

The computer reading modules were developed by the researchers and included a number of cognitive tools and scaffolding devices meant to improve comprehension. The modules were constructed on a PowerPoint template, and students read the material by clicking through the slideshows at their own pace. Orienting instructions have been found

to be beneficial in helping adults attend to reading comprehension tasks (Thompson, 1997) and were placed at the beginning of the slideshows to advise the reader of the usefulness and importance of the additional tools at their disposal, such as advance organizers. Advance organizers were in place to provide background knowledge, activate schema, and help generate predictions. The module provided questions that asked the students to paraphrase the information contained in the advance organizers in writing to encourage them to encode that information into memory. In order to trigger inferences and predictions, words from within the text that were central to its meaning flashed across the screen prior to certain chunks of text. A vocabulary function allowed students to scroll over words in the text to reveal their meaning as they were used within the context of the passage. Students answered identical adjunct questions to those in the textbook ISR group, but the questions were embedded within the module on the screen. Some pictures associated with the text appeared at the beginning of the slideshow to assist with schema production and add interest, but none appeared within the body of the passages so that the focus would remain on students' visual processing of the text alone.

Results

All analyses were conducted in two ways: First, the textbook ISR and module ISR groups were collapsed to create a single ISR group to compare the overall effects of ISR against the performance of the control group. Next, each analysis was run comparing all three conditions (control, textbook ISR, module ISR) as separate independent variables in order to identify whether the performance of students in either of the treatment conditions differed significantly from one another or from the control group. With few exceptions, ANCOVA was used to test for change in skills and disposition across the study because it

is effective in controlling for initial levels in academic skill, motivation, and attribution. ANCOVA is also particularly effective in measuring relative gains, which was the focus of the study, rather than overall achievement. The homogeneity of slopes assumption was tested on each relationship prior to running the analysis, and none of the relationships were found to violate the assumption, indicating that the use of ANCOVA was appropriate in each instance.

Achievement Measures

Of the 156 students who took the Gates-MacGinitie reading test, 5 students missed the pretest, 8 students missed the posttest, 10 students dropped out or transferred out, 2 students refused to complete the test, and 26 students' scores had to be removed due to random guessing on either the pretest or the posttest, or 9.0% of the total 289 tests administered. Students' scores were removed for random guessing based on chance level results and visual inspection of the score sheets. This left 105 students who completed both the pre and post tests (210 tests) in a valid fashion. While it was troubling to lose 9% of the final data due to students randomly guessing, this number is likely in line with the percentage of students who would randomly guess on any in-school assessment and translates to between 2 and 3 students per class per assessment.

Theoretically, students should gain 1.0 grade level per school year from beginning to end. Likewise, in one semester, or half a school year, we would expect to see a mean gain of approximately .5 grade levels for all students. In terms of raw numbers, according to the Gates-MacGinitie conversion measures, in this study the students in the combined ISR group showed more than twice the amount of gain in total reading ability as the students in the control group. Those in the control group showed a mean gain of .7 grade

levels in total reading ability (going from a 9.5 mean grade level to 10.2) while those in the combined ISR group showed a mean gain of 1.5 grade levels (going from a 10.2 grade level to 11.7). When the two treatment groups were examined individually, the textbook ISR group gained 1.5 grade levels (from 10.0 to 11.5), and the module ISR group gained 1.8 grade levels (from 10.5 to 12.3). The gain of .7 grade levels by the control group is consistent with the gains that would be expected over the course of a five month semester. However, the fact that both treatment groups gained at least 1.5 grade levels is notable because it suggests their total reading ability improved three times faster, or three times more, than would be expected in half a school year.

The results for vocabulary were less pronounced, with more moderate gains and fewer differences between the groups. The students in the control group gained .7 grade levels in vocabulary (going from an 8.9 mean grade level to 9.8), while the combined ISR group gained 1.0 grade level (from 8.9 to 9.9). When considered individually, the textbook ISR group gained .8 grade levels (from 8.8 to 9.6), but the module ISR group gained 1.4 grade levels (from 9.5 to 10.9). While the module ISR group appeared to perform better than the control group and textbook ISR group in vocabulary, none of these differences proved to be statistically significant when entered in ANCOVA, as detailed below.

The most striking gains were in the area of reading comprehension. The students in the control group gained a total of .7 grade levels (going from a 9.0 mean grade level to 9.7), and the combined ISR group gained 1.8 grade levels (from 10.0 to 11.8), more than twice as much. When examined individually, the textbook ISR group gained 1.8 grade levels (from 10.0 to 11.8), and the module ISR group gained 1.9 grade levels (from

10.0 to 11.9). Here again, the students in the control group gained in comprehension at a pace that would be consistent with what would be expected over the course of a five month semester, while both the students in the textbook ISR group and those in the module ISR group gained at a pace that was three times faster than would be expected over that time frame, or gained three times as much in reading comprehension. The grade level results that were discussed above can be found in Table 1 below.

Table 1

Total Reading Ability

Group	Pre ESS	Post ESS	ESS Δ	Pre GE	Post GE	GE Δ
Control	546.16	550.42	4.26	9.5	10.2	.7
Combined ISR	550.34	558.37	8.03	10.2	11.7	1.5*
Textbook ISR	549.18	557.18	8.0	10.0	11.5	1.5
Module ISR	552.17	560.25	8.08	10.5	12.3	1.8

Vocabulary

Group	Pre ESS	Post ESS	ESS Δ	Pre GE	Post GE	GE Δ
Control	541.51	545.32	3.81	8.9	9.6	.7
Combined ISR	541.75	547.24	5.49	8.9	9.9	1.0
Textbook ISR	539.76	545.10	5.34	8.8	9.6	.8
Module ISR	544.96	550.69	5.73	9.5	10.9	1.4

Reading Comprehension

Group	Pre ESS	Post ESS	ESS Δ	Pre GE	Post GE	GE Δ
Control	543.40	548.51	5.11	9.0	9.7	.7
Combined ISR	551.24	561.27	10.03	10.0	11.8	1.8*
Textbook ISR	551.05	560.97	9.92	10.0	11.8	1.8*
Module ISR	551.54	561.75	10.21	10.0	11.9	1.9*

Note: ESS = Gates-MacGinitie Extended Scale Score, GE = Gates-MacGinitie Grade Equivalent, Δ = change in scores, * = relationships that were statistically significant

An ANCOVA was conducted to compare the performance of the control group to the combined ISR group (textbook ISR and module ISR) in total reading ability. The total reading score from the Gates-MacGinitie pretest was entered as the covariate to control for initial ability levels, condition served as the independent variable, and the students' posttest scores constituted the dependent variable. The results showed a significant

difference between groups, $F(1, 102) = 4.429$, $p = .038$, $d = .39$, with the combined ISR group increasing their overall reading ability to a greater extent than did the students in the control group. Next, the same covariate and dependent variable were entered, but this time all three groups were compared individually. These results did not prove to be significant, $F(2, 101) = 2.230$, $p = .113$. Pairwise comparisons did not show significant difference between the control and module ISR groups, $p = .075$; the control and textbook ISR groups, $p = .083$; or the textbook ISR and module ISR groups, $p = .79$. While none of these three relationships proved to be significant, it was clear that both ISR groups showed similar gains, far more alike than the students' performance in the control group, and when collapsed statistically, the overall ISR group did improve substantially more in total reading ability than those in the control group. Means and standard deviations for the total reading analyses can be found in tables 2 and 3 below.

Table 2

Total Reading: Control vs. Combined ISR

Condition	Mean	Std. Deviation	N
Control	550.42	21.50	43
Combined ISR	558.37	18.99	62
Total	555.11	20.34	105

Table 3

Total Reading: Control vs. Textbook ISR vs. Module ISR

Condition	Mean	Std. Deviation	N
Control	550.42	21.50	43
Text	557.18	19.10	38
Module	560.25	19.07	24
Total	555.11	20.34	105

Next a similar ANCOVA analysis was conducted using the vocabulary subsection pretest as the covariate and the vocabulary subsection posttest as the dependent variable

to test for differences in vocabulary ability across the study. When the control group was compared to the combined ISR group, the results were not significant, $F(1, 124) = .601$, $p = .44$, $d = .09$. When all three groups were compared, no difference was found $F(2, 123) = 5.03$, $p = .606$. In pairwise comparisons, again, no differences emerged between the control and module ISR groups, $p = .318$; the control and textbook ISR groups, $p = .706$; or the textbook ISR and module ISR groups, $p = .524$. These results suggest that no changes occurred between the different groups in relation to vocabulary development as a result of the interventions.

Another ANCOVA was performed, this time with the reading comprehension subsection scores on the pretest as the covariate and the reading comprehension subsection scores from the posttest as the dependent variable. When the control group was compared to the combined ISR group the difference was significant, $F(1, 104) = 5.71$, $p = .019$, $d = .61$ indicating that students who took part in weekly ISR, no matter which format, increased their reading comprehension ability more than the students in the control group did. All three groups were then compared, and the difference in this case was not significant, $F(2, 103) = 2.834$, $p = .063$. Pairwise comparisons revealed that there was no difference between the textbook ISR group and the module ISR group, $p = .914$; the difference between the module ISR group and the control group fell slightly short of statistical significance, $p = .057$, $d = .63$; but there was a significant difference between the control group and the textbook ISR group, $p = .041$, $d = .59$. These results indicate that the module ISR group and textbook ISR group increased their performance similarly, but that only the performance of the textbook ISR group met the threshold for statistical significance when compared individually to the control group, while the performance of

the module ISR group fell just outside that threshold. But, just as with total reading ability, the combined ISR group showed a clear difference and more pronounced improvement in reading comprehension than the students in the control group did. Means and standard deviations for the reading comprehension analyses with comprehension as the covariate can be found in tables 4 and 5 below.

Table 4
Reading Comprehension with Comprehension as Covariate: Control vs. Combined ISR

Condition	Mean	Std. Deviation	N
Control	548.51	21.87	45
Combined ISR	561.27	20.23	62
Total	555.91	21.78	107

Table 5
Reading Comprehension with Comprehension as Covariate: Control vs. Textbook ISR vs. Module ISR

Condition	Mean	Std. Deviation	N
Control	548.51	21.87	45
Text	560.97	20.68	38
Module	561.75	19.93	24
Total	555.91	21.78	107

Also of theoretical interest was whether differences emerged if initial total reading ability was entered as the covariate with each component part as a dependent variable. The total reading ability score provides the best overall baseline measure for the skills that students possessed at the beginning of the study, and each component part from the two subsections provided an incomplete picture of the students' initial ability levels. Moreover, a reciprocal effect has been shown to exist between vocabulary and reading comprehension with each component influencing the other. Initial vocabulary level has been found to affect growth in reading comprehension (Alfassi, 2004; Beck, Perfetti, & McKeown, 1982; Connor, et al., 2004; Ouellette, 2006), while gains in reading

comprehension have been found to influence vocabulary growth (Joshi, 2005). Therefore, if only the subsections are considered when controlling for initial levels, it ignores a major source of possible influence on the dependent variable, the students' initial skill levels on the other subsection. For instance, if only reading comprehension is controlled for in initial skill level, it would not account for the possible effects that initial vocabulary level may play in students' growth in reading comprehension and vice versa.

For this reason the ANCOVA analyses were repeated using the total reading ability scores as the covariate and each subsection as the dependent variable. When the control group was compared to the combined ISR group in this way to test for effects on vocabulary, no significant differences were found, $F(1, 102) = .087$, $p = .768$, $d = .12$. Likewise, when all three groups were compared on vocabulary no differences emerged, $F(2, 101) = .415$, $p = .661$, with no difference between the control and textbook ISR groups, $p = .517$; the control and module ISR groups, $p = .756$; or the textbook ISR and module ISR groups, $p = .391$. This verified the earlier analysis on vocabulary, suggesting again that vocabulary did not change between groups as a function of the interventions, even when taking into account the effects that initial reading comprehension levels may have had on vocabulary growth.

A similar analysis was then conducted using total reading ability as the covariate and reading comprehension as the dependent variable. When the control group was compared to the combined ISR group in this way a significant difference became apparent, $F(1, 102) = 9.847$, $p = .002$, $d = .57$. In comparing all three groups, significant differences again emerged, $F(2, 101) = 4.935$, $p = .009$. Pairwise comparisons showed no difference between the textbook ISR and module ISR groups, $p = .741$, but significant

differences between the control and textbook ISR groups, $p = .004$, $d = .55$, and the control and module ISR groups, $p = .029$, $d = .60$. This analysis shows that when taking initial total reading ability into account, instead of just initial reading comprehension, the combined ISR groups improved substantially more than the control group in reading comprehension. Additionally, when compared separately, both treatment groups improved to a similar extent, and both treatments groups improved significantly more than the control group. Because the results were more pronounced when considering initial vocabulary levels via total reading ability in controlling for overall beginning skill levels, it underscores the fact that the interventions appeared to target reading comprehension specifically. Means and standard deviations for the reading comprehension analyses with total reading ability as the covariate can be found in tables 6 and 7 below.

Table 6

Reading Comprehension with Total Reading Ability as the Covariate: Control vs. Combined ISR

Condition	Mean	Std. Deviation	N
Control	549.12	22.19	43
Combined ISR	561.27	20.23	62
Total	556.30	21.79	105

Table 7

Reading Comprehension with Total Reading Ability as the Covariate: Control vs. Textbook ISR vs. Module ISR

Condition	Mean	Std. Deviation	N
Control	549.12	22.19	43
Text	560.97	20.68	38
Module	561.75	19.93	24
Total	556.30	21.80	105

To test for differences on how each group performed on the individual reading assignments, repeated measure ANOVAs were performed. Scores from students' posttests following the reading assignments on the 5th, 8th, 12th and 13th interventions were entered as repeated measure dependent variables, while condition was entered as the between-subjects variable. When comparing the control group to the combined ISR group, the difference was found to be highly significant, $F(1, 104) = 9.104$, $p = .003$, partial $\eta^2 = .080$ with the combined ISR group outperforming the control group on each of the four interventions. When all three groups were compared, the outcome again was highly significant, $F(2, 103) = 5.587$, $p = .005$, partial $\eta^2 = .098$. In this case the pairwise comparisons revealed that there was no difference in the performance between the textbook ISR and module ISR groups, $p = .162$, and the difference between the control and textbook groups fell just short of significance, $p = .055$, but there was a highly significant difference between the control and module ISR groups, $p = .002$. This suggests that while the computer reading module did not appear to provide benefits to global reading comprehension beyond those benefits experienced by the textbook ISR group, as the Gates-MacGinitie data revealed, the module did in fact appear to assist students with comprehending material on the individual assignments. The technological package encompassing the cognitive tools helped students to better understand the specific stories they read even if that improved comprehension did not generalize to all reading tasks. While the reading passages were not equivalent in terms of difficulty, with by far the most abstract selection coming at the end and all students struggling on that final assessment, the module ISR group outperformed the other two groups on all four passages. Means and standard deviations for the scores from the individual reading

assignments, along with the accompanying graphs, can be found in tables 8 and 9 and figures 1 and 2 below.

Table 8

Scores from Individual Reading Assignments: Control vs. Combined ISR

Passage	Condition	Mean	Std. Deviation	N
Dr. Heidegger's Experiment	Control	64.64	17.71	56
	Combined ISR	72.60	12.63	50
	Total	68.40	15.95	106
Narrative of Frederick Douglass	Control	78.13	18.43	56
	Combined ISR	82.30	12.58	50
	Total	80.10	16.01	106
A Rose for Emily	Control	75.45	21.69	56
	Combined ISR	85.20	13.01	50
	Total	80.05	18.69	106
The Jilting of Granny Weatherall	Control	56.86	20.17	56
	Combined ISR	67.10	15.05	50
	Total	61.70	18.58	106

Table 9

Scores from Individual Reading Assignments: Control vs. Textbook ISR vs. Module ISR

Passage	Condition	Mean	Std. Deviation	N
Dr. Heidegger's Experiment	Control	64.64	17.71	56
	Text	68.39	13.56	31
	Module	79.47	6.85	19
	Total	68.40	15.95	106
Narrative of Frederick Douglass	Control	78.13	18.43	56
	Text	82.10	13.02	31
	Module	82.63	12.18	19
	Total	80.10	16.01	106
A Rose for Emily	Control	75.45	21.69	56
	Text	81.94	13.58	31
	Module	90.53	10.26	19
	Total	80.05	18.69	106

The Jilting of Granny Weatherall	Control	56.88	20.17	56
	Text	66.29	15.49	31
	Module	68.42	14.63	19
	Total	61.70	18.58	106

Figure 1

Graph Depicting Scores from Individual Reading Assignments: Control vs. Combined ISR

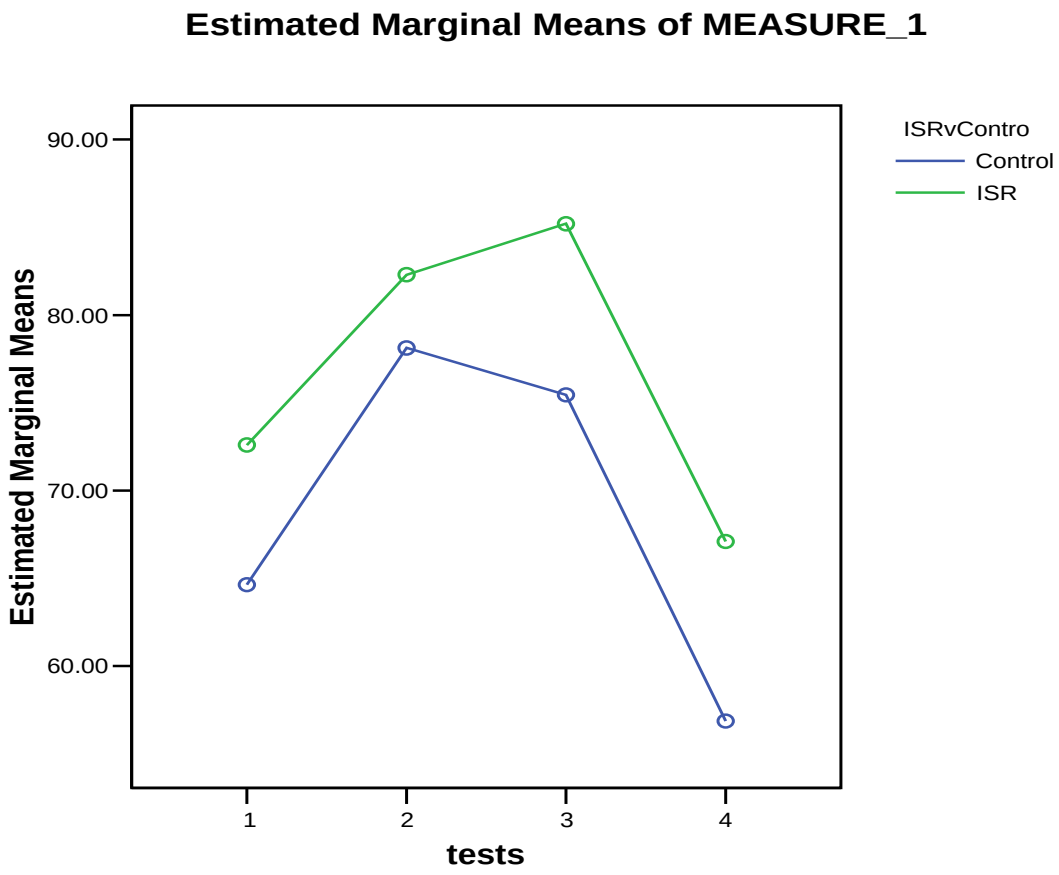
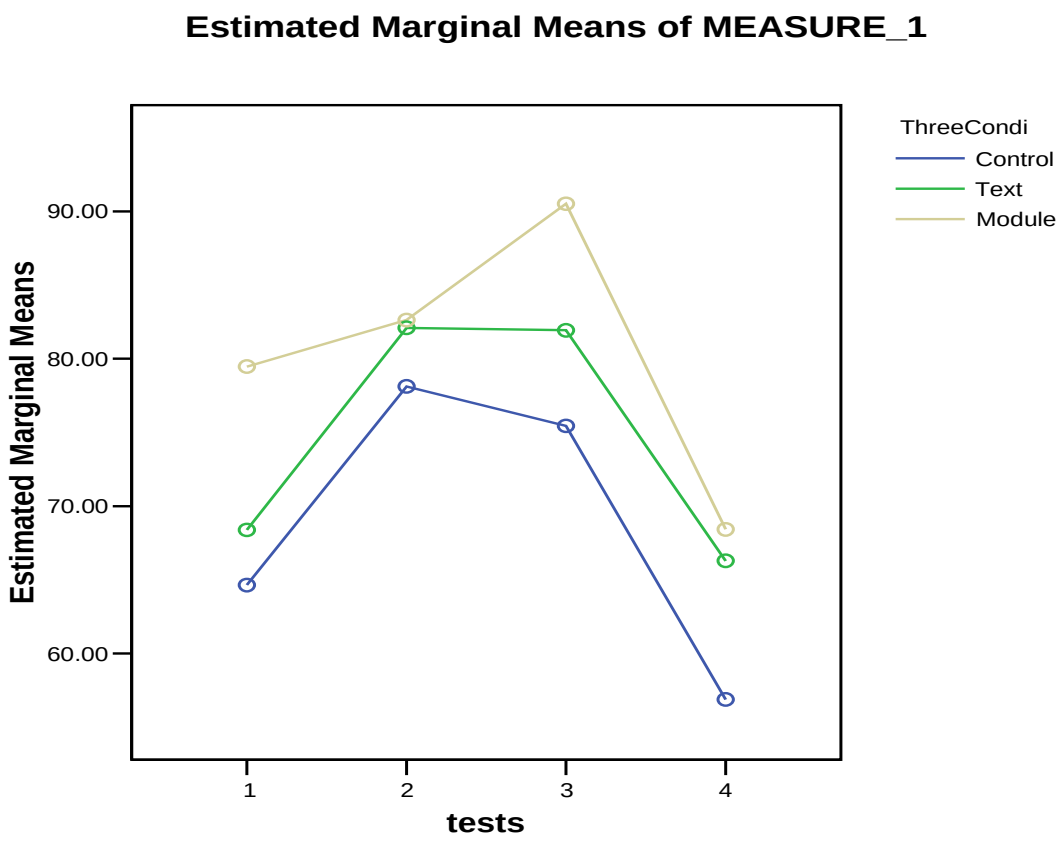


Figure 2

Graph Depicting Scores from Individual Reading Assignments: Control vs. Textbook ISR vs. Module ISR



The final group of achievement analyses examined how the students in each condition fared on the state mandated American Literature End-of-Course Test (EOCT) and provided the most practical measure of whether the interventions contributed to the development of skills that are essential to success in high school. ANCOVA analyses were conducted with the Gates-MacGinitie total reading ability scores from the pretest used as the covariate to establish a baseline measure for initial reading skill. Students' scores from the Reading and American Literature subsection of the EOCT were entered as the dependent variable. When the control group was compared to the combined ISR groups, there was a significant difference, $F(1, 104) = 6.515$, $p = .012$, $d = .55$, with the

students in the treatment groups outperforming those from the control group after controlling for initial reading ability. When all three groups were compared separately, there was again a significant difference, $F(2, 103) = 3.254$, $p = .043$. In this case there was no difference between the textbook ISR and module ISR groups, $p = .819$, and there was a significant difference between the control and the textbook ISR groups, $p = .019$, $d = .50$, but the difference between the control and module ISR groups was not significant, $p = .073$, $d = .66$. These results mirror those from the previous achievement measures and reinforce the findings that the two treatment groups performed similarly and together clearly outperformed the control group in reading, but that the students in the textbook ISR group appeared to show the most consistent difference in contrast to those in the control group. Means and standard deviations for the EOCT reading subsection with total reading ability as the covariate can be found in tables 10 and 11 below.

Table 10

EOCT Reading Subsection with Total Reading Ability as the Covariate: Control vs. Combined ISR

Condition	Mean	Std. Deviation	N
Control	14.39	4.68	44
Combined ISR	16.73	3.73	63
Total	15.77	4.28	107

Table 11

EOCT Reading Subsection with Total Reading Ability as the Covariate: Control vs. Textbook ISR vs. Module ISR

Condition	Mean	Std. Deviation	N
Control	14.39	4.68	44
Text	16.56	4.08	39
Module	17.00	3.12	24
Total	15.77	4.28	107

Disposition Measures

In examining the raw data on the disposition measures, the students in the combined ISR group showed greater gains in reading motivation on the Motivation for Reading Questionnaire (MRQ) than those in the control group (a gain of .09 for the control group and .15 for the combined ISR group). When examined individually, the textbook ISR group showed a gain of .14 on reading motivation, and the module ISR group showed a gain of .17 in the same construct. However, none of these relationships proved to be statistically significant when analyzed using ANCOVA. On the Adult Motivation for Reading Survey (AMRS), the students in the control group showed a gain of .03 in reading motivation, while those in the combined ISR group showed a gain of .12. When considered individually, the students in the textbook ISR group showed a gain of .07, while those in the module ISR group showed by far the most gain (.24). The difference in the increase of reading motivation between the combined ISR group and control group did prove to be significant, as detailed below, and was largely driven by the pronounced gains in reading motivation by the students in the module ISR group. These data are shown below in Table 12.

Table 12

Reading Motivation Scales

Group	Pre MRQ	Post MRQ	MRQ Δ	Pre AMRS	Post AMRS	AMRS Δ
Control	2.41	2.50	.09	2.9	2.93	.03
Combined ISR	2.59	2.74	.15	3.20	3.32	.12*
Textbook ISR	2.62	2.76	.14	3.25	3.32	.07
Module ISR	2.54	2.71	.17	3.10	3.34	.24*

Note: MRQ = Motivation for Reading Questionnaire, AMRS = Adult Motivation for Reading Survey, Δ = change in scores, * = relationships that were statistically significant

The results of the MRQ were analyzed to test for change in overall reading motivation between groups. There were 123 students who completed both the pre and

post MRQ assessment. For each analysis, the students' scores from the MRQ administered at the beginning of the semester were entered as the covariate to control for initial levels of motivation, group was the independent variable, and the scores from the MRQ administered at the end of the semester served as the dependent variable. First the control group was compared against the combined ISR group, and the difference between groups was not found to be significant, $F(1, 120) = 2.79$, $p = .098$. Next all three groups were compared and again no significant differences emerged $F(2, 119) = 1.38$, $p = .255$. Pairwise comparisons revealed no significant differences between any of the three groups: control vs. textbook ISR, $p = .148$; control vs. module ISR, $p = .20$; textbook ISR vs. module ISR, $p = .969$. These results suggest that changes in overall reading motivation, as measured by the MRQ, a scale originally developed for children and later also used with adolescents, did not differ significantly between any of the three groups across the duration of the study.

Results from the AMRS were then analyzed to test for changes in overall reading motivation on a scale geared towards adults' perspectives on reading. There were 117 students who completed both the pre and post AMRS assessments. Again, the pretest scores were entered as the covariate, group as the independent variable, and posttest scores as the dependent variable in the ANCOVA analysis. When the control group was compared against the combined ISR group, the results were significant $F(1, 114) = 6.20$, $p = .014$, $d = .62$, suggesting that on this particular measure, students in the treatment group increased their overall reading motivation significantly more than those in the control group. To examine the relationships in greater detail, all three groups were compared and again a significant difference emerged $F(2, 113) = 3.84$, $p = .024$. Pairwise

comparisons revealed that there was not a significant difference between the control group and the textbook ISR group, $p = .090$, or the textbook ISR and module ISR groups, $p = .229$, but that there was a significant difference in overall reading motivation between the control group and the module ISR group, $p = .009$, $d = .66$. These results suggest that as a whole, the students who took part in ISR for the semester increased their reading motivation on the adult scale to a greater degree than those in the control group. Additionally, the most pronounced changes in motivation occurred in the students who read from the computer module, whose reading motivation increased substantially more than those students in the control group. The means and standard deviations for the AMRS survey can be found in tables 13 and 14 below.

Table 13

AMRS: Control vs. Combined ISR

Condition	Mean	Std. Deviation	N
Control	2.93	.72	51
Combined ISR	3.32	.55	66
Total	3.15	.66	117

Table 14

AMRS: Control vs. Textbook ISR vs. Module ISR

Condition	Mean	Std. Deviation	N
Control	2.93	.72	51
Text	3.32	.58	43
Module	3.34	.50	23
Total	3.15	.66	117

For the Sydney Attribution Scale (SAS), an ANCOVA was again performed with the score for each dimension on the pretest as the covariate, group as the independent variable, and the score for each dimension on the posttest as the dependent variable. There were 123 students who completed both the pre and post administrations of the

SAS. No significant differences were found on any of the last five of the six dimensions: 2) success/effort, 3) success/external, 4) failure/ability, 5) failure/effort, 6) failure/external. However, on the first dimension, success/ability, a significant difference emerged, $F(1, 120) = 7.868$, $p = .006$, $d = .47$, suggesting that those students who took part in ISR were more likely to show an increased tendency to attribute their successes in reading to their own ability than were those students in the control group. The means and standard deviations for the SAS success/ability dimension for two groups can be found below in table 15.

Table 15

SAS Success/Ability Dimension: Control vs. Combined ISR

Condition	Mean	Std. Deviation	N
Control	3.84	.95	57
Combined ISR	4.22	.64	66
Total	4.05	.82	123

Next a similar analysis was conducted on the SAS scores, but comparing all three groups. Just as in the analysis between only the two groups, no significant differences were found on any of the last five of the six dimensions. However, a significant difference once again appeared for the success/ability dimension, $F(2, 119) = 4.03$, $p = .020$. When pairwise comparisons were examined, there was not a significant difference between the control group and the module ISR group, $p = .087$, or the textbook ISR group and module ISR group, $p = .623$. There was a significant difference between the control group and the textbook ISR group, though, $p = .008$, $d = .42$. This indicates that while students who did ISR from the textbook had similar outcomes regarding what they attributed their success to as those students who did ISR from the module, those who read from the textbook were substantially more likely to attribute their successes in reading to

their own ability than were those students in the control group. The means and standard deviations for the SAS success/ability dimension for three groups can be found below in table 16.

Table 16

SAS Success/Ability Dimension: Control vs. Textbook ISR vs. Module ISR

Condition	Mean	Std. Deviation	N
Control	3.84	.95	57
Text	4.18	.63	42
Module	4.30	.66	24
Total	4.05	.82	123

Because prior research has shown there to be a strong correlation between reading achievement and ability attributions (Marsh, 1984), it was necessary to explore this relationship as well. A Pearson product-moment correlation was conducted to determine whether a linear relationship existed between the students' SAS posttest success/ability scores and their Gates-MacGinitie posttest scores on the reading comprehension subsection, since that is the achievement area that showed the most change across the study. The correlation between students' reading attribution success/ability score and their actual reading comprehension ability at the end of the semester was in fact significant, $r(122) = .31$, $p = .002$. A similar analysis was then conducted to determine whether students' ending scores in total reading correlated with their success/ability attribution scores, and once again there was a significant correlation $r(122) = .28$, $p = .006$. This suggests that both the students' reading comprehension ability and their total reading achievement were moderately correlated with their tendency to attribute their reading success to their own ability. The higher the students' ending skill levels, the more likely they were to view their own ability favorably. While this dynamic seems intuitive, it is notable that this relationship cannot be attributed to students' confidence being

bolstered due to feedback on their achievement scores, because neither their Gates-MacGinitie scores nor their scores on the EOCT reading subsection were revealed to them. The means and standard deviations for the SAS success/ability dimensions and the Gates-MacGinitie reading comprehension and total reading scores used in the correlation analysis can be found below in tables 17 and 18.

Table 17

Pearson Correlation: SAS Success/Ability Dimension vs. Gates-MacGinitie Reading Comprehension Scores

Measure	Mean	Std. Deviation	N
SAS Success/Ability	4.04	.82	124
Gates-Mac Reading Comp	555.91	21.78	107

Table 18

Pearson Correlation: SAS Success/Ability Dimension vs. Gates-MacGinitie Total Reading Scores

Measure	Mean	Std. Deviation	N
SAS Success/Ability	4.04	.82	124
Gates-Mac Reading Comp	555.11	20.34	105

Discussion

The central question of the study was whether in-class independent silent reading could positively impact students' global reading ability and its component parts, a question the National Reading Panel acknowledged had not yet been answered (NICHHD, 2000). When examining the change in reading achievement of the combined ISR groups, it was clear that the ISR group did indeed improve their overall reading ability to a greater extent than did the students in the control group. This suggests that teachers can help students to significantly improve their reading ability simply by having

them read independently in class for an hour each week and ensuring that all students follow through with that reading. These findings meet the rigorous methodological criteria of the NRP (NICHHD, 2000) and appear to support the contentions of researchers such as Krashen, (2000), Marzano (2004), and Pilgreen (2000), who argue for the efficacy of ISR. While the effect sizes were not large, it must be noted that the students' gains were achieved after just 14 hour-long interventions over five months, and researchers such as Marzano and Pilgreen advocate at least three years of consistent ISR practice. It is likely that effect sizes would increase if the program was continued across a number of years or if more ISR time were incorporated into the week.

Despite the modest effect sizes, the practical results in terms of grade equivalency were profound. Bare in mind that students are expected to gain one grade level in one school year for every year they are in school. On both total reading ability and reading comprehension, the control group made gains that are consistent with what would be expected under normal circumstances; they gained approximately half a grade level in half a school year, which would have been just over one grade level when extrapolated over the full school year. In contrast, on the same measures, both the textbook ISR and module ISR groups gained more than twice as much as the control group in terms of grade equivalency level. If the program were to be extended to a full year and students in the treatment groups continued to gain at the same pace they did in this study, each group would gain at least three grade levels in both total reading ability and reading comprehension, achievement that would be at a pace three times the rate that would be expected in one school year. For reading, a construct that has proven to be very difficult to affect under any circumstances, these results must be viewed as relatively striking.

The results also provide further indirect evidence that students are not reading enough sufficiently challenging material on a regular basis, just as Goodlad (1984) and Moss (2005) had previously observed. Had the students in this study been reading ample amounts of grade level material outside of class, it is highly unlikely that 14 one-hour reading sessions would have produced any measurable change at all. The fact that it did appear to have a substantial impact would suggest that the students were doing little to improve their reading skills either outside of class or in other content classes.

It was also clear that the ISR method did not have any appreciable effect on global vocabulary regardless of whether the reading was done via a traditional textbook format or the computer module format, which appears to contradict the conclusions of Joshi (2005), who found vocabulary development to be related to reading amount. This is somewhat puzzling for a number of reasons. First, it has been well documented that reading comprehension and vocabulary levels are related (Alfassi, 2004; Beck, Perfetti, & McKeown, 1982; Connor, Morrison, & Petrella, 2004; Cromley & Azevedo, 2007; Leone et al., 2005; Nelson & Stage, 2007; Ouellette, 2006), and growth in either area can produce a reciprocal effect. Also, the reading modules were constructed specifically to help students address shortcomings in vocabulary with a built in, interactive vocabulary function. There are several possible explanations for the lack of change in students' vocabulary skills in this study. The most obvious and most likely one is that the ISR method simply does not work well for vocabulary development because it does not provide enough specific support for individual word meaning. Another likely explanation may be that there was a fragmented relationship between the vocabulary measured on the Gates-MacGinitie reading test and the vocabulary that students encountered in the

literature during their weekly readings. The students in the ISR group may have indeed increased their vocabulary within the context of American literature, but those gains may not have been captured by the more generalized Gates-MacGinitie assessment. Finally, the five month semester may not have provided enough time for the reciprocal effect to occur. At this point it is still unclear whether reading comprehension and vocabulary skills affect each other simultaneously or whether there is a lapse in time with one developing more extensively before the other.

Among the strongest findings in the study is that ISR appeared to stimulate substantial measurable gains in reading comprehension. This was apparent from several findings: Because the ISR group showed significant gains in total reading ability but no gains in vocabulary, it suggests that the gains had to be entirely derived from the other component that contributes to total reading ability, reading comprehension. Indeed, when reading comprehension was examined in isolation while accounting for initial reading comprehension levels, the gains shown by the ISR group were more pronounced. When reading comprehension was analyzed while controlling for initial total reading ability, as opposed to just reading comprehension, the differences were even greater. This suggests that the ISR interventions not only targeted reading comprehension very specifically, but that the growth that was stimulated in the area was enough to boost overall reading ability even in the absence of any measurable change in vocabulary. The findings that the increased reading amount experienced by the treatment groups was related to gains in comprehension underscore previous findings reported by researchers such as Cunningham and Stanovich (1997), Guthrie, et al. (1999), and Hasselbring and Goin (2004).

As further evidence for the efficacy of the method, the results on the American literature EOCT closely mirrored those suggested by the various Gates-MacGinitie measurements. According to the EOCT metric, students who took part in ISR outperformed those in the control condition on the reading subsection of the test after either initial reading comprehension or initial total reading ability levels were controlled for statistically. The findings from this particular analysis add an important detail, though, in that they suggest that the growth in reading skills that were revealed on the Gates-MacGinitie reading test also generalized to a high stakes assessment. This appears to be strong verification of the robustness of the effects of the ISR intervention and supports the contentions of Moss (2005), who asserted that ISR time is related to gains in achievement. Since the EOCT comprised 15% of the students' total grade for this required course, the gains the treatment groups realized are evidence of practical, real-world enhancement of the skills that are essential to their success in high school and which help them meet the educational criteria set by the state. The convergence of evidence based on these varied measurements suggests a strong relationship exists between students taking part in hour-long in-class ISR on a weekly basis and significant gains in reading comprehension ability, as well as in total reading ability.

The findings in regard to the effectiveness of the computer reading module and the associated scaffolding tools were somewhat less pronounced but promising nonetheless. The analyses consistently showed that there was no difference in academic achievement between the textbook ISR group and the module ISR group. They performed very similarly in almost every respect. While at times the various analyses showed significant differences between the textbook ISR group and the control group,

with the difference between the module ISR group and the control group falling just outside the threshold for statistical significance, it is likely that this slight discrepancy was due to the overall smaller sample size of the module ISR group. Due to limitations to computer access within the school and other factors beyond the control of the researchers, such as students dropping out or transferring from the module ISR classes, the sample size was reduced to only 24 students on most of the academic measures. Even so, their gains in performance were very similar to the gains the students in the textbook ISR classes showed. However, their gains on the global academic measures did not outpace those of the textbook ISR group, suggesting that it was the ISR that stimulated growth and not the scaffolding tools built into the modules. From this we must conclude that this particular computer format did not extend any benefits to global reading comprehension beyond those that the textbook format provided. In practical terms, this is a reassuring finding for school districts because it indicates that the ISR method can positively affect students' academic skills without the cost to the schools of additional instructional technology; gains can be accomplished with the books on hand.

There was, however, an important academic outcome that the module ISR group benefited from. The computer reading package, with its various cognitive tools, did appear to help students to better understand each specific assignment they read, as the module ISR group showed the strongest performance on all of the internal reading assessments that gauged how well students comprehended the weekly reading passages. These results mirror those of Magliano, et al. (2005) and Salmeron, Kintsch, and Fajardo (2005), who found that technological scaffolding could assist students with their comprehension of reading tasks at hand. But the module ISR group's improved

comprehension on individual assignments did not clearly generalize to other more global measures such as the Gates-MacGinitie reading test or the EOCT. Instead, the benefits appeared to be more localized. However, the module's apparent ability to help the students to learn the material at hand is a valuable educational outcome in itself.

Another significant outcome emerged from the module ISR group. While none of the groups showed any change in overall reading motivation on the MRQ, the students who read from the computer module showed a significant and pronounced increase in reading motivation based on the AMRS when compared to the control group and the textbook ISR group. Indeed, the module ISR group's increase in motivation was largely responsible for the difference the combined ISR group showed in contrast to the control group. So the question begs to be asked, why did motivation not appear to change according to the MRQ, but did appear to change drastically according to the AMRS? As noted earlier, the MRQ tends to measure self-concept in regard to reading, while the AMRS tends to measure attitudes *about* reading without putting as much emphasis on identity. It is likely that attitudes about reading will change prior to how students perceive themselves as readers. For instance, a student will probably decide she is beginning to enjoy reading, seeing the task in a more positive light, before she begins to identify herself as someone who is "a reader". In this way, motivation as measured by the AMRS may be a precursor to that measured by the MRQ because self-concept is likely to change much more slowly, and the five month semester may not have been long enough to affect self-concept. It can also be argued that the results of the AMRS, which was developed for adults, are more relevant to secondary students than are those of the MRQ, which was developed for children. High school students are leaving childhood and entering

adulthood, so their dispositions from an adult perspective will become increasingly pertinent as they age. Regardless, the results in regard to the change in reading motivation experienced by the students who did their ISR from the module are promising and are consistent with the findings of Howard, Ellis, and Rasmussen (2004) and Liu and Bera (2005), who argued that technology could be used to enhance academic motivation in modern students. It had been predicted that the module ISR group would show gains in academic skills beyond those of the textbook ISR group, which they only did on individual assignments, not in global ability, but they did meet the prediction that they would experience the greatest growth in reading motivation, a very powerful construct in learning.

The SAS provided the final measure of student disposition, and the results paralleled those of most of the other analyses. In terms of what the students attributed their success in reading to, the students in the combined ISR group were more likely to attribute their success to their own ability than were those in the control group. So it appears that as students took part in ISR, their confidence in their ability to read and be successful in the endeavor grew substantially more than did those students who did not participate in ISR. As with other analyses here, the textbook ISR group's confidence in their ability to succeed met the test for statistical significance when compared to the control group, while the module ISR group again fell just outside it when examined in isolation. This slight difference may reflect a belief on the part of the module group that the computer, with its cognitive tools and scaffolding devices, may have been partially contributing to their success, whereas the textbook ISR group had no such benefit. It is

worthwhile to note, however, that on this measure the two treatment groups did not differ significantly from each other.

The SAS was analyzed for another relationship, the correlation between students' actual academic achievement and their attributions regarding whether their own ability was responsible for their academic success. A strong positive correlation between the two has been noted in prior literature (Marsh, 1984). In the present study there was a moderate correlation between students' success/ability attributions with both reading comprehension skill and overall reading ability. Students who finished the semester with the highest skill levels in both areas were more likely to attribute their success to their own ability rather than to causes such as external forces or enhanced effort. However, students were not privy to the results of either the Gates-MacGinitie reading test or the reading subsection of the EOCT, so their confidence in their own ability cannot be attributed to a reaction to receiving feedback on their high skill levels. The unit tests and course grades that are ubiquitous in their classes are more often a reflection of students' memory of course content and provide little to no evaluation of reading ability. This would suggest that the enhanced confidence shown by students who participated in ISR had a deeper, internal origin, rather than being derived via external influences such as grades. One possible explanation for the increase in students' tendency to attribute their success to their own inherent ability is that as they improved in reading ability their development was accompanied by increased metacognition and metacomprehension. It is certainly plausible that metacognition and metacomprehension are an essential link between achievement and attribution, and this is a relationship worth investigating in future research.

Limitations

While it was clear that the students in both ISR groups showed benefits in a variety of areas, from global reading comprehension to high stakes assessments to motivation and attribution, because this study was designed within the context of applied research and design-based research, certain specifics cannot be extrapolated from the results. Most notably, the findings indicate that one-hour of weekly ISR can provide substantial benefits to students in terms of stimulating reading comprehension. However, we cannot parse out the contribution that having students answer the reading comprehension questions may have had on their gains. The reading comprehension questions served two purposes: first, to provide an assessment component to ensure that all students followed through with their reading, and second, to possibly stimulate metacognition and in turn metacomprehension. It is unclear whether students would indeed have completed the readings without the adjunct questions or if the questions contributed to the students' gains beyond what they would have experienced by simply reading for the hour. We do not know if the adjunct questions are a necessary component to realize the gains seen here or if reading alone can lead to similar results. The design of the study could not account for this possible variance.

Next, while there appeared to be no discernable change in vocabulary ability between groups in the study and we must accept this finding at face value, there is a question as to how closely aligned the Gates-MacGinitie vocabulary subsection was to the actual texts the students were reading on a weekly basis. The students may very well have increased their vocabulary on text-specific words, but evidently their global vocabulary did not change as a function of the interventions. In future studies it would be worthwhile to

measure vocabulary that is specific to the reading passages in order to discern whether the ISR method can in fact have any impact on text-specific vocabulary. Based on these results we certainly cannot conclude that it does, but given the reciprocal effect of reading comprehension and vocabulary and the clear change in reading comprehension measured in this study, there may be more nuanced relationships to explore in this regard.

Finally, it was regrettable that the sample size of the module ISR group was so small, numbering only 24 students by the end of the semester. But because of the limited availability of the school computer labs and other factors beyond the control of the researchers, the final size of this group was less than optimal. While there is no indication that the module ISR group would have outperformed the textbook ISR group academically with a greater sample size, it is likely that the differences between the module ISR group and the control group would have been more pronounced since the module ISR group's performance mirrored that of the textbook ISR group so closely. It would be worthwhile to replicate the process in an environment where there is not such a high premium on the access to instructional technology.

Future Research and Implications

While the racial background of the students was not a main focus of the study, it is worth noting that the students in the sample were predominantly African American. Due to this dynamic, this study provides evidence that the ISR method can be successful in promoting literacy skills in a minority population from a predominantly working class socioeconomic background. It is likely that the success shown by the students in this study could be replicated by Anglo, Asian, and Hispanic students if they were to be provided with an identical intervention. However, if students already have high levels in

reading comprehension and are accustomed to doing extensive reading at home, as may be the case for students from more affluent environments, in-class ISR time would likely have a less pronounced effect. For this reason it would be beneficial to test the method in other socioeconomic environments.

The effects of the module ISR treatments were somewhat inconclusive in this study. Students who read from the computer performed very similarly to the textbook ISR group in most respects, suggesting they received the same benefits as those who read from the textbook, but few additional benefits academically. However, those students from the module group showed a distinct increase in reading motivation above both the control group and the textbook group, and motivation is a powerful dynamic in academic success. The module intervention may be considered a success for this reason alone. However, future research could test more powerful or more elaborate technological packages that may produce additional benefits in academic achievement that go beyond those of traditional ISR while maintaining the motivational benefits of the package tested here. Also of interest is whether the benefits in learning that the module ISR group showed on individual assignments would generalize to global improvements in reading given more time or more interventions, considering the module ISR group only took part in nine computer-based interventions.

Public education in the U.S. is in dire need of research based methods that can address issues of literacy and reading comprehension in adolescents and young adults in secondary schools. Students' reading ability affects their ability to learn across all content areas and influences their success in post-secondary environments such as college and the workplace. Therefore, it can have a tremendous impact on students' chances for success

at life in general. Too often students leave high school with inadequate reading levels, and by extension limit their potential to thrive in society. The results of this study provide much needed evidence for one way to stimulate growth in reading for high school students. Because the results of the various measures in this study often converged and provided similar conclusions, the uniform findings suggest ISR has the potential to be incorporated into a broad range of classrooms and benefit a large number of students without the need for extensive additional funding or elaborate training. It is clear that students must read more challenging material on a more regular basis in order to stimulate the cognitive processes that will allow their reading skills to flourish. ISR may be one of the few ways that teachers can directly and consistently facilitate this process.

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APPENDIX A

Reading Passages

Passage	Author	Word Count	Flesch-Kincaid Grade Level
Narrative of the Captivity	Mary Rowlandson	3,128	8.4
*The Interesting Narrative of Olaudah Equiano***	Olaudah Equiano	4,801	9.3
The *Declaration of Independence***	Thomas Jefferson	1,704	12.0
The Devil & Tom Walker	Washington Irving	4,744	8.1
*Dr. Heidegger's Experiment***	Nathaniel Hawthorne	3,686	9.4
excerpts from *Nature* & *Self-Reliance*	Ralph Waldo Emerson	1,618	8.1
Resistance to Civil Government and other essays**	Henry David Thoreau, Mohandas Gandhi, Martin Luther King Jr.	3,948	9.0
*Narrative of the Life of Frederick Douglass***	Frederick Douglass	2,440	6.1
*An Occurrence at Owl Creek Bridge***	Ambrose Bierce	3,726	7.5
*The Lowest Animal***	Mark Twain	2,070	7.8
To Build a Fire	Jack London	7,096	6.7
*A Rose for Emily***	William Faulkner	3,702	7.7
*The Jilting of Granny Weatherall***	Katherine Anne Porter	3,894	5.3
*Everyday Use***	Alice Walker	3,588	4.7

**- denotes the passages that were converted to computer modules

Total mean word count = 3,582
Total mean reading level = 7.86

Module mean word count = 3,356
Module mean reading level = 7.9