

THE EFFECTS OF LITERACY INTERVENTION IN HIGH SCHOOL BIOLOGY

by

Christopher G. Monsour

A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2011

STATEMENT OF PERMISSION TO USE

In presenting this professional paper in partial fulfillment of the requirements for a master's degree at Montana State University, I agree that the MSSE Program shall make it available to borrowers under rules of the program.

Christopher G. Monsour

July 2011

TABLE OF CONTENTS

INTRODUCTION AND BACKGROUND1

 Background..... 1

 Focus Question..... 2

CONCEPTUAL FRAMEWORK2

METHODOLOGY7

DATA AND ANALYSIS14

INTERPRETATION AND CONCLUSION24

VALUE.....27

REFERENCES CITED.....30

APPENDICES33

 APPENDIX A: Informed Consent.....34

 APPENDIX B: Biology Reading Survey36

 APPENDIX C: Reading Anticipation Guide.....40

 APPENDIX D: Rate Reading Comprehension.....43

 APPENDIX E: Odyssey Annotation45

 APPENDIX F: Pre-Reading Organizer48

 APPENDIX G: Poverty Reading Annotation.....50

 APPENDIX H: Student Led Discussion.....52

 APPENDIX I: Metacognitive Reading Log54

 APPENDIX J: Stem Cell Annotation57

 APPENDIX K: Supplemental Reading.....59

 APPENDIX L: Supplemental Reading List.....61

 APPENDIX M: Reading Verification64

 APPENDIX N: Evaluation of Intervention.....66

 APPENDIX O: Change In Reading Level.....69

 APPENDIX P: Three Areas to Improve On71

 APPENDIX Q: Transcript from Final Interview73

LIST OF TABLES

1. Triangulation Matrix.....14

LIST OF FIGURES

1. Biology and Memorization	15
2. Study for Vocabulary	16
3. Reading Skills and Biology	17
4. Hurdles to Reading	18
5. Reading Intervention and Understanding	20
6. Change in Reading Level.....	22
7. Understanding of Biology Increased	23
8. More Likely to Read Science on My Own	24

ABSTRACT

In this investigation, issues of reading comprehension in high schools students were explored. Reading comprehension interventions such as metacognitive reading logs were administered with the goal of improving student literacy. Trade books, newspapers, and others types of media were used to differentiate instruction as part of intervention strategies. The results indicate that when students are given the opportunity to read outside of class, their ability to comprehend scientific information increases.

INTRODUCTION AND BACKGROUND

The purpose of the study was to investigate how students' opportunities to read and learn in science were related to development of skills in science and reading proficiency. The class that was selected for the study was advanced biology. Advanced biology taught at Tiffin Columbian High School, Ohio, is a rigorous course offered to ninth and tenth graders. There are currently 75 students in the class: 39 males and 36 females spread out over three periods. A majority of the students are classified as college preparatory, and the course is meant for students going into a math or science career. All of the students in the class are Caucasian and come from middle to upper class households. There are 972 students currently taking courses at Tiffin Columbian High School, Tiffin, Ohio, with 97% Caucasian and 3% being African American or Hispanic (<http://ilrc.ode.state.oh.us/Schools>).

Science and the communication skills of reading and writing are important aspects of the science classroom. I have recognized there is a need to make instruction meaningful and relevant to the real world of my students. I have found an array of trade books available today that can be used to introduce my students to the world in which they live and to teach reading skills and science content in a meaningful context. Having worked with students in the past who have limited reading ability, it has become clear that for students to be successful in science, they must be able to read, and more importantly, be able to comprehend the material found in science textbooks. As a school, some departments have addressed the issue of reading in the content area better than others. As a school though, there is no one uniform strategy. Unfortunately, there is little use of such strategies in the science classes at Tiffin Columbian High School. Some of the teachers use the texts only as a source of problems to use for assignments. Others assume their students have the ability to effectively read and comprehend the text

information without any prior instruction or modeling. What results, in my opinion, is an inability of the students to effectively gather information from a text and apply that information to new situations.

Concern about the reading ability of students led to the development of the primary focus questions. The first question was, what types of interventions can be created to improve the reading comprehension of students in science class and increase their knowledge base? The second was, if specific reading strategies were taught, will students demonstrate an increase in their comprehension of the reading assigned?

CONCEPTUAL FRAMEWORK

For centuries, the ability to read and write has given power to those who possessed it, although access to book learning is often limited to a privileged minority (Vincent, 2000). Today, by contrast, students live in a digital age in which written texts are more widely available than ever before.

One of the most commonly cited reasons for the level of illiterate youth is students simply do not have the literacy skills to keep up with the high school curriculum, which has become increasingly complex (Kamil, 2003; Snow & Biancarosa, 2003). In the era of Reading First and especially the No Child Left Behind Act of 2001, performing below grade level in reading and writing carries increasingly higher stakes for retention and ultimately withholding of high school diplomas (NCES, 2003).

Less than one-third of America's high school students read or write at grade level. Almost 7,000 students drop out of high school every school day (Alliance for Excellent Education, 2006). Among low-income students, fewer than one in six can read at grade level (Perie & Dion, 2005). In a typical high-poverty urban school, roughly half of incoming ninth-grade students read at a sixth- or seventh-grade level (Balfanz & Shaw,

2002). Creech and Hale (2006) describe a study in which 65% of incoming high school freshmen read below a sixth-grade level. Heller and Greenleaf (2007) make a sobering statement about the reading level of the nation's 8th and 12th graders when they state that millions of America's students in grades 4 through 12 are unable to read and write well enough to achieve academic success. The National Assessment of Education Progress indicates that more than two thirds of all eighth and 12th graders read at less than proficient level, and half of those students are so behind they drop off the scale entirely (Perie, Grigg & Dion, 2005; Grigg & Donahuet, 2007). Ippolito (2008) discusses how high school students who lack core-reading skills such as understanding and evaluation are at a disadvantage. Of greater importance is the effect of an illiterate population.

According to *America's Perfect Storm* (2007):

Current labor market trends, demographics, and student achievement data are combining to create a perfect storm that could inflict lasting damage upon the nation's economy and upon its social fabric, as well. Simply put, if the middle and high schools continue to churn out large numbers of students who lack the ability to read critically, write persuasively, and communicate effectively, then the labor market will soon be flooded with young people who have nothing to offer, and who cannot handle the jobs that are available. There will be tens of millions more adults, who lack the education and skills they will need to thrive in the new economy, raising the specter of joblessness and despair on a scale not seen since the Great Depression. If that future is to be avoided, the nation's secondary schools will have to begin immediately to help many more students to reach much higher levels of literacy than ever before. (p. 4)

Over the past decade there has been an effort to increase the literacy of students. Reading is an essential part of scientific literacy. Literacy is the ability to read and make sense of written symbols in a variety of settings and subject areas and then to be able to locate information, evaluate it critically, synthesize it and communicate it. Far too many students leave American secondary schools without the advanced literacy skills they need to succeed in higher education or to flourish in a knowledge-based economy (Biancarosa & Snow, 2006). When students graduate from high school, many do not have the knowledge or skills to tackle readings, tests, and papers at the next level (Bauerlein, 2011). More alarming is that some research has found that students engage in very little sustained reading. In schools, the reading is mainly from brief, teacher-created handouts and textbooks. In a 2006 report titled *Reading Between the Lines: What the ACT Reveals About College Readiness in Reading*, the ACT asserts, “The type of text students are exposed to in high school has a significant impact of their readiness for college-level reading” (p. 23). The more students are exposed to complex texts, the more they realize that they can’t complete their studies through “a single superficial reading” (p. 24).

Most content area teachers devote little, if any, class time to showing students, explicitly, what it means to be a good reader or writer in the given subject area. In schools, much of the reading to which students has access is in course textbooks, and most students engage in very little discussion of what they have read, how to write, or how to interpret, analyze, or otherwise respond to texts (Wade & Moje, 2000; Connors, 1997; Cuban, 1989; Hillocks, 1986). Studies have shown students are capable of reading most of the words in their textbooks and can memorize words and phrases for short-term purposes. Memorizing terms and learning for short-term does not indicate mastery of the subject nor does it indicate the students are literate in the subject (Clark, 2009).

The most difficult hurdle to literacy as defined above is for teachers to help students

connect with texts being read and viewed in class. Many times extra activities and in-class time may be used to try to get students to connect. With so much focus on high stakes testing and scores, many teachers are not doing the extra activities in the name of covering content (Miners & Pascopella, 2007).

David Donahue (2000) describes science readers as interactive information processors who switch between selective perceptions of texts and concurrent experiences such as experiments and discussions. He suggests that science reading should be as interactive as a lab experiment. So the challenge to teachers is to make reading an involved, active, and interactive exercise. This means science teachers need to use strategies in their classrooms that help students to read, to understand and most importantly, to connect to the science content (Matheny, 2009). Even though most science teachers are not reading experts, their teaching methodologies share at least one important characteristic. Effective reading and science teachers integrate the acquisition of skills with the understanding of content. Science teachers can build on this to help their students become more proficient readers (Improving Reading Skills, 2005).

It has been common practice for teachers to rely on traditional textbooks as means to relay or review information. When assigned the task of reading and taking notes from the textbook, many students skim the section and write down the bold faced words. Martin (2002) suggests that students do not take expository reading seriously. They skim over the text, ignoring the sidebars, and picture captions. Donovan and Smolkin (2001) explained that students have difficulties with textbooks because of the nature of the textbooks. There is too much information densely packed, too much assumed knowledge, and too much irrelevant information.

Along with the amount of information, Moss (1991) explained that textbooks are unappealing to students and often “fail to arouse student interest” (p. 27). Beyond the

problems of the texts themselves, Donovan and Smolkin (2001) discuss another limitation of traditional textbooks: one book and one grade. The use of single text per grade makes it difficult to differentiate instruction. Students come to class with a myriad of learning styles and textbooks do not always facilitate differentiated instruction.

Some make a good point that the movement to improve the quality of learning begins with freeing teachers and others to become facilitators of learning. Science teachers often lack the expertise and interest in teaching reading (Rogers & Frieberg, 1994). When instruction is planned around minimizing reading weaknesses however, students receive fewer opportunities for reading practice and support, and a critical science instructional tool goes unused (Improving Reading Skills, 2005). Teachers of science may not be trained to teach reading in the content area and therefore avoid it. By providing professional development and classes on how to incorporate reading, learning can improve.

To address the problem, teachers first need to identify the areas of weakness in students in the science classroom. Vocabulary, detailed concepts and relationships, and multi step processes and cycles are identified as the three areas in which students struggle (Improving Reading Skills, 2005). By using techniques to tackle the weaknesses in reading comprehension, teachers then can incorporate reading into the classroom. By incorporating books into class activities or to extend investigations, students will develop advanced literacy skills. Guensberg (2006) further reinforces this concept when she states, “basic literacy no longer suffices. In higher education and the workplace, young people must handle an array of complex texts -- narratives, repair manuals, scholarly journals, maps, graphics, and more -- across technologies. They need to evaluate, synthesize, and communicate effectively” (para.1).

If the nation's students are to go beyond the basics of literacy, then secondary science teachers must acknowledge they are more than teachers of facts, figures, dates, and procedures. Science teachers must teach their students to read and write and communicate like scientists and educated members of society. Educators must figure out how to ensure every student gets beyond basic literacy skills to the more challenging literacy of secondary school years. “This will require teaching students new literacy skills: how to read purposefully, select materials that are of interest, learn from those materials, figure out the meanings of unfamiliar words, integrate new information with information previously known, resolve conflicting content in different texts, differentiate fact from opinion, and recognize the perspective of the writer—in short, they must be taught how to comprehend” (Biancarosa & Snow, 2006, p. 1).

METHODOLOGY

My project was based on the action research model. It spanned four biology units that occurred between late September 2010 and early January 2011. These units included concepts in nutrient cycling, cellular biology, metabolism, and genetics. The project focused on the use of contemporary scientific literature (textbook alternatives) to investigate how students' opportunities to read and learn in science are related to reading proficiency.

As found in the literature review, science textbooks can be overwhelming for students to read and comprehend due to the amount of new vocabulary. Textbooks cover many topics that often leave students memorizing facts and figures with little comprehension of the topics. The lack of comprehension and sufficient understanding of material leaves students lacking conceptual understanding that is necessary to become scientifically literate citizens. Students do not understand why they are learning the

science content and find little relevance to the material they are learning. However, if students can find personal connections, like those found in materials other than textbooks, then they are more likely to become interested in science and closer to becoming scientifically literate. There is an array of trade book and other alternatives available today. Teachers can use trade books to introduce students to the world in which they live and teach both reading skills and science in a meaningful context.

There had been discussion at previous staff meetings and professional developments that addressed the need to improve reading in the content area and the plan for my project was discussed with the staff. Once the purpose and the plan for suggested action research was discussed, Mr. Anyway, the high school principal, decided that a blanket Informed Consent form would suffice for the project (Appendix A).

The pre-treatment phase began in late September with the administration of the Reading Interest Survey to determine the types of literature students read and the amount of time students spend reading (Appendix B). The survey was given before the pre-treatment phase, and the data analyzed to look for the most common response to questions. This information gave some insight into attitudes and beliefs students had about reading in the science classroom and the amount of time spent reading for both pleasure and school. This survey also gave insight into what type of material the students were reading and aided in the selection of materials to be used in class. The data from the survey was broken up into common themes, and then percents of response were calculated. These percents were then plotted as a bar graph for use during analysis.

During late September, I began to read passages from the text aloud to the students in hopes that it would improve students' reading skills. I thought hearing the text while looking at it on a page would help my students process the information more effectively. This was utilized in three ways in the class. The configurations included

students reading to a small group of students, students reading to the whole class, and the teacher reading to the students. The students were not forced to read aloud, but were invited to read and to my surprise many students did volunteer to read. While the students read to the whole class, I would make note of words that were mispronounced and phrases students stumbled over. During the reading aloud, I would stop the class and make predictions about what would happen or how it related to what was being discussed. At the end of the reading I would then go back to the list of words I created and as a class we would discuss the meanings. The texts read included the textbook, contemporary magazines and the newspaper. The challenge here was finding the time to make room for these different types of text in the curriculum.

The treatment phase began with the use of a Reading Anticipation Guide (Appendix C). The anticipation guide was used during the discussion of ecological principles and biomagnification of chemicals in the environment. Biomagnification was one of the topics that have been recognized as being difficult for students to understand. Students were given an excerpt from Rachel Carson's book *Silent Spring*. Reading Anticipation Guides were completed because I wanted to develop students' analytical reading skills, develop students' awareness of interactive reading strategies and finally to develop students' abilities to respond to texts they read.

I formed a series of three generalized statements related to the passage of text the students read. I chose the statements from the beginning, middle and end of the text. Prior to reading, the students were asked to consider each generalization and use The Reading Anticipation Guide to indicate their level of agreement or disagreement with the generalization. As students read the passage, they took their own notes on the issues presented by the generalizations I generated. After reading, the students evaluated their original marks to determine if their level of agreement or disagreement had changed. We

then discussed why the levels changed. I collected the students' work after they had a chance to evaluate themselves and looked for two things. One, what was their original level of agreement and two, what was the subsequent agreement level after reading.

Another part of the treatment phase occurred when students were learning about the nitrogen cycle. As with biomagnification, the nitrogen cycle had been identified as one of the topics in biology that many students struggle with due to its abstract concepts. I know this because I have taught the cycle for the past 12 years and just felt the students did not get it. A short story by Aldo Leopold titled *Odyssey* was selected for the students to read because it addresses the voyage of two molecules X and Y, which represent nitrogen. Students were given the Rate Your Reading Comprehension instrument (Appendix D). As the students read, they were told to underline any word or phrase they did not understand using a specific color or pattern. When the students were finished reading, the students gave themselves a comprehension score of 1-10, 10 meaning they understood the reading completely. The students then read the piece a second time and underlined what they still did not understand with a different color or pattern. Again the students evaluated the extent of their understanding using a scale of 1-10. During the third reading, the students again underlined the words with yet a different color or pattern and evaluated their comprehension. The students were then directed to write down one question about the text and a question about one aspect of the text they still did not understand. At the end of the activity I had the students break up into small groups and answer each other's questions. When the small groups were finished, the small groups met as a whole class and had a large group discussion that began with those questions that were still unable to be answered.

Once the group discussion was over, I collected the students' work and looked for changes in reading level from their original reading to the third reading and looked for

changes in the level of understanding. I also read through the students' questions to look for misunderstandings and misconceptions they still had.

Students were given a Pre-Reading Organizer (Appendix F) as an introduction to the unit on population and population growth. Students were given an article about the rising tide of poverty around the globe and a set of vocabulary terms to look over. Students were asked to classify the vocabulary into seven groups. The groups included people, places, events, objects, problems, outcomes, and unknown words. Once the students classified the terms they then developed an anticipatory statement of what they thought the article would be about. I encouraged my students to use their own words.

After reading the article, students completed a metacognitive response to the article read and these were then discussed as a class. I collected both the Pre-Reading Organizer and metacognitive reading log. From the Pre-Reading Log, I looked for the most common unknown word students selected and I also looked over the anticipatory statements to see if the students truly understood what the article was about. I used the metacognitive reading log to get an idea of what students still had misconceptions about.

An important part of increasing students' ability to comprehend is for students to have the ability to discuss questions they develop from their readings. This treatment was based on the Socratic method of teaching. Students were given opportunity to examine a common piece of text, and after reading the students created open-ended questions, which were discussed in a large group setting.

The common piece of text I chose was an article that discussed outbreaks of Cholera in Haiti after a major earthquake that occurred in January of 2010. The students were provided with the article and then students posed three questions on the Student Led Discussion Sheet (Appendix H). Students posed questions about who, what, when, and where in nature. I also encouraged students to come up with how and why questions.

The treatment encouraged students to pose statements that would elicit conversation that required students to explain or defend a point of view while hearing other perspectives on the text. Once the students had read the article, we spent a period discussing the questions they raised from the article and the outbreak of Cholera in Haiti. When I collected the students' responses, I looked for the type of questions they posed. I wanted to see if the students were asking questions that required a higher level of contextual understanding.

The Metacognitive Reading Logs (Appendix I) were used to help students explore reading from popular science magazines, such as *Discover*. This treatment was used as a probe before the unit over cell biology. I wanted to determine what students knew about stem cells and the controversy surrounding stem cell use in research. Students were given an article that discussed the research and use of stem cells. I chose this particular topic because there were many questions about stem cells brought up in class and even more misconceptions. As the students completed the reading, they filled in the Metacognitive Reading Logs. The students were required to respond to several metacognitive prompts that explored their thoughts about the reading. For example I had the students complete statements about what confused them or what made them stop and think as they read the piece. The reading log also had students create their own questions that were shared in class. Finally, students were asked to create a list of vocabulary from the reading that was unfamiliar. Once the vocabulary was selected, students then had to come up with a meaning from the reading, and then create a visual representation of the word. As a class, we discussed the reading logs, and I had some students place their drawings on the board to help further explain their rationale. I looked over the students' vocabulary lists to see if there were words that appeared more often.

The post-treatment phase had the students select a novel of choice that dealt with any topic that may be covered in science class. The Supplemental Reading (Appendix

K) was assigned at the end of November so that the students would have time to read. Many of the books came from a classroom library I created over the past two years and stocked with books that I read or were suggested by previous students. The goal of the independent reading was to provide students with an excellent means of integrating all of the different texts and treatments completed in class into their reading experience.

The students were presented with a list of books to choose from (Appendix L), rated as easy, medium, and hard. The key here was that the students had the choice in book selection. Students were also given the choice of answering questions or creating their own study guides for the books. I kept the number of questions to twenty for each book. To ensure that parents were involved in the process, a Reading Verification Form (Appendix M) was completed. This ensured the student completed the reading and encouraged discussion about the book at home.

Over the course of the post-treatment phase, students met with me to conference about how their reading was going and to address any concerns they had. I requested that the students meet at least three times to discuss the book. Daily in class, students were asked as a group how the reading was going and several interesting discussions came up because of the reading. I had students make notes over the book and during the conference I would clear up misconceptions and explore what new knowledge the student gained. This time also allowed the students to reflect on the reading. I looked over the students' notes and created transcripts of interviews about the books to find some common issues or concerns the students' had during the reading process.

At the conclusion of the post-treatment phase, students were given the Evaluation of Intervention Survey (Appendix N) to determine if reading levels increased in the students, their views on how the treatments impacted learning, and how they could improve as readers. I took data from the final survey and looked for common themes,

converted the data into percents and created several bar graphs to use for analysis. The data collected from survey allowed me to clarify my students' attitudes and capabilities as readers after the treatment and to see if there was any change. The survey also provided a powerful opportunity for me to have discussions with my students.

This and other data sources described above are summarized in Table 1 below. Together they provide triangulated data for my primary questions and secondary questions regarding reading and comprehension in the science classroom.

Table 1
Triangulation Matrix

	Data Source 1	Data Source 2	Data Source 3
<i>Primary Question:</i> 1. Can the use of trade books in the science classroom improve science literacy in students?	Instructor observations and survey responses.	Interviews	Metacognitive reading logs and students' written responses
<i>Secondary Questions:</i>			
2. Will reading other texts increase student interest in biology?	Pre-surveys Reading Logs	Interviews	Post survey and students written response to book reading.
3. Will readings increase students understanding of content?	Pre-surveys Reading logs	Interviews	Post surveys and reflections
4. Will students reading abilities improve as a result of reading interventions?	Instructor observations	Interviews	Post surveys and reflections

DATA AND ANALYSIS

The Biology and Personal Experience Survey was used to establish a baseline of student opinions regarding the importance of reading and communicating as it relates to biology (Appendix A). Seventy-two percent of the students surveyed agreed that it was important to be able to read and communicate effectively in biology ($N=75$). Eight

percent of the students who disagreed could not justify the reasoning for disagreeing.

One student indicated, “I really didn’t understand what you meant by a personal experience.” The 21% who indicated they were neutral had similar reasoning that they did not understand what was meant by personal experience.

The results of the Biology and Memorization Survey indicated that 42% of the respondents thought that memorization was not the best way to learn biology on the pre-survey, with an increase to 60% on the post-survey (Appendix B). The pre-survey indicated that 21% strongly agreed that memorization of facts was how one learned biology compared to 0% in the post-survey (Figure 1). When asked why the view changed, one student remarked, “Once you started making the tests more short answer and essay, they got harder because I had to know more than a vocab word to get by.” Another student said, “Once we started doing more reading in class, your tests got tougher and me memorizing the terms was not gonna get me an A.” One student said, “It won’t work in your class anymore, but I can get away with it in my other ones.” When I further asked the student to clarify this statement about other classes, he said, “That’s all I have to do to pass the test.” As indicated from the pre-survey, 20% of the students indicated they were neutral on the topic, which decreased to 16% post-survey. When I questioned the reason for the neutral response, one student said, “I never really thought about it.”

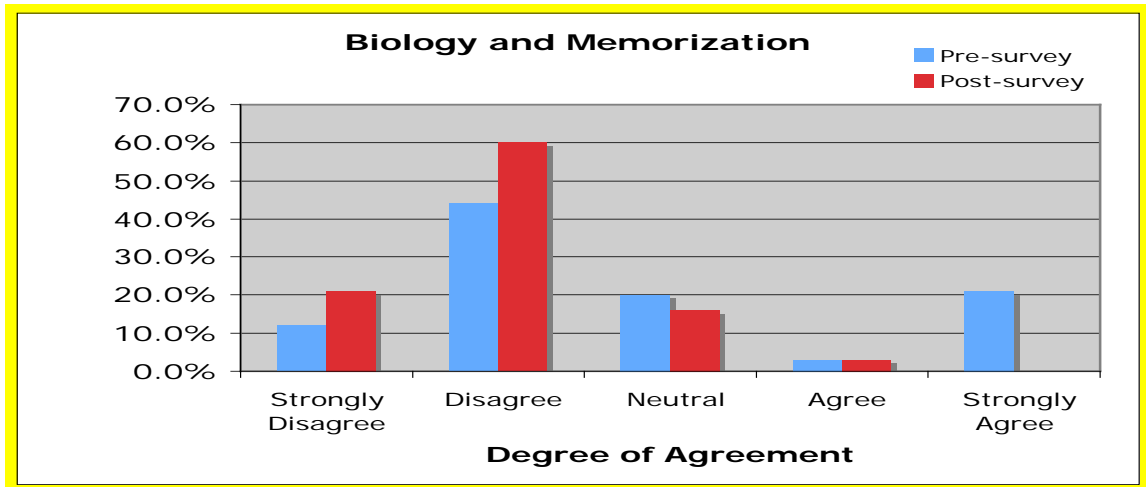


Figure 1. Student responses to the statement that to understand biology they only need to memorize facts and definitions, ($N=75$).

One of the Biology Reading Survey questions asked the students to indicate how they study for vocabulary quizzes. Over the course of teaching, many students have remarked that the amount of new vocabulary they learn in biology can be overwhelming. When surveyed about how they learn new vocabulary, 88% of my students indicated that context clues were used to figure out the definition of a word on a quiz. When surveyed about the use of note cards, 29% indicated that they use note cards to study (Figure 2). The quiz data revealed that students who used note cards scored much better than those who used context clues.

The survey also asked students about their use of vocabulary. When surveyed about use of vocabulary, 63% of the students indicated that they did use the vocabulary outside of the classroom (Figure 2).

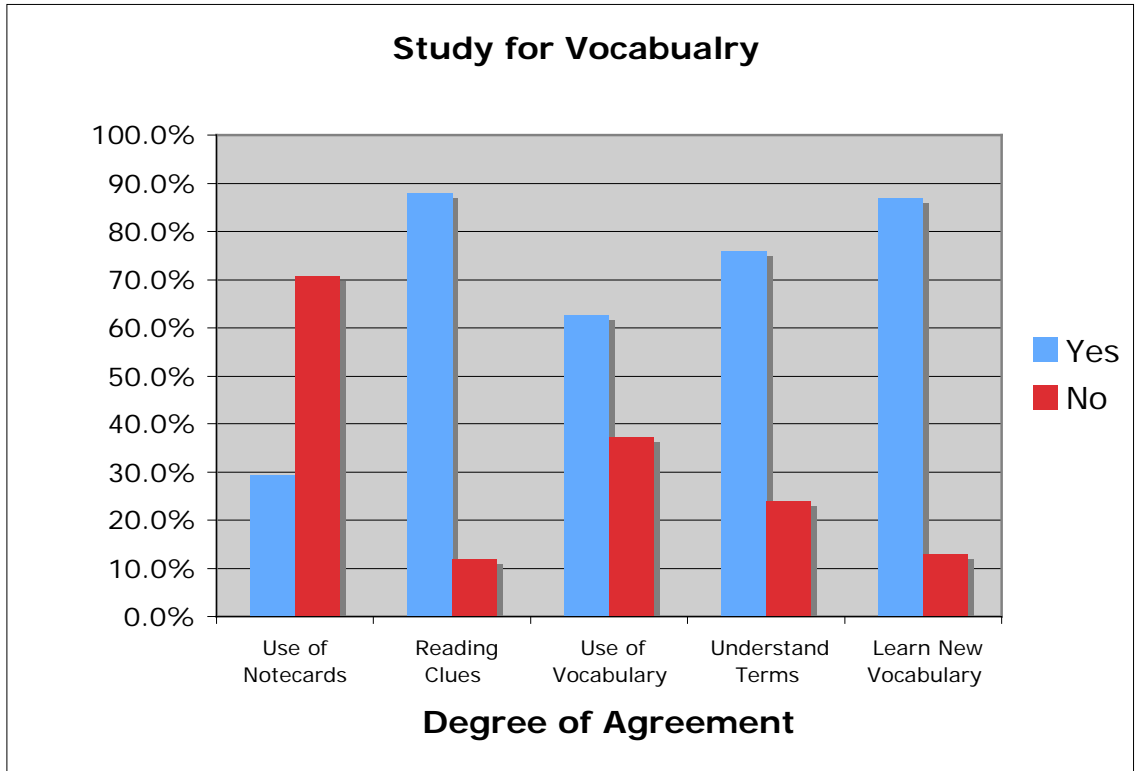


Figure 2. Student responses to questions about vocabulary and how they practice for vocabulary, ($N=75$).

One of the Biology Reading Survey questions asked the students about the reading assigned in class. I require my students to read and take their own notes over sections from the textbook. I found that when asked questions from the reading, many students cannot answer higher-level questions because they skimmed the reading and looked for the answers. When I encouraged my students to read over the section several times, I found they didn't actually do this.

The results of the Vocabulary Usage Question from the survey indicated that 56% of my students strongly agreed that reading skills were important for understanding biology (Figure 3). Furthermore, 32% indicated that they agreed that reading skills were important to understand biology. I asked some of the students why reading was important and one student stated, "By having me read and do my own notes, I have a better idea of what is going on when you start discussion." The data indicated that I had

12% that were neutral on the topic, which converts into nine out of my seventy-five students (Figure 3). I asked one of my students during an interview why he felt neutral and made the remark, “it’s just homework, I skim and get most of the answers.”

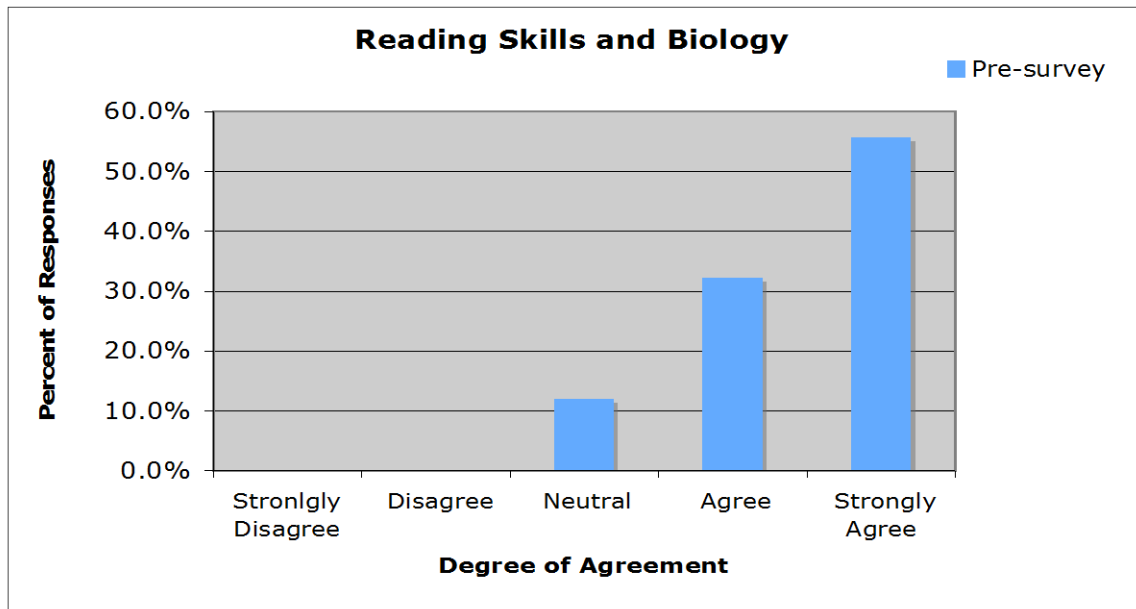


Figure 3. Student responses to the importance of reading skills in biology, ($N=75$).

To explore the issue of why my students were reading but were not comprehending the concepts, I asked my students to indicate some of the hurdles to reading. The Hurdles to Reading question indicated that distractions were the most common at 37% (Figure 4). When I asked some of the students about the distractions, cell phones, the Internet and television were the top culprits.

The other hurdle to reading was the lack of interest. When surveyed, 31% of students indicated that a lack of interest was a hurdle (Figure 4). On many occasions, students indicated that the textbook was not interesting to read and many of the interviews indicated that the terminology used was difficult. One student during an interview stated about textbooks, “they’re too cut and dry and use examples and stuff that I can’t relate too.” Another student indicated, “I think they’re boring cuz they don’t use any excitement and they use words I don’t understand.”

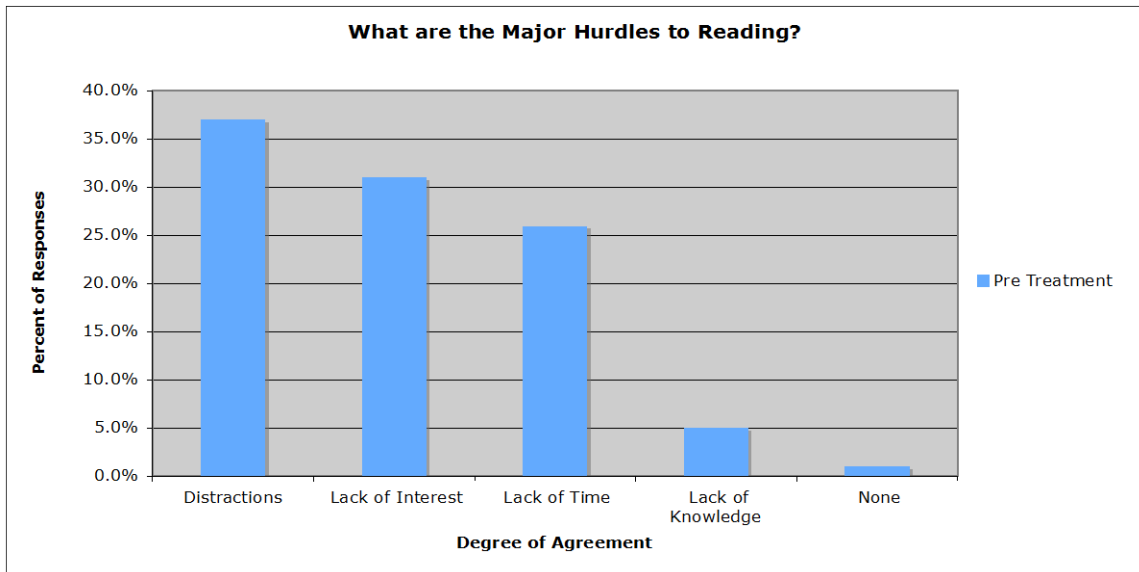


Figure 4. Student responses to several questions about hurdles to reading, ($N=75$).

After analyzing the data I had collected from the pre-surveys, I conducted several types of reading interventions to improve comprehension of the texts. The first intervention was a reading comprehension activity. The results of the Reading Intervention and Understanding Survey indicated that 80% of the students felt that the two readings helped to better understand the concepts (Figure 5). In terms of *Silent Spring*, 49% of the students agreed and 31% strongly agreed that the reading helped them to better understand the concept of bioaccumulation. The second reading, *The Odyssey*, by Aldo Leopold, was used to help students with some of the more difficult concepts of the nitrogen cycle. As indicated, 65% of students surveyed indicated the reading helped with understanding and 16% strongly agreed the *Odyssey* activity improved understanding of the concepts (Figure 5).

I selected at random, students' comments and found a common theme. After reading the passage several times, students were able to understand what the passage was about. The key was that the students read the passage several times in a short amount of time, not once like many had indicated that they have done in the past. One student

stated, “the first time I read this passage I didn’t really understand any of it. After reading it a second time, I was more focused and thought about it differently. By the third time, I think I understand what the passage was about.” Another student stated, “The passage was hard to understand. It used many words unfamiliar to me. After reading it a second and third time, I could guess what some of the words meant by using context clues. After reading it three times I think I understand the passage a lot more.”

Those students who read the passage as directed were able to successfully describe the nitrogen cycle and were able to trace the pathway of X and Y through the environment. An example of a student response that shows understanding is as follows:

Aldo Leopold’s passage is about how pollution has affected the environment and how people have built dams and terraces to keep pollution from running off. It explores how pollution is carried into plants and then when animals eat the plants they too are effected by the pollution and some eventually die.

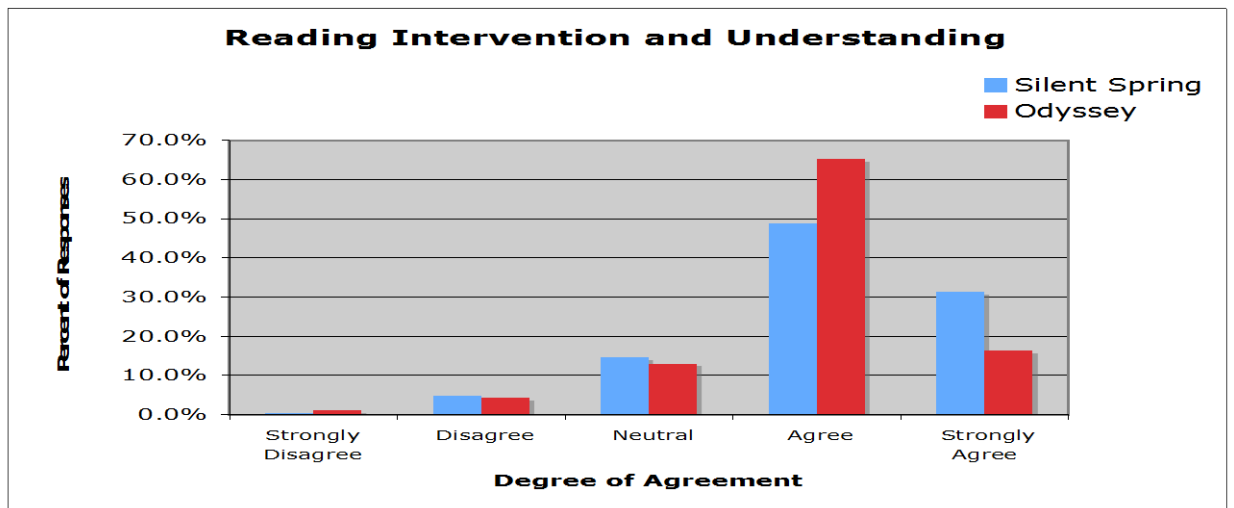


Figure 5. Student responses to the use of specific reading materials, (N=75).

When one student was asked about the relevancy of the material selected for the nitrogen cycle unit, he stated, “for the most part, I think the readings were relevant. Some of them like the nitrogen cycle not so much. I really don’t walk around thinking

about the nitrogen cycle.” When I further asked for some clarification about the importance of reading about the nitrogen cycle the student went on to say, “Yea, yea, I understand why it is important and I have a better understanding of how chemicals move. I don’t think if I would not have read it, I would have understood the process.”

After the stem cell intervention, the students completed the Metacognitive Reading Log and the results revealed that the students had a better understanding of what stems cells were and their use in science. One student stated, “this piece gives me a lot of information that I had no idea of. It was a little difficult to understand, but I comprehend a lot more than I would have a month and a half ago.” Another stated, “I thought this article was very interesting to read. It kept me entertained and I followed along with most of it because I liked it. It was kind of confusing though. It’s pretty neat to see the things doctors had to do or had to look into to figure out things.” Finally, one student said, “I was impressed how much of our technology and improved research has helped with stem cell research. Also how they can use rats and mice to test stem cell research.”

The culmination of the treatment was the students selecting their own book to read. When asked if their reading level changed, the results of the Change in Reading Level Survey, 86% of the students indicated that their reading level increased due to the reading interventions, whereas 11% indicated no change in reading level (Figure 6). One student said, “I’d like to think I improved in my reading skills even though I’m already a good reader. Being exposed to more of the science and factual literature widened my literary capabilities and allowed me to be exposed to something I don’t normally read.” Another student stated that “I believe it is because when you have us read, you expect us to think more in depth when reading, increasing my ability to read.” Finally one student stated, “I have been reading a lot more on my own and in class. Also, I am more interested in the readings this year.”

When asked if the readings had enhanced instruction, one student replied, “Yeah, even though I didn’t really like doing the reading, it was good to do it before we actually learned the material. When we did the stem cell reading, there was vocabulary in there that we later talked about again. I think when I kept seeing the words over and over again, I started to get it.” Another student stated, “I thought some of the articles were kind of difficult to read, but most of them weren’t bad. I thought a lot of them were pretty interesting. I am not usually a big reader, but the readings were interesting.”

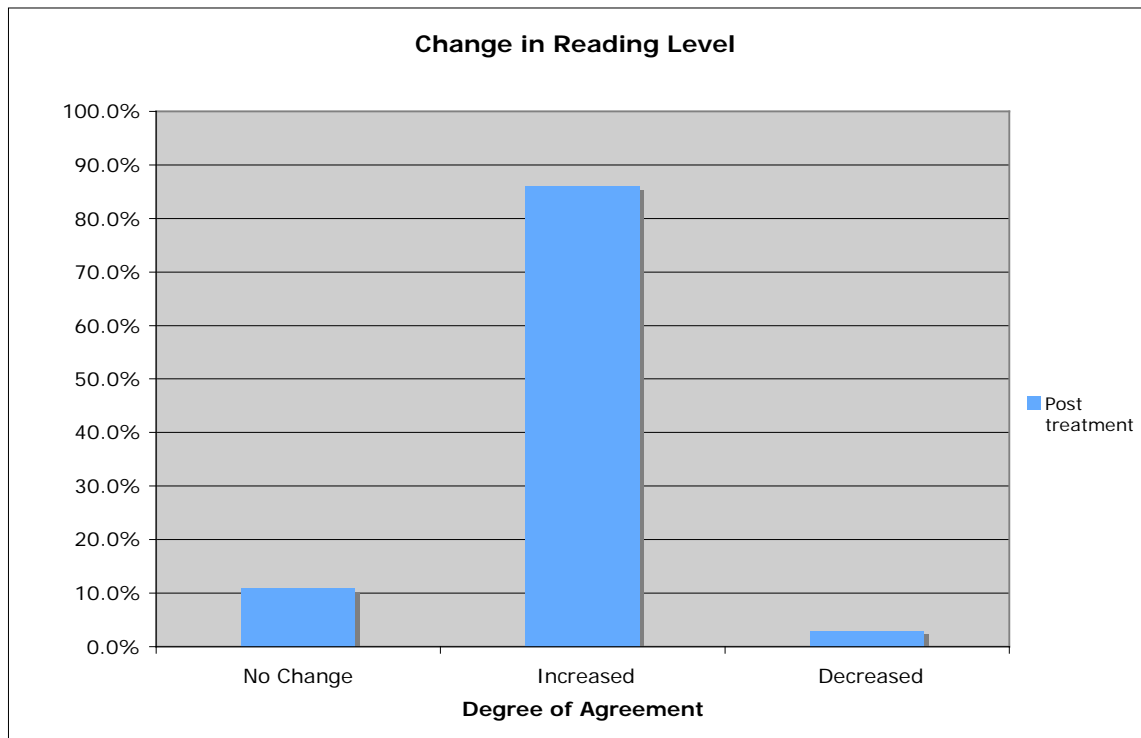


Figure 6. Student responses to change in reading level, ($N=75$).

In terms of the reading interventions and their impact on students’ understanding of biology, results from the survey indicates that 56% reported that their understanding of biology increased due to the reading and reading interventions used over the course of the project (Figure 7). As indicated by the survey question, 36% of the students felt neutral in the fact that the reading had increased their understanding of biology. With these data

in mind I asked the students what they thought they needed to do to improve their reading. One student stated, “I need to read faster, I wish I could read and understand the first time, and I need to find more time to read.” Another student said, “I need to understand more of the words, be able to focus the whole time on my reading, and to get the correct meaning from the reading.” Another student stated that “try not to be distracted by my cell phone, Facebook, or television and just read more.”

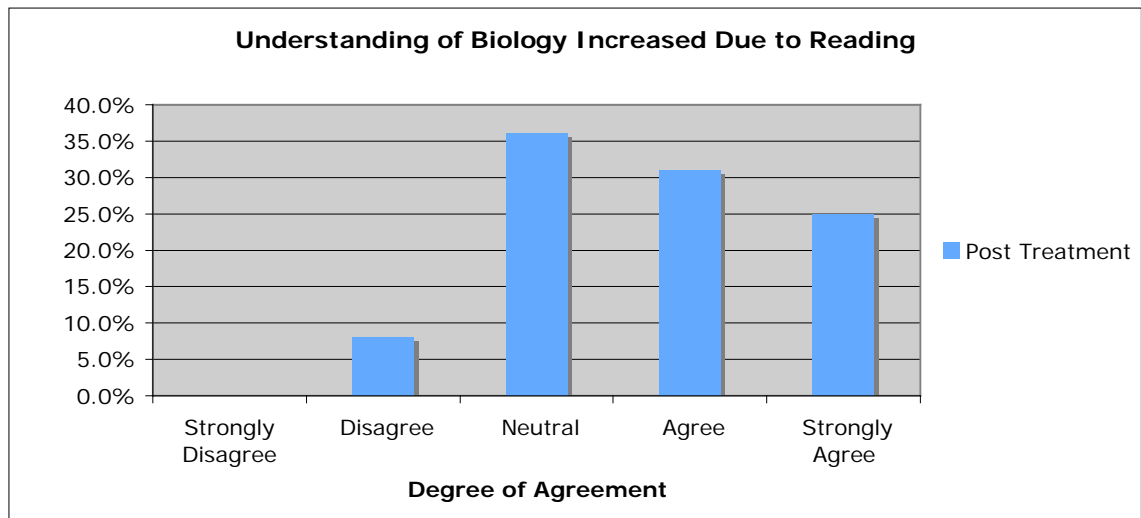


Figure 7. Student responses to change in understanding, ($N=75$).

These responses indicate that students were not enjoying the reading and were finding it to be something they had to do, instead of something they wanted to do. The results of the More Likely to Read Science on My Own Survey showed that 51% of the students, if given the choice, would not read science on their own, despite that 21% agreed they would.

As indicated, after the students were given the choice of selecting their own book to read, there was a shift in the number of students who would read on their own (Figure 8). Before the students had the opportunity to read a book of choice, 51% disagreed that they would read a science on their own. After reading the book, this dropped to 32%. On the other side of the scale, before the book was assigned, 21% of my students would

select a book on their own. After reading a book of choice, 43% of my students stated they would read a science book on their own (Figure 8). The key to this change was that the students had a choice in the reading; I had not assigned a book, but let them choose the type of book that they wanted to read. When I asked a reluctant reader why his views changed, he stated "before class, no way. I like to read fantasy books, but I'm not into science. There are some other books on the list that sound interesting, so maybe I'll pick another one."

The importance of choice in terms of reading became clear during the final interviews. One student stated when asked about why they picked a particular book, "Well, I choose *Bitten* because I like to read stories about real people and I really like disease. I knew it wouldn't put me to sleep. She has another book I am gonna read for second semester. Its about worms and parasites, the title sounds interesting." Another student said, "I chose a book about cancer because some of my family's close friends and some of my family has had cancer. It made me want to read it."

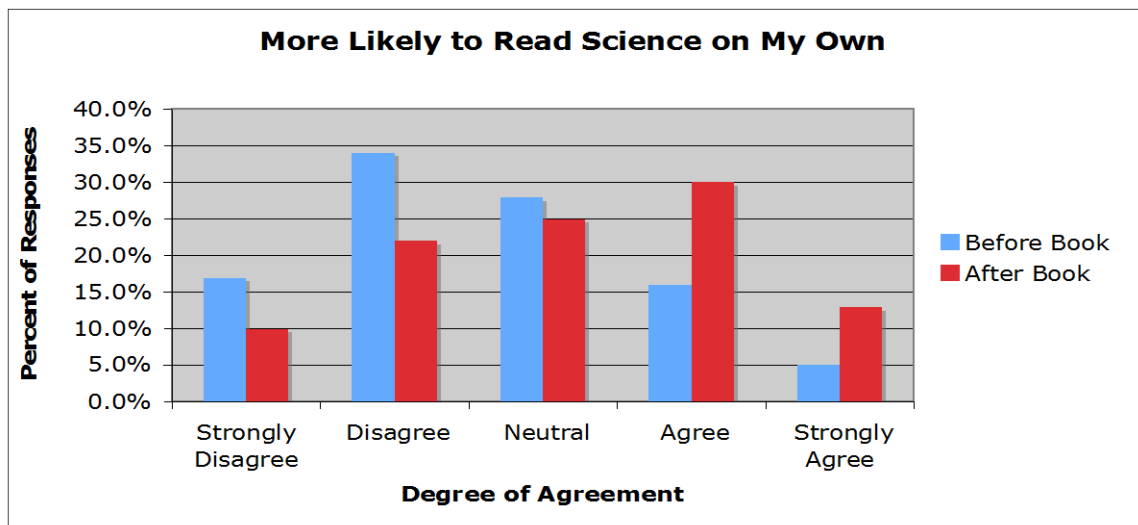


Figure 8. Student responses to the question about reading more on their own, ($N=75$).

INTERPRETATION AND CONCLUSION

My classroom research project based on the action research model provided me with evidence that by creating opportunities for students to read materials other than textbooks, their understanding of science content increased. Several of the students indicated that the reading of the articles, short stories and novels enabled them to better understand the material and have a better understanding of difficult concepts. When looking over the students' responses, two things are clear. One, the students were exposed to other types of science related material. Instead of the textbook being the primary source of information, students were given texts from magazines and short excerpts from books. By giving the students more variety of reading material and reading level, they spent the time reading because of interest in the topic. Second, students were given techniques to read materials that require a higher level of thinking. By modeling reading strategies and having the students complete the same strategies, students were no longer apprehensive about the reading material.

The overall positive response to the incorporation of the reading in my classroom has dramatically changed the way I teach science and how I incorporate reading in the classroom. By providing students with the chance to read within the science curriculum, I am able to introduce students to reading materials they otherwise may have overlooked. The most profound response that really made me think about why I did this project was when a student stated what they needed to do to become a better reader was "learn to enjoy reading."

One of the major issues I discovered through this project was that my students see science as being learned through memorization. When I asked my students about how to best learn biology, I was surprised by the results. I expected that my students would have overwhelmingly disagreed that memorization was not the best way to learn biology.

However, as I learned over the course of the study period, my students viewed memorization as learning. For example, I found that my students could state the organelles of the cell and their function, but not how they worked together. They had memorized the functions: but when asked to explain how the organelles worked together or what happens if one of the organelles does not function, they had no response. The same type of responses occurred later when I asked the students about mitosis. Mitosis, a topic that is universal to biology, has been reduced to four letters, PMAT (prophase, metaphase, anaphase, and telophase). My students knew the names of the phases, but once I probed, I found that many had no clue what occurred in the phases or why it occurred. These two experiences indicated my students saw science as a group of facts to be memorized or vocabulary terms to learn and this was a driving force in my project.

When I asked students about how they develop understanding, several students indicated they understand concepts they can relate to or see in their everyday life. When the concepts were put into a context that was relevant to their lives, the material had meaning.

The positive response I received from the students after completing the reading interventions has convinced me to make reading outside of the context of the textbook a permanent part of my curriculum. There are some modifications that I will have to make as I make reading a part of my science curriculum. I think getting students to read for science will be a matter of suggesting the right works for them and I think this has occurred. What I will have to do to make the project more successful is to set goals and have the class set reading goals. By having the students set their own goals, they not only take ownership of reading, but they can measure their own progress. When creating the goals, I will have the students create short term and long-term goals. Short-term goals, so

the students can see that their efforts are making a difference. I also will have the students create goals that are measurable and clear so the student knows when goals are reached.

One of my goals was to grade more on completion of reading, not quality or length of book. I found through this process though, that if I place emphasis entirely on the grade, my students would go for the easiest or safest assignment.

Another goal is to give students more choice in the reading selections. I strongly feel that students should feel free to choose what they want to read. It had never occurred to me that the students did not enjoy reading. School had become a place where students learn to hate reading. My students were not given the choice in what they could read in my class. I feel that by giving the students control over what they read, they took ownership of their reading and the dynamic between the students and me changed. I really think I was seen more as a coach and a facilitator to their reading than a teacher.

An unexpected benefit is that my classroom library has grown due to the project. As the number of books has increased in my classroom, the more the books have been an avenue for me to act as a reading mentor. I have also had the added benefit of creating a working relationship with the English teachers and librarians in my building. The library, because of this project, has allocated \$1500 to purchase science related books because of the increased demand.

VALUE

The process of developing and executing the classroom research project based on the action research model has changed me as a teacher in several ways. First and most importantly, I need to give my students the chance to read more often in class and more choice when it comes to what is read in class. Students need to be given the opportunity to read more material in the science classroom besides the textbook. This was made evident when I had the students read the *Odyssey*, which was used to illustrate the

nitrogen cycle. For the first time in my twelve years of teaching, I felt comfortable that my students understood a concept that I had dreaded to teach. Also for the first time, I actually enjoyed teaching the nitrogen cycle. The controversial topic of stem cells could be addressed in my class without the gut reaction statements that had been made in the past because now students had background information. The opportunity to read is key and I have learned that improving reading skills is important for students to be successful. If they cannot comprehend what is being read, then they do not have good foundation to build upon.

I changed in the way I view assessments. In the past I would introduce the topic and the students would struggle because I placed focus on memorization. They were so focused on memorizing the cycle, the phases, or the vocabulary, that they missed the big picture. I learned that I was part of this problem by what I expected my students to do on assessments. I was only asking questions that required rote memorization, and not much in terms of critical thinking. I learned that I need to develop assessments that not only require critical thinking skills like reading, but also those that have applications to their greater world.

I learned that even though I am not a language arts teacher, I can teach reading. Like most of us in the high school classroom, I received little or no training on how to teach reading. By completing this action research and having my students read pieces of literature that was not the textbook, they were able to not only understand the process I was teaching, but learn to appreciate the process.

I changed in the fact that I see reading as a part of all subjects and I have come to the conclusion that all teachers should be teaching reading in some form in their class. I strongly feel that the reading not only helped my students understand difficult concepts, but also in the end, made me a better teacher because it made me think outside of the box.

I used techniques I would have never used before, and look at teaching biology in a different way. We are all readers, and I used this fact to help improve my students' skills.

In terms of what I would change, I have also decided that next year I am going to make an effort to allow the students to really immerse themselves in their books. I am working with an English teacher to help develop reading journals and ways to do some formative assessment of the students.

My students were resistant to it at first, but once we used the activities and began reading and discussing the books, they came around. I will give students more opportunity to select materials to read on their own. I found when the students were given the ability to choose their own book or reading material, the reading became more personal. Hopefully this act of selecting scientifically relevant reading material will become a life long habit for my students.

REFERENCES CITED

- ACT. (2006). *Reading between the line: What the ACT reveals about college readiness in reading*. Iowa City, IA: Author. Retrieved February 2, 2011 from www.act.org/research/policymakers/pdf/reading-summary.pdf
- Alliance for Excellent Education. (2006). *Who's counted? Who's counting? Understanding high school graduation rates*. Washington, DC: Alliance for Excellent Education.
- Balfanz, R., McPartland, J. M., & Shaw, A. (2002). *Re-conceptualizing extra help for high school students in a high standards era*. Baltimore, MD: Center for Social Organization of Schools, Johns Hopkins University.
- Bauerlein, Mark (2011). Too dumb for complex texts? *Education Leadership*, 68 (5), 28-32.
- Biancarosa, G., & Snow, C. E. (2006). *Reading next — A vision for action and research in middle and high school literacy: A report to Carnegie Corporation of New York* (2nd ed.). Washington, DC: Alliance for Excellent Education.
- Clark, S.L. (2009). Using the newspaper to involve students in science literacy. *Adolescent Literacy in Perspective*, 14-15. Columbus, OH: Ohio Resource Center.
- Colombo, M. W., & Colombo, P. D. (2007). Using blogs to improve differentiated instruction. *Education Digest*, 73(4), 10-14.
- Connors, R. (1997). *Composition-rhetoric*. Pittsburgh: University of Pittsburgh Press.
- Cuban, L. (1989). *How teachers taught: Constancy and change in America's classrooms, 1880-1980*. New York: Teachers College Press.
- Creech, J., and Hale, G. (2006). Literacy in science: A natural fit. *The Science Teacher*, 73 (2), 22-27.
- Donovan, C.A., & Smolkin, L.B. (2001). Genre and other factors influencing teachers' book selections for science instruction. *Reading Research Quarterly*, 36 (4), 412-440.
- Donahue, D. M. (2000). Experimenting with texts: New science teachers' experience and practice as readers and teachers of reading. *Journal of Adolescent & Adult Literacy*, 43(8), 728-739.
- Douglas, Rowena, et al. (Ed.). (2006). *Linking science & literacy in the K-8 classroom*. Arlington, VA: NSTA Press.
- Fradd, S. H., & Lee, O. (1999). Teachers' roles in promoting science inquiry with students from diverse language backgrounds. *Educational Researcher*, 28(6), 4-20, 42.

- Glencoe/McGraw-Hill (2005). Improving reading skills in the science classroom. *Teaching Today*. Retrieved November 29, 2010 from http://www.glencoe.com/sec/teachingtoday/subject/reading_skills.phtml.
- Guensberg, Carol. (2006). Why johnny (still) can't read: schools meet the challenge of producing teen readers. *Edutopia*. Retrieved November 29, 2010 from <http://www.edutopia.org/magazine/feb06>.
- Grigg, W., & Donahue, P. (2007). *The Nation's Report Card: Reading 2007* (NCES 2007-496). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, Washington, D.C.
- Heller, R., & Greenleaf, C. (2007). *Literacy instruction in the content areas: Getting to the core of middle and high school improvement*. Washington, DC: Alliance for Excellent Education.
- Hillocks, G. (2003). *The testing trap: How state writing assessments control learning*. New York: Teachers College Press.
- Ippolito, J., Steel, J. L., & Samson, J. F. (2008). Introduction: why adolescent literacy matters now. *Harvard Educational Review*, 78(1).
- Jacobs, G. E. (2004). Complicating contexts: Issues of methodology in researching the language and literacies of instant messaging. *Reading Research Quarterly*, 39, 394-406.
- Kamil, M.L. (2003). *Adolescents and Literacy: Reading for the 21st century*. Washington, DC: Alliance for Excellent Education.
- Kirsch, I., Braun, H., Yamamoto, K., & Sum, A. (2007). *America's perfect storm: Three forces changing our nation's future*. Educational Testing Service.
- Matheny, K. (2009). Addressing Literacy in the Science and Mathematics Classrooms. *Adolescent Literacy in Perspective*, 17-19. Columbus, OH: Ohio Resource Center.
- Martin, G.T., (2002). Reading, writing, and comprehension. *The Science Teacher*, October 2002, 56-59.
- Miners, Z., & Pascopella, A. (2007). The new literacies. *District Administration*, 43(10), 26-34.
- Moss, B. (1991). Children's nonfiction trade books: A complement to content area texts. *The Reading Teacher*, 45, 26-32.
- National Center for Education Statistics (NCES). (2003). *Nation's report card :Reading 2002*. Washington,DC:U.S.Government Printing Office. Retrieved November 30, 2010 from <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2003521>

- Perie, M., Grigg, S. W., & Dion, G. S. (2005). The nation's report card mathematics 2005. National Center for Education Statistics, National Assessment of Educational Progress (NAEP).
- Rogers, C.R. & Freiberg, H.J. (1994). *Freedom to learn* (3rd Ed). Columbus, OH: Merrill/Macmillan.
- Snow, C.E., & Biancarosa, G. (2003). *Adolescent literacy and the achievement gap: What do we know and where do we go from here?* New York: Carnegie Corporation of New York.
- Vincent, D. (2000). *The rise of mass literacy: Reading and writing in modern Europe*. Cambridge, England: Blackwell.
- Wade, S. & Moje, E. (2000). The role of text in classroom learning. In M. Kamil et al. (Eds.), *Handbook of reading research, Volume III*. Mahwah, NJ: Lawrence Erlbaum Associates, 609-628.

APPENDICES

APPENDIX A

INFORMED CONSENT

Exemption Regarding Informed Consent

I, Steven Anway, Principal of Tiffin Columbian High School, verify that the classroom research conducted by Christopher G. Monsour is in accordance with established or commonly accepted educational settings involving normal educational practices. To maintain the established culture of our school and not cause disruption to our school climate, I have granted an exemption to Christopher G. Monsour regarding informed consent.

(Signed Name)

(Printed Name)

(Date)

APPENDIX B

BIOLOGY READING SURVEY

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. 1. It is possible to explain biological ideas with everyday language.					
2. I think about the biology I experience in everyday life.					
3. When I am answering a biology question, I find it difficult to put what I know into my own words.					
4. To understand biology, I sometimes think about my personal experiences and relate them to the topic being analyzed.					
5. To understand biology I discuss it with friends and other students.					
6. I enjoy figuring out answers to biology questions.					
7. It is important for the government to approve new scientific ideas before they can be widely accepted.					
8. To learn biology, I only need to memorize facts and definitions.					
9. Reasoning skills used to understand biology can be helpful to my everyday life					
10. The subject of biology has little relation to what I experience in the real world.					
11. When studying biology, I relate the important information to what I already know rather than just memorizing it the way it is presented.					

12. Reading skills are important for understanding biology.					
13. The general public misunderstands many biological ideas.					
14. I think that reading the textbook in detail is a good way to learn biology.					
15. Understanding biology basically means being able to recall something you've read or been shown.					
16. I think it is important to read novels in classes other than English.					
17. I basically don't read books much at all					
18. I don't have much time to read for pleasure, but I like to when I get the chance					
19. I only read what I'm supposed to for school.					
20. I read constantly for my own personal satisfaction					
21. The reading of "Silent Spring" enabled me to better understand the concept of DDT and Bioaccumulation.					
22. The articles by Aldo Leopold enabled me to better understand the concept of the nitrogen cycle.					

	Yes	No
1. I use note cards to help when I study vocabulary.		
2. I use clues from the reading to define vocabulary terms for biology.		
3. I use biology vocabulary outside of Mr. Monsour's class.		
4. I read newspapers and magazines outside of school.		
5. I understand most of the terms Mr. Monsour uses during class discussion.		
6. When I read materials outside of class, I understand most of the vocabulary.		
7. My other teachers expect me to read and learn new vocabulary.		
8. When doing my biology notes, I read the section first.		
9. I find it helpful when Mr. Monsour goes over the section.		
10. I find it helpful to take a note quiz before we start a new section.		

APPENDIX C

READING ANTICIPATION GUIDE

Reading Anticipation Guide

Directions: Each of the following statements is connected in some way to the reading assignment you are about to complete. Before reading, mark your level of agreement or disagreement with each statement. Consider the statements as you read and mark your level of agreement again once the reading assignment is complete. If your opinion changes, use details from the reading assignment to explain the cause of the change.

Statement 1: _____

Level of agreement:

Strongly Agree

Agree Somewhat

Strongly Disagree

Reasoning before reading:

Did your level of agreement change due to the reading assignment? Why or why not?

Statement 2: _____

Level of agreement:

Strongly Agree

Agree Somewhat

Strongly Disagree

Reasoning before reading:

Did your level of agreement change due to the reading assignment? Why or why not?

Statement 3: _____

Level of agreement:

Strongly Agree

Agree Somewhat

Strongly Disagree

Reasoning before reading:

Did your level of agreement change due to the reading assignment? Why or why not?

Statement 4: _____

Level of agreement:

Strongly Agree

Agree Somewhat

Strongly Disagree

Reasoning before reading:

Did your level of agreement change due to the reading assignment? Why or why not?

APPENDIX D

RATE READING COMPREHENSION

Rate Your Reading Comprehension.

Name: _____

Date: _____

Directions: After reading the assigned passage the first time, rate your understanding on the scale below. Read the passage a second and third time, rating your understanding after each reading. Notice the change in your ratings from the first to third readings.

First Reading

1 2 3 4 5 6 7 8 9 10

Second Reading

1 2 3 4 5 6 7 8 9 10

Third Reading

1 2 3 4 5 6 7 8 9 10

Summary statement:

APPENDIX E

ODYSSEY ANNOTATION

Student Number	Annotation
-------------------	------------

1	Aldo Leopold's passage is about how pollution has affected the environment and how people have built dams and terraces to keep pollution from running off. It explores how pollution is carried into plants and then when animals eat the plants they too are effected by the pollution and some eventually die.
2	The first time I reading this passage I didn't really understand any of it. After reading it a second time, I was more focused and thought about it differently. By the third time, I think I understand what the passage was about.
3	The passage was hard to understand. It used many words unfamiliar to me. After reading it a second and third time I could guess what some of the words meant by using context clues. After reading it three times I think I understand the passage a lot more.
4	X is an atom. It talks about how atoms first became involved in rocks and nonliving things then get involved with the living environment. How it moves about through the organism when they eat something and expose of it. Then it dies and gets places in the soil and the whole routine goes all over again. In the second part, Y talks about the atoms and how they are involved in seeds and then feed livestock and get disposed of, as the process goes again.
5	The odyssey of X and Y help show that atoms do not change even when time passes and the world changes, these compounds will never stop in their journey through time, from sea to land, and from plant to animals.

APPENDIX F

PRE- READING ORGANIZER

Pre-Reading Organizer

Name: _____ Date: _____

Directions: Study the list of words and assign each word to **one** of the categories below. Study the categorizations and write a state of anticipation for the assignment you are about to read.

People	Places	Events	Objects
Problems	Outcomes	Unknown Words	

Anticipatory Statement:

APPENDIX G

POVERTY READING ANNOTATION

Selected Annotations from *The Rising Tide of Poverty* Metacognitive Responses.

Student Number	Annotation
1	Our world is divided greatly by wealth. Poverty greatly affects and determines the quality of life for the future of our world. Many countries have many of their people living in shantytowns outside of large cities. Even some of the richest countries are victims of poverty. Scholars believe that poverty plays a role in rapid population growth.
2	This article discusses the increase of poverty in the world. Poverty has lead to an increase in the growth rate, death rate, and a decrease in literacy. It can lead to the depletion of resources. If we want to reduce poverty we must increase the literacy rate.
3	Poverty is one of the biggest problems our world is facing. Over 80% of poor people live in developing countries. With the rise of population more people become poor under the poverty line. With more children in families, as developing families have, more likely to be poor when older.
4	Today poverty still continues and the number of people in poverty keep multiplying. Poverty is not evenly distributed among people. Women, children, elderly, and minorities have been hardest hit. Poverty frequently contributes to population growth.
5	Poverty is a bad thing that is killing millions of people. There are people dying everyday from disease and malnourishment, even though there are people also taking advantage of what they have. People of poverty do not make enough money to live on. As time goes on poverty is getting better.

APPENDIX H

STUDENT LED DISCUSSION

Name _____

Cholera Student Led Discussion

Below pose 3 questions for class discussion. Questions can be who, what, when, where in nature (1pt.), but the best questions will be why and how (3 pts.). You may also pose statements that would elicit conversation such as explain, defend, argue, judge, choose (3 pts.). You do not necessarily need to know the answer to the question/statement to pose it. However, you will earn points based on your responses to others' questions (5 pts.). This is a time for you to hear other perspectives on the text and expand on your understanding of the text through conversation.

1. _____

2. _____

3. _____

*Please note if your questions concern the beginning, middle or end of the reading so we may have some flow to our discussion.

Finally, if you offer your question in class please circle its number (3 pts.).

APPENDIX I

METACOGNITIVE READING LOG

Name _____ Period _____ Date Due: _____ Log # (Circle) 1

Metacognitive Reading Log

Title of article _____ Author _____

Pages read _____ to _____ Total number of pages _____

A. Respond to two of the metacognitive prompts below. Try different prompts for each log.

- | | |
|--|--|
| <ul style="list-style-type: none"> <input type="checkbox"/> <i>I was distracted by..</i> <input type="checkbox"/> <i>I started to think about</i> <input type="checkbox"/> <i>The time went by quickly because ...</i>
 <input type="checkbox"/> <i>I stopped because...</i> <input type="checkbox"/> <i>I figured out that... that...</i> <input type="checkbox"/> <i>I finally understood...</i> | <ul style="list-style-type: none"> <i>I felt confused when....</i> <i>I got stuck when ...</i> <i>A word/some words I did not know...</i>
 <i>I lost track of everything except...</i> <i>I first thought that...but then realized</i> <i>I remembered that earlier in the book</i> |
|--|--|

1.

2.

B. What was the most interesting fact that you learned this week?

C. Write down two questions that you could ask about this week's reading ("author and me" or "on my own" questions – questions not answered directly in the text).

1.

2.

D. Draw a picture/graphic that shows an important idea from this week's reading. Label your drawing with words/descriptions

E. Chose 4 new words from this week's reading (words not commonly used outside of science). Use them to fill in the table.

Word	Meaning	Visual Aid	Example

F. Summarize the most important ideas in week's reading in a paragraph (at least 4 detailed sentences). Explain them as if you were talking to a person who had not read the book.

APPENDIX J

STEM CELL ANNOTATION

Selected Annotations from *Have We Entered the Stem Cell Era?* Reading Log

Student Number	Annotation
1	I was impressed how much of our technology and improved research has helped with stem cell research. Also how they can use rats and mice to test stem cell research.
2	This piece gives me a lot of information that I had no idea of. It was a little difficult to understand, but I comprehend a lot more than I would have a month and a half ago.
3	I think the reading piece was very interesting. There were a lot of things I didn't know, and the medical information and discoveries were awesome.
4	I thought this article was very interesting to read. It kept me entertained and I followed along with most of it because I liked it. It was kind of confusing though. It's pretty neat to see the things doctors had to do or had to look into to figure out things.
5	Stem cells do amazing things, but scientists need to perfect the process before it can be widely used to prevent people from having awful side affects.

APPENDIX K

SUPPLEMENTAL READING

Supplemental Reading

DUE: Once a semester. You can turn in completed supplemental reading assignments at any time, just be sure you have one turned in by the last day of the semester!

Worth: 100 class work points (usually turns out to being about 2-4 percent of your overall grade, but this can vary).

Assignment:

1. Choose a book from the options. Some are easy, some are hard. All are great!
2. Acquire the book (libraries have multiple copies of these books or you can get copies of some of them from the classroom collection). You can also link through to Amazon from this site and order the books direct.
3. For books in list
 - ⌘ **Get the question sets linked from the book titles .**
 - ⌘ **Read the book, love it, and answer the questions in your own writing. ANSWERS MAY NOT BE TYPED.**
 - ⌘ **Complete the [supplemental reading verification form](#)**
 - ⌘ **Turn in your question packets and be rewarded with the points (100 max)!**
4. If you bought a book and want nothing more to do with it, then PLEASE donate your book to the classroom collection! What good karma you will have.

APPENDIX L

SUPPLEMENTAL READING LIST

Supplemental Reading List

A Brief History of Time by Stephen Hawking
A Field Guide to bacteria by Betsey Dexter Dyer
A Walk into the Woods by Bill Bryson
AP Biology reading list:
Before the Dawn by Nicholas Wade
Chromosome 6 by Robin Cook
Darwin's Blind Spot: Evolution Beyond Natural Selection by Frank Ryan
Deep Survival by Laurence Gonzales
Doubt is their Product: by David Michaels
Endless Forms Most Beautiful: The New Science of Evo Devo by Sean Carroll
Full House by Stephen Jay Gould
Genome by Matt Ridley
Good Germs, Bad Germs by Jessica Snyder
In Defense of Food: An Eater's Manifesto by Michael Pollan
In the Shadow of Man by Jane Goodall
Into the Woods by Jon Krakauer
Monkey Girl by Edward Humes
Moral Minds: by Marc Hauser
Number: The Language of Science by Tobias Dantzig
Of Moths and Men by Judith Hooper
Proust was a Neuroscientist by Jonah Lehrer
Refuge by Terry Tempest Williams
Relics of Eden by Daniel J. Fairbanks
Rosalind Franklin: The Dark Lady of DNA by Brenda Maddox
Second Nature: A Gardener's Education by Maichael Pollan
Silent Spring by Rachel Carson
Survival of the Sickest by Sharon Moalem
Symbiosis in Cell Evolution by Lynn Margulis
The Beak of the Finch by Jonathan Weiner
The Demon in the Freezer by Richard Preston
The Diversity of Life by Edward O. Wilson
The Double Helix by James D. Watson
The Lives of a Cell by Lewis Thomas
The Making of the Fittest: DNA and the Ultimate Forensic Record of Evolution by Sean B. Carroll
The Omnivore's Dilemma by Michael Pollan
The Origin of Species by Charles Darwin
The Panda's Thumb by Stephen J. Gould

The Red Queen by Matt Ridley

The Selfish Gene by Richard Dawkins

The Stuff of Thought: Language as a Window into Human Nature by Steven Pinker

The Third Chimpanzee by Jared M. Diamond

The Third Man of the Double Helix by Maurice Wilkins

The World without Us by Alan Weisman

The Woman with a Worm in her Head by Pamela Nagami

Why Zebras Don't Get Ulcers by Robert Sapolsky

Your Inner Fish by Neil Shubin

APPENDIX M

SUPPLEMENTAL READING VERIFICATION

Supplemental Reading Verification Form

This summary and questions must be completed to receive credit for the assignment.
If you need more room for an answer you may use the back of the page.

1. How is the book related to what we have studied or will be studying?
2. Would you recommend this book to someone else? Why or why not?
3. What science topics are addressed in the book?
4. Do you think the science content is accurate?
5. Are there parts of the book that confuse you or are difficult to understand? Explain.

For students:

I [print name] _____ verify that I have read the book [book title] _____ . I am the person who did the reading and I answered all the questions individually. I understand that if it is discovered that I did not actually read the book, copied or plagiarized that answers that I will be subject to the repercussions as outlined in the student planner.

Signed: _____

Date: _____

For parents / guardians:

I [print name] _____ verify that I observed my student reading the book written above. To the best of my knowledge, my student read the entire book and completed the associated assignment on their own accord.

Signed: _____

Date: _____

APPENDIX N

EVALUATION OF INTERVENTION SURVEY

Final Survey

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

_____A. I have enjoyed the readings we have done in class

_____B. The readings in class have helped me to know more about the world around me.

_____C. I feel that my test/quiz grades have increased because of the readings we have read in class.

_____D. I feel I understand biology better because of the readings we have done in class.

_____E. I have become more curious about how biology affects me and my world.

_____F. I am more likely to read about science on my own now.

_____G. I have enjoyed this year of science more than last.

_____H. I feel I am prepared to advance to the next level in science because of my experience with reading non-textbook materials.

_____I. I feel that I know how to better study for science because of my experience this semester.

1. Obviously I cannot let you choose what you want to read all the time. However, please make some remarks about being able to choose your own book as opposed to being assigned a book to read for class.

2. How would you rate yourself as a reader on a scale of 1-10 at the beginning of the school year _____?

How would you rate yourself today _____.

Why was there a change?

- 3. Which class (that you are currently taking) asks you to read the most?
- 4. Which class (that you are currently taking) has the most difficult reading?

5. If you could improve up to three things about yourself as a reader, what would you choose?

6. The following consistently interfere with my ability to read as well as I would like.

- Distractions Lack of time Lack of knowledge
- Lack of interest None of the above

APPENDIX O

CHANGE IN READING LEVEL ANNOTATION

Selected Annotations from “Why was there a change in reading level?”

Student Number	Annotations
1	This class has taught me how to read more science-based books.
2	You require us to read more and have given me techniques to help with my reading.
3	You make us read a lot more than my other classes.
4	In earlier years we did not have to read as much.
5	I just started to read science related books for pleasure.
6	Because I'd like to think I improved in my reading skills even though I'm already a good reader. Being exposed to more of the science and factual literature widened my literary capabilities and allowed me to be exposed to something I don't normally read.
7	I was exposed to more difficult reading.
8	I understand a lot of stuff better and I learned to read certain amount of pages everyday, instead of waiting until the last minute.
9	I have increased my vocabulary and now understand how to read science related pieces of literature.
10	There was a change because I read things a lot more carefully and asked questions if I didn't understand something.
11	As we continued to read more, I continued to improve and I am still improving.
12	I believe it is because when you have us read, you expect us to think more in depth when reading, increasing my ability to read.
13	Because of the articles and books I have read in your class.
14	Because of the readings we do in class.
15	I have been reading a lot more on my own and in class. Also, I am more interested in the readings this year.

APPENDIX P

THREE THINGS I NEED TO DO TO IMPROVE READING ANNOTATION

Selected Annotations from Three Things to Change.

Student Number	Annotations
1	Comprehension and ability to read faster.
2	Read faster, not get bored or antsy, and increase my vocabulary.
3	Understand the more difficult terms in readings and read more to learn.
4	Read for pleasure, comprehend on a higher level, and read faster.
5	Try not to be distracted by my cell phone, Facebook, or television and just read more.
6	Pay better attention to what I am reading, learn bigger words, and understand better.
7	Read more, read more, and read more.
8	Try not to get distracted as much and try to be able to read for pleasure.
9	Comprehend more words, understand the details expressed, and read faster.
10	To understand more of the words, be able to focus the whole time on my reading, and to get the correct meaning from the reading.
11	To stay focused while I read, understand what I read better, and read faster.
12	I need to read faster, I wish I could read and understand the first time, and I need to find more time to read.
13	I would increase my vocabulary, allow myself the time so I understand, and read faster.
14	Try not to get distracted while reading, comprehend what I read the first time, and ask if I need help.
15	Learn to enjoy reading, learn to read quicker, and learn to comprehend the reading the first time.

APPENDIX Q

TRANSCRIPT FROM FINAL INTERVIEW

Transcript of Student Interview (February 17, 2011)

CM refers to Chris Monsour

7 refers to Student 7

14 refers to Student 14

CM: Thanks for coming in this morning and helping me out with this project. I am going to ask you some of the questions I gave you ahead of time. Be honest, your not going to hurt my feelings and don't tell me what I want to hear.

CM: Question 1: What were your impressions about the reading assignments that we have done this year so far?

7: I thought some of the articles were kind of difficult to read, but most of them weren't bad. I thought a lot of them were pretty interesting. I am not usually a big reader, but the readings were interesting.

CM: Was there a reading you really liked?

7: I really liked the stem cell reading. I really had no idea what it was and it was kind of a surprise on what they can do with the cells.

CM: 14, what did you think about the reading so far?

14: You want us to be honest right? I thought some of the articles were kind of boring, not because of what they were about, but because I did not understand a lot of the terms. It was kind of hard to focus when I couldn't understand a word I skipped it and moved on.

CM: 14, were there any articles you liked?

7: Yea, there were. I really liked the book I read and the stem cell article.

CM: Question 2: Was the material we read this year so far relevant to you?

7: For the most part, I think the readings were relevant. Some of them like the nitrogen cycle not so much. I really don't walk around thinking about the nitrogen cycle.

CM: Do see the importance now?

7: Yea, yea, I understand why it is important and I have a better understanding of how chemicals move. I don't think if I would not have read it, I would of understood the process.

CM: How about you 14?

14: The stuff we read about disease did because I've been sick before. I think the nitrogen cycle reading was kind of boring though. I get why you picked it, but maybe you should find something else to read.

CM: I will see what I can do.

CM: Alright let's move on.

CM: Question 3: Do you think the reading enhanced the instruction in the classroom?

CM: 14, I will let you go first this time.

14: Yea, even though I didn't really like doing the reading, it was good to do it before we actually learned the material. When we did the stem cell reading, there was vocab in there that we later talked about again. I think when I kept seeing the words over and over again, I started to get it.

CM: What about you 7?

7: For the most part, I think having us read before you taught the stuff helped me understand. I know reading made me think about viruses in a different way.

CM: Question 4: Would you choose to read about science on your own if not assigned?

14: Before class, no way. I like to read, but I'm not into science. There are some other books on the list that sound interesting, so maybe I'll pick another one.

CM: 7, what do you think? Would you have read a science-based book?

7: It depends on what it is about. I really like the virus and disease stuff.

CM: I think you might like *Survival of the Sickest*, its about diseases and evolution. Think about it.

CM: Lets switch gears here and get to some questions about class.

CM: Question 5: Does class make you want to learn more about your world?

7: Oh yea, we get to ask a lot of questions in class and there are some I would of never thought about and that's what makes me want to learn more. I really didn't like science till this year.

CM: Have the readings helped?

7: Sure, but I think the class discussions are better.

CM: 14, what about you?

14: Sometimes. I really like when we talk about body stuff.

CM: So I should have more human body readings?

14: Yea, at least for me.

CM: We don't use the textbook as much as other classes.

CM: Question 6: Why is it that student's do not like textbooks?

CM: 7, you go first.

7: I think there boring cuz they don't use any excitement and they use words I don't understand.

14: They're too cut and dry and use examples and stuff that I can't relate too. I like how you have us do the notes and explain them, besides, they're not useful.

CM: So you would both agree that the readings I had you do were note interesting?

7 and 14: yes.

CM; We need to wrap this up so your not late to first period so here is the last question.

CM: Question 11. Why did you choose the book you did to read? 14, why don't you go first.

14: Well, I chose *Bitten* because I like to read stories about real people and I really like disease. I knew it wouldn't put me to sleep. She has another book I am gonna read for second semester. Its about worms and parasites, the title sounds interesting.

CM: 14, would you have read these books if not directed to or had to class.

14: Probably not to be honest.

CM: 7, how about you?

7: I chose a book about cancer because some of my family's close friends and some of my family has had cancer. It made me want to read it.

CM: Thanks for giving up your time before school, I do appreciate it.