THE EFFECT OF LITERACY STRATEGIES IN SCIENCE CONTENT AREAS
ON REDIRECTIONS AND ASSIGNMENT COMPLETION

by

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DEDICATION

To my children, Eileen and William; for their love for me and my love for them, and their tolerance of my working so much during school breaks and on weekends. I want them both to see that they can do anything that they set their minds to, no matter what the circumstances are in life. I love you both more than words can convey.

To my parents, Jim and Rhonda Beers: thank you for your support and endless love, and for encouraging me to pursue my education even when life is challenging. Thank you for helping shape who I am today.
ACKNOWLEDGEMENT

Thank you to my advisor, Walt Woolbaugh, for his generous and never-ending support and guidance. In part due to his support, I feel like a stronger teacher. Through the feedback and advice given, he has helped me immensely in completing this program, and I will always strive to be more like him in my own teaching.

Many thanks to my science reader, Dana Skorupa. Her guidance pushed my writing to a new level and taught me so much.

Thank you to my colleagues (both past and present) that helped shape this final draft: Karen Malmkar, Erin Duez, Aeron O’Brien, Pamela Aguilar, and Duane Sisto.

Thank you to my administrators, Andrew Donahue, Megan Mauro, and David Riddle, for believing in me and supporting me through this process. Thank you also to my students who gave honest feedback about the effects the strategies had, and for never being anything other than middle school students.

And lastly, thank you to the MSSE program. I could not have asked for a better program. I am so grateful to every instructor I had, for each class I had, and for the amazing experiences I was lucky enough to have with the field classes in Yellowstone National Park. This program is truly a gem.
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ABSTRACT

Literacy is essential to learning. Students with lower literacy skills, such as those in the process of learning English, need to be intentionally taught specific strategies in content areas, such as science. Such strategies can then be employed by the students to better learn content presented in the classroom. Students who struggle with literacy skills often mask their academic weaknesses with off-task behaviors. This study compared the use of critical reading strategies to the number of student redirections and on-time assignment completion occurrences. This study also looked at how the use of these strategies affected English Learners, if and how the literacy strategies affected student attitudes toward learning science, and whether there were correlations between attitude and assignment completion. Results indicate that the use of critical reading strategies in science decreases the number of necessary student redirections and increases the likelihood of students turning in assignments that are both complete and submitted on time.
INTRODUCTION AND BACKGROUND

On a morning in the spring of 2018, my principal informed the staff of some disappointing news. Due to a new state policy, our school was now classified in the bottom 5% of schools in the state. Despite integrating more reading and writing into content areas for the last two years, our standardized test scores remained low, with lower than expected growth in student test scores. Table 1 shows the scores for LaVenture Middle School (compared with the Washington State averages) on the Smarter Balanced Assessment (SBA) and the 8th grade Washington Comprehensive Assessment of Science (WCAS) in May 2018.

Table 1
Percent of Students That Met Standard on the Smarter Balanced Assessment (SBA) and Washington Comprehensive Assessment of Science (WCAS), Spring 2018

<table>
<thead>
<tr>
<th>Grade</th>
<th>English Language Arts SBA, LaVenture</th>
<th>English Language Arts SBA, Washington State Average</th>
<th>Math SBA, LaVenture</th>
<th>Math SBA, Washington State Average</th>
<th>Science WCAS, LaVenture</th>
<th>Science WCAS, Washington State Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th grade</td>
<td>30.4%</td>
<td>55.9%</td>
<td>31.8%</td>
<td>49.0%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>7th grade</td>
<td>39.6%</td>
<td>59.6%</td>
<td>38.2%</td>
<td>47.5%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>8th grade</td>
<td>42.1%</td>
<td>58.9%</td>
<td>32.9%</td>
<td>40.6%</td>
<td>34.9%</td>
<td>52.9%</td>
</tr>
</tbody>
</table>

Note. Data pulled from the Washington State’s Report Card website. (Office of Superintendent of Public Instruction), \((N=633)\)

Students in my school struggle with academic classes for a variety of reasons.

Two of the primary explanations are that many students (1) display below grade-level reading abilities and (2) struggle with learning the academic vocabulary required for
content area classes. Because of these deficiencies, many students become disengaged when the classwork becomes challenging, often failing to complete their work. Some students also display disruptive or distracting behaviors as an avoidance mechanism. With our school’s recent reclassification as a low performing academic institution, there is an increased pressure to identify strategies to improve student test scores and increase student learning.

Due to the large number of English Learners (EL) and students still trying to master reading skills sets, teachers at LaVenture Middle School were encouraged to utilize reading and writing activities in every class – regardless of the subject. During the past two years, as I increased the amount of reading and writing in my science classes, I observed a drop in on-task behaviors and assignment completion, and subsequently, a decrease in content mastery. My suspicions were that low reading skills were preventing students from accessing the material. The goal of this classroom research project was to help students with lower level reading skills remain engaged and complete classroom assignments.

**Demographics**

Most students attending LaVenture Middle school come from low-income households. Approximately 75% of students qualify for free or reduced lunch, and for a high proportion of the student body English is their second (or even third) language. Of our 735 students attending LaVenture during the 2018-2019 school year, 23.9% were formally identified as EL, though many others without an EL designation are still not fluent in the higher-level and content-specific vocabulary present in most academic
English-speaking classrooms. The prerequisites for formally labeling a student as an EL require that a student’s language be something other than English and that the student score below the proficient-level on the on the English Language Proficiency Assessment for the 21st Century. According to Washington State’s Office of the Superintendent of Public Instruction (OSPI) School Report Card, in May 2018 LaVenture Middle school was 69.8% Latino, 25.1% white, with the remaining 5% a mixture of various races/ethnicities. Many LaVenture students come from migrant families (23% according to OSPI), moving from year-to-year or season-to-season. Finally, a high proportion of our student body reads below grade level, with 70 of 154 eighth graders testing more than two years behind grade level on the reading inventory assessment (given in the fall). The statistics outlined above make it extremely difficult for LaVenture Middle School to score well on standardized tests and are likely strong contributing factors for why LaVenture has observed a drop in school status.

The sample for this study consisted of five eighth grade science classes. Table 2 below breaks down each class into demographic components to provide a snapshot. Classes have been given a letter name and are shuffled to provide anonymity for students.

Table 2
Demographic Breakdown of Each Class (2018-2019)

<table>
<thead>
<tr>
<th>Class</th>
<th>Total Number of students</th>
<th>male/female breakdown</th>
<th># of English Learners</th>
<th># of students receiving Free/Reduced Lunch</th>
<th>Homeless or Migrant Students (numbers combined)</th>
<th># of students with home language other than English</th>
<th># of Special Education Students</th>
<th># of students with 504 Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>34</td>
<td>17/17</td>
<td>17</td>
<td>28</td>
<td>5</td>
<td>25</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Class B</td>
<td>29</td>
<td>13/16</td>
<td>6</td>
<td>24</td>
<td>4</td>
<td>22</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Class C</td>
<td>29</td>
<td>16/13</td>
<td>10</td>
<td>26</td>
<td>5</td>
<td>18</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Class D</td>
<td>28</td>
<td>18/10</td>
<td>8</td>
<td>20</td>
<td>3</td>
<td>17</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Class E</td>
<td>26</td>
<td>13/13</td>
<td>5</td>
<td>19</td>
<td>1</td>
<td>14</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>146</td>
<td>77/69</td>
<td>46</td>
<td>117</td>
<td>18</td>
<td>96</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Percent of total</td>
<td>100%</td>
<td>52.7%/47.3%</td>
<td>31.5%</td>
<td>80.1%</td>
<td>12.3%</td>
<td>65.8%</td>
<td>11.6%</td>
<td>4.1%</td>
</tr>
<tr>
<td>------------------</td>
<td>------</td>
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</tr>
</tbody>
</table>

*Note.* A 504 plan indicates that a student has a medical condition or disability that requires accommodations in an educational institution.

Of the 96 students with a home language that is not English, 82 speak Spanish at home. Within the remaining 14 students, two students speak Russian, one speaks Ukrainian, one speaks Yupik (indigenous to Alaska or Russian Far East), one student speaks Vietnamese, eight speak Mixtec, and one speaks Triqui (both of which are indigenous languages of Mexico).

**Classroom Research Project Focus**

My classroom research focused on the question: “How does the use of literacy strategies in science content areas affect the amount of time a student can remain on task (as measured conversely though the number of redirections needed) and the number of on-time assignments completed?” The related sub-questions were:

1. How does the use of literacy strategies affect assignment completion rates in EL students as compared to non-EL students?
2. How does the use of literacy strategies affect student attitudes toward learning science?
3. Is there a significant correlation between time on task and assignment completion rates?
4. Is there a correlation between student attitude towards science learning and assignment completion rates?

This topic is significant not only to my own students and myself, but to the entire staff of my middle school and those similar to LaVenture Middle School.
Support Team

Several colleagues have agreed to be a part of my support team. Included in this team are a language arts teacher, three science teachers, and an administrator (former elementary teacher). They provided feedback on the initial student survey, as well as the general research proposal, in addition to proofreading.

CONCEPTUAL FRAMEWORK

Literacy is traditionally defined as the ability to read and write (Merriam-Webster, 2018). The definition has expanded in modern history to now include skills such as listening and speaking. The National Institute for Literacy gives a more all-encompassing view: according to their webpage, called the Literacy Information and Communication System, literacy is "an individual's ability to read, write, speak in English, compute and solve problems at levels of proficiency necessary to function on the job, in the family of the individual and in society" (Workplace Investment Act of 1998, p. 127). This view of literacy is what educators across the nation are struggling to help their students achieve, due to the ever-increasing time demands required for teaching discipline-specific content using hands-on methods. The problem is especially noticeable in science disciplines, and is also driven by a significant increase in the proportion of students who are learning English as their second or third language. In 1996-1997, 4.7% of the students in Washington State were “transitional bilingual,” whereas in 2016-2017 11.3% of the students in the state were (OSPI Report Card).

Suleiman (2014) reminds us that in the role of education, language is critical and that learning a new language can be a “life-long process,” however, it is necessary for
learning new content. As such, it is no surprise that there is a heavy emphasis in schools on reading and writing. For EL students, this emphasis is critical to their development of English, but that same emphasis can cause delays if language acquisition is not developing at the expected rate. If language development, reading, and writing are to progress, a variety of strategies and theories will need to be employed. Hodges, Feng, Kuo, and McTigue (2016) claim “more diversity in theories representing these [reading and writing] constructs can broaden the field and focus on more specific aspects of both reading and writing” (p. 10). They go on to say theories about writing are “lagging behind the research” (Hodges, et al., 2016, p. 10) and strong theories could guide such research. The first part of the article focused on various theories regarding reading. One can see how the various theories have grown and shifted over time, from the Schema theory (that new knowledge fits into existing knowledge in a person’s understanding) which parallels Piaget’s theories of cognitive development in children (applied to reading, specifically), to Rosenblatt’s Transactional theory, describing reading as interactions between reader and text, to the Third Space theory: students’ knowledge and experiences can enhance literacy learning. When the theories are intertwined, each building on its predecessor, it becomes clear that in order for students to gain skills in reading and writing, they must first interact with the text.

According to Fisher and Ivey (2005), “the ability to read and write is an access skill to all other content areas” (p. 3), and that teachers are not always aware of the connection between their content information and the requisite literacy skills. They also go on to say teaching content literacy is “nonnegotiable if your goal is to help students
learn and grow as readers and writers” (Fisher & Ivey, 2005, p. 6). In his article “Seven Literacy Strategies that Work” (2002), Fisher describes ways content area teachers can purposefully use literacy strategies to improve literacy skills in students. These strategies are reciprocal teaching, writing to focus and process knowledge, reading aloud to students, teaching students how to take structured notes, accessing background knowledge, using graphic organizers, and teaching vocabulary with a focused approach. Weiss (1975) argued reading teachers need to work with content area teachers to ensure reading happened in every classroom, because “no one teacher or one period of reading a day can solve most children’s reading problems” (p. 174). He suggested there be a reading committee at each school to capitalize on a reading specialist’s knowledge, having the specialist serve “as a catalyst who can help a total faculty improve instruction for all” (Weiss, 1975, p. 178).

Literacy is vital to accessing and understanding science content. A student lacking fundamental literacy skills will not gain a deeper understanding of the science concepts being taught. Krajcik and Sutherland (2010) explain, “fundamental literacy practices such as reading, writing, and oral discourse are essential to developing an understanding of the core ideas of science” (p. 456). Their description of how to accomplish this parallels much of Fisher’s work in the context of scientific inquiry. They also state “studies have shown that the vocabulary, complex sentence structures, use of passive voice, and other elements of scientific discourse prove challenging for many readers and may contribute to students’ waning interest in learning science” (Krajcik & Sutherland, 2010, p. 457). One key difference between Krajcik and Sutherland’s article and Fisher’s works is they
describe teachers explicitly teaching how to read scientific text and diagrams through modeling.

Fang, Lamme, Pringle, Patrick, Sanders, Zmach, and Henkel (2008) studied integrating reading into middle school science classes, something noticeably less researched than at the elementary levels. During this study, Fang et al. worked with two classroom science teachers, planning and teaching reading lessons to six of their ten middle school science classes. Additionally, they implemented a home reading program with science trade books (commercially available non-fiction science content books) and professional development for the team members. The remaining four classes did not receive the specific reading lessons or at home program. At the end of the study, there was an increase in reading scores between the experimental and control groups (almost 9 points between the means, measured using the Gates-McGinitie Reading test, 4th edition) and science content scores (2.25 points difference, measured by a Curriculum-Referenced Science Test from Glencoe publishers). The researchers also noted the science teachers grew more confident in incorporating reading into their curriculum, with the authors directly attribute to the incorporation of literacy skills with outside support. Akın, Koray, and Tavukçu (2015) studied how critical reading skills affect the understanding of science text in classrooms. The researchers found that groups of students directly taught critical reading lessons increased not only their academic understanding of the science concept, but also their ability to think critically (measured by the Cornell Critical Thinking Level X Test). Both of the aforementioned studies show how the integration of literacy skills into science teaching increases students reading skill and science concept
understanding. It thus remains to be seen why literacy strategies are not actively incorporated into all science classes. Studies show that content area teachers feel it takes time away from the content they are required to teach (Fisher and Ivey, 2005), and that it is often not viewed as a viable method for teaching the content. The low value placed on literacy skills is also suggested to be a result of science teachers viewing themselves as-area specialists who are focused on covering content (Fang et al., 2008). Additionally, science at the middle and high school levels uses more technical, content-specific, and abstract language which often frustrates students and alienates them from the material (Fang, et al., 2008) These issues are often magnified for students who are in the process of learning English.

At a more simplistic level, school often presents additional challenges for ELs such as basic interpersonal communication skills (BICS) with fellow peers and teachers. BICS generally takes one to three years to develop (Carrier, 2005). In addition, the cognitive academic language proficiency (CALP) required by middle and high school students in specific content areas takes five to seven years to develop (Cummins, 2001 as cited by Carrier, 2005, p.6). These development time frames highlight the exceptional challenge ELs face when navigating a content class while simultaneously learning the language is exceptionally challenging. As Carrier (2005) states:

At the same time, they [EL students] are called upon to (a) locate information in science texts; (b) interpret and apply that information; and (c) ask, answer, describe, explain, and make predictions about science – all in a language which is still in its developmental stages. This difference in the science literacy skills of ELs and native English speakers results in what Au and Raphael (2000) refer to as a literacy gap (p. 5).
This gap highlights the need for science teachers – and all content teachers – to reinforce literacy skills in their discipline. Research shows reading is mastering both decoding and understanding the text, and being able “to understand written English is intertwined with proficiency in spoken English” (Connell and the American Educational Research Association, 2004, p. 1). Students must learn the vocabulary and be taught how to engage with the text to understand what the text is about. A 2014 study using 56 EL students, demonstrating that blending reading and science together allowed EL students to increase in reading fluency and comprehension (Tong, et.al., 2014). In order to truly make science a subject all students can learn, we need to embed direct teaching of literacy skills as well as use them for learning.

METHODOLOGY

Treatment Description and Schedule

This classroom research project was exempt from a full Institutional Review Board review because it presented the lowest amount of risk to subjects, and the data was reported without identifiers (Appendix A).

This classroom research study utilized two rounds of treatment, incorporating four “literacy in the content area” strategies gleaned from the articles and studies mentioned above. These treatment rounds lasted approximately four weeks, with no specific literacy strategies being incorporated in between rounds. As our school operates on a block schedule, students have science every other day for about 80 minutes a day. Table 3 identifies the strategies used in each round as well as the approximate timeline for this study.
Table 3
Treatment Rounds and Timeline

<table>
<thead>
<tr>
<th>Approximate Dates</th>
<th>Treatment/Non-treatment</th>
<th>Data collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>No treatment. (No data collection in September)</td>
<td>Off Task Redirection Count, Assignment Completion Percentages, Initial Student Surveys (early to middle of October)</td>
</tr>
<tr>
<td>Last week of October/November</td>
<td>First round of treatment: teaching root/prefix/suffix, direct pre-teaching of critical vocabulary, writing to learn.</td>
<td>Off Task Redirection Count, Assignment Completion Percentages, Student surveys: early December</td>
</tr>
<tr>
<td>December/Most of January</td>
<td>No treatment.</td>
<td>Off Task Redirection Count, Assignment Completion Percentages</td>
</tr>
<tr>
<td>End of January and through February</td>
<td>Second round of treatment: Critical reading and reciprocal teaching</td>
<td>Off Task Redirection Count, Assignment Completion Percentages, Student surveys (early March), followed by student interviews</td>
</tr>
</tbody>
</table>

Traditionally, students learn vocabulary after being exposed to the unknown word in the context of the lesson. Understanding the vocabulary of a lesson is critical to understanding the lesson concepts and is key to comprehending the primary message in the text. To help EL students and those with lower reading abilities, important vocabulary for the unit was chosen and taught prior to lessons. Additionally, important roots (prefixes and suffixes) were taught so students could better recognize an unknown word. The vocabulary and roots chosen can be found in Appendix B, as well as samples of the vocabulary charts used in the student notebooks. The vocabulary words were taught by providing the definition with visual and verbal examples, and students worked in groups to write sentences using the word in correct scientific context. Students repeated the word chorally as the words were introduced by the teacher. In class, review sessions were included where students had to identify words. Students also created word wall displays. The words were then used frequently in the lessons, which included visuals and videos in
addition to the graphic organizers. Students were required to use the words repeatedly in their classwork, reading, and discussions.

Writing to learn is a term used to classify strategies used to further learning rather than writing to communicate or to assess learning. Examples of this include writing a summary of the day’s events or of the notes taken in class. The strategy was incorporated during this classroom research project by having students write their own sentences for vocabulary words and when explaining the utility and purpose of food. Samples of the method are included in Appendix C. Writing to learn can often look a lot like writing to communicate, but the way it is used is markedly different. For example, in one activity, students were asked to describe the purpose of a food web. This resembles an assessment item; however, students were not graded, and rather were given feedback to promote further thinking. The goal of the strategy was for the student to process all content learned up to a specific point and formalize their thoughts.

To incorporate critical reading into the class, students were given text passages about the content and asked to mark the text (also known as close reading activities), as well as answer questions throughout the reading. Students worked together in cooperative groups for several texts, including the use of the jigsaw strategy of reading a difficult piece of text about eukaryotic and prokaryotic cells. In the jigsaw strategy, students start in a “home group” and divide into expert groups. Students responsible for section A of a text will work together and build a common understanding of the section, and teach their home group about that section, while other students do the same for other sections of the text.
Reciprocal reading (sometimes referred to as reciprocal teaching) is a strategy that uses similar items as critical reading but is more structured. The purpose is similar to that of critical reading: to get students to engage with the text, think about what is being read, and determine the meaning of the text. Students were given sentence stems and question stems (Appendix D) to help guide them through predicting, summarizing, and questioning the text. They read the text together aloud, summarizing what was read in a section, predicting what may come next, and asking questions about the text. Samples of the critical readings are included in Appendix E.

Data Collection

A variety of strategies were designed to collect data to answer the research questions, with each strategy connecting to more than one investigated question. Table 4 below identifies the data collection methods and the research questions they connect with.

Table 4  
Data Triangulation Matrix

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Off-Task Redirection Count</th>
<th>Assignment Completion Percentage</th>
<th>Student Surveys</th>
<th>Student Interviews (post treatment cycles)</th>
<th>Teacher Reflection Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Question: How does the use of literacy strategies in science content areas affect the amount of time a student is able to remain on task (as measured conversely though the amount of redirections need) and the amount of assignments completed?</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Sub-question 1: How does the use of those strategies affect assignment completion of EL</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(English Learning) students as compared to non-EL students?

Sub-question 2: How does the use of these literacy strategies affect student attitudes toward learning science?  

Sub-question 3: What is the correlation between the number of redirections and assignment completion, and do the literacy strategies affect the correlation?

Sub-question 4: What is the correlation between student attitude towards learning science and assignment completion rates?

A tally system was developed to collect data about off task redirections. When a student was off-task and redirected by the teacher (verbally or non-verbally) to return to the task at hand, a tally mark was noted on the class roster. If students appeared on task, they were not redirected and thus no tallies were recorded. Assignment completion was determined by the number of assignments turned in on time and complete. Also recorded was whether assignments were turned in late, incomplete, or remained missing. Per school policy and to align with our standards-based grading philosophy, students had until the end of the quarter to turn in assignments without penalty.

Student surveys were given through Google Forms in early October (before treatments), mid-December (after the first round of treatment), and early March (after the second round of treatment). Following the December survey, ten students were selected for an in-person interview, using a random stratified sampling method which selected five EL students and five non-ELs. The same students participated in a follow-up
interview in March, except those absent from school. This random stratified sampling method was chosen because a large percentage of students are former ELs, with students currently classified as ELs comprising 24% of my student body. Additionally, the EL students possibly have more to gain from the treatment methods and thus their opinions could provide more insight into the effectiveness of the treatments. Copies of the student surveys can be viewed in Appendix F. Interview questions from interviews can be found in Appendix G. These surveys and interviews were shared prior to the first survey date with colleagues and the capstone review team to check for validity and reliability, and triangulation of instruments also helped ensure the findings were reliable.

Throughout the classroom research process (October through early March), a teacher journal was kept, including items such as unique events that might affect data, what activities were conducted in class, and perceptions observed by the teacher. Also recorded were personal feelings about how the day went and thoughts about what to keep/change in the future.

DATA AND ANALYSIS

Off-Task Redirections

The two dependent variables pertaining to the main research question “How does the use of specific literacy strategies affect off task redirections and assignment completion” were examined separately. The average number of student redirections was calculated for each treatment type in every round of the study. This was determined by calculating the average number of redirections for each student per round (e.g. 24 redirections for one student over six class periods results in an average of four
redirections). Following this, a grand mean was determined. It should be noted that the number of redirections for off-task behavior decreased from the first round of non-treatment data collection through the first round of treatment. Table 5 shows the average number of redirections calculated per student for each treatment round.

Table 5

<table>
<thead>
<tr>
<th></th>
<th>Non-Treatment round 1</th>
<th>Treatment round 1</th>
<th>Percent change</th>
<th>Non-Treatment round 2</th>
<th>Treatment round 2</th>
<th>Percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Students (n = 137)</td>
<td>0.86 ± 0.99</td>
<td>0.33 ± 0.40</td>
<td>-61%</td>
<td>0.48 ± 0.67</td>
<td>0.47 ± 0.65</td>
<td>-2.1%</td>
</tr>
<tr>
<td>EL Students Only (n= 38)</td>
<td>1.18 ± 1.21</td>
<td>0.42 ± 0.40</td>
<td>-65%</td>
<td>0.50 ± 0.83</td>
<td>0.68 ± 0.72</td>
<td>36%</td>
</tr>
<tr>
<td>Non-EL Students (n=99)</td>
<td>0.73 ± 0.86</td>
<td>0.28 ± 0.37</td>
<td>-62%</td>
<td>0.40 ± 0.59</td>
<td>0.40 ± 0.61</td>
<td>-1.4%</td>
</tr>
</tbody>
</table>

*Note. (N=137)*

From the first period of non-treatment to the end of the first round of treatment, the average times a student was redirected for off-task behavior decreased by about 61%, from an average of 0.86 times per class period to an average of 0.33 times per class period. When this data is broken down into the subgroups to compare students who are still classified as ELs to the students who are not (Non-EL students), the data shows similar results for the first round of non-treatment to treatment, but a 36% increase in redirections for ELs following the second round of treatment. However, when combining the non-EL and the EL student redirections together in the second round, the change was
negligible. If the non-treatment periods are combined and compared with combined treatment periods, then the resulting combined data (Figure 1) shows a decrease of 41% in the average number of redirections a student receives when comparing non-treatment to treatment, regardless of which subgroup the student is in.

Figure 1. Average number of redirections per student for combined periods, broken down by subgroup, (N=137; EL n=38; Non-EL n=99).

Another way to look at this data set is to compare the average number of students receiving no redirections over the period of time, the average number receiving one redirection, and so on. The first round of treatment brought an increase in the number of students needing no redirection to remain on task; the second round of treatment also showed an increase, though not quite as large. Figure 2 (below) shows the average number of students per day for each redirection count. The number of students needing one redirection slightly declined over the periods of data collection, while the average number of students needing two, three, and four redirections fluctuated. This might
indicate the students were struggling with an issue that was unrelated to what was taking place in class, and some days were easier for them to remain focused on classwork while other days they needed more support with remaining on task.

Figure 2. Average number of students per number of redirection, (N=137).

In surveys administered following the treatment periods, students were asked if they felt the literacy strategies utilized helped them to stay on task. The results found the majority of students thought the strategies were helpful to staying on task (82% and 80% respective to each survey, combined El/non-EL students). Students were also polled on a follow up question of why the student felt the strategies were helpful (or not). Some of the responses included: “These strategies helped me stay on task in class because it helped to stay focused,” “[the strategies] have [helped] because it keeps me doing
something in class and not just waiting because we always have work which I like,” and “they make learning interactive.”

A subset of students did indicate that the redirections were not helpful, and responded with comments such as: “I just can’t seem to focus on anything” or “no, because I get distracted.” Both response types indicate that there are other factors affecting the ability of the student to focus on their classwork. One student responded with “They have not helped me stay on task, but they helped me learn the subject quicker.” This is considered a positive response, as the end goal of comprehending the material is attained.

While some of the decrease in redirections can likely be explained by student adjustments to specific classroom expectations over time, the second round of non-treatment also showed a dip in the number of students needing no redirections. Table 5 shows more off-task redirections were needed in the non-treatment round that occurred across December and January than in the treatment rounds on either side of that time frame. For example, the teacher journal entry on January 15 noted that students struggled with remaining on-task while reading an article. A similar assignment was given in February, with the intentional use of critical reading, and reflections in the journal note that students were “asking deep questions and making thoughtful observations.” At the beginning of the data collection, there were a few students that needed an excessive number of redirections (5 or more during an 80 minute class period) to remain on task, and field journal entries note a sense of frustration for the teacher. Over the course of this classroom research project, the number of excessive redirections decreased, as shown in
Figure 2 (above). These results are not solely the result of the classroom strategies employed; but also included other interventions at the administrative.

**Assignment Completion**

During the first round of treatment, the amount of completed assignments submitted on time decreased by a significant amount, from a 36% return rate to a 20% return rate while the missing assignment percentage did not change very much, going from a 35% missing assignment rate to a 38% missing assignment rate. The assignment completion data is shown in Table 6 below.

Table 6

*Assignment Completion Data for Each Treatment Round*

<table>
<thead>
<tr>
<th></th>
<th>On time, Complete</th>
<th>Late, Complete</th>
<th>Incomplete</th>
<th>Missing</th>
<th>Excused</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Treatment Round 1 Count</td>
<td>99</td>
<td>30</td>
<td>45</td>
<td>95</td>
<td>5</td>
<td>274</td>
</tr>
<tr>
<td>Non-Treatment Round 1 Percent</td>
<td>36.1%</td>
<td>10.9%</td>
<td>16.4%</td>
<td>34.7%</td>
<td>1.8%</td>
<td>100%</td>
</tr>
<tr>
<td>Treatment Round 1 Count</td>
<td>83</td>
<td>62</td>
<td>108</td>
<td>155</td>
<td>3</td>
<td>411</td>
</tr>
<tr>
<td>Treatment Round 1 Percent</td>
<td>20.2%</td>
<td>15.1%</td>
<td>26.3%</td>
<td>37.7%</td>
<td>0.7%</td>
<td>100%</td>
</tr>
<tr>
<td>Percent Change</td>
<td>-44.1%</td>
<td>38.7%</td>
<td>60.0%</td>
<td>8.8%</td>
<td>-60.0%</td>
<td></td>
</tr>
<tr>
<td>Non-Treatment Round 2 Count</td>
<td>93</td>
<td>29</td>
<td>56</td>
<td>96</td>
<td>0</td>
<td>274</td>
</tr>
<tr>
<td>Non-Treatment Round 2 Percent</td>
<td>33.9%</td>
<td>10.6%</td>
<td>20.4%</td>
<td>35.0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Treatment Round 2 Count</td>
<td>178</td>
<td>37</td>
<td>62</td>
<td>143</td>
<td>1</td>
<td>411</td>
</tr>
<tr>
<td>Treatment Round 2 Percent</td>
<td>43.3%</td>
<td>6.6%</td>
<td>15.1%</td>
<td>34.8%</td>
<td>0.2%</td>
<td>100%</td>
</tr>
<tr>
<td>Percent Change</td>
<td>27.6 %</td>
<td>37.9%</td>
<td>26.2%</td>
<td>-0.7%</td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* (*N=137*) Percent change calculated from non-treatment percent compared with treatment percent.
The most significant change was in the amount of incomplete assignments turned in, changing from 16% of the assignments in the non-treatment round turned in incomplete to 26% after treatment (Figure 3). The amount of late assignments submitted fluctuated between rounds, staying relatively constant in both non-treatment rounds (around 10%) but going up in treatment round two (up to 15.1% from 10.9%) and down in treatment round two (down to 6.6% from 10.6%).

*Figure 3.* Assignment completion data for all students, \((N=137)\).

In the second cycle of non-treatment and treatment, some of trends reversed. The amount of assignments submitted on time went from 34% in the second round of non-treatment to 43% on time. This was higher than the first round of non-treatment, even though the non-treatment rounds had similar percentages. The amount of late assignments turned in went down slightly (from 11% to 7%), and the incomplete assignments went
down slightly (from 20% to 15%), but the missing assignments remained virtually unchanged, from 35.0% to 34.8%. This indicates that there are further barriers or challenges to completing required classwork that need to be dealt with.

If the combined amounts are compared (all non-treatment period assignments compared with all treatment period assignments) the results are very similar to each other. The amount of assignments turned in on time decreased from 35% to 32% (Table 7), and the amount of incomplete assignments increased from 18% to 21%. Overall, the changes did not seem significant when looking at the combined data.

| Assignment Completion Data, Non-treatment Rounds combined and Treatment Rounds, Combined |
|-----------------------------------------------|---------------|---------------|---------------|
| On Time, complete                             | Non-Treatment, combined | Percent | Treatment, combined | Percent |
|                                               | 192            | 35%          | 261            | 32%     |
| Late, complete                                | 59             | 11%          | 89             | 11%     |
| Incomplete (either late or on time)           | 101            | 18%          | 170            | 21%     |
| Missing                                        | 191            | 35%          | 298            | 36%     |
| excused                                       | 5              | 1%           | 4              | 0%      |
| Total of Assignments                           | 548            | 100%         | 822            | 100%    |

Note. (N=137)

However, if one compares the data from the first round of treatment through the school year to the end of the second round of treatment, there are some significant changes to note. From October to February, the amount of assignments turned in on time (N=137) increased from 36% to 43% (Table 8). The amount of assignments turned in late decreased from 11% to 7% (a 36% decrease), however the missing assignment rate remained consistent at 35% return rate. This could be attributed to some students facing
other challenges that are interfering with their ability to complete the assignment on time, or this could indicate that there is a larger issue with motivation and/or interest.

Table 8
Percent Change (Assignment Completion) from Beginning to End

<table>
<thead>
<tr>
<th></th>
<th>On Time</th>
<th>Late, complete</th>
<th>Incomplete (on time or late)</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Treatment Round 1</td>
<td>36%</td>
<td>11%</td>
<td>16%</td>
<td>35%</td>
</tr>
<tr>
<td>Treatment Round 2</td>
<td>43%</td>
<td>7%</td>
<td>15%</td>
<td>35%</td>
</tr>
<tr>
<td>Percent of change</td>
<td>19%</td>
<td>-36%</td>
<td>-6%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note. (N=137)

In the student engagement surveys, most students reported that the critical reading and reciprocal reading strategies as helpful. Table 9 shows the results for several questions pulled from the last engagement survey conducted in March.

Table 9
Student Responses to Likert-Style Survey Questions Regarding Literacy Strategies (March Survey)

<table>
<thead>
<tr>
<th>Response Options</th>
<th>The vocabulary strategies used in this school year have helped me understand the science topics better.</th>
<th>The critical reading strategies used in the past six weeks have helped me understand the science topics better (marking text, discussion points)</th>
<th>The reciprocal teaching strategies used in the past six weeks have helped me understand the science topics better.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Strongly Agree</td>
<td>9</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>3-Agree</td>
<td>81</td>
<td>82</td>
<td>77</td>
</tr>
<tr>
<td>2-Disagree</td>
<td>15</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>1-Strongly Disagree</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Note. (N=107)

As Table 9 shows, the overall response was quite positive; the vast majority of students felt that the strategies were helpful to understanding, which likely contributed to the increase of completed assignments being turned in on time. Each of those questions were followed up with “Why or why not?” Students responded with things such as leaving annotations makes is (sic) so they are “force to think about the topic” leading to
“a deeper understanding”, or that summarizing “is a great way to understand what [they]
have learned.” Of particular note was a comment from one student who appeared to
really grasp the point of the strategy:

When we have to make the prediction before going onto the next page and things
like that, it helps because it makes you actually think about the text and what your
reading so that when you get to the end of the reading you don’t forget what you
read, or just not have actually been reading and paying attention to what you were
reading.

Comparison of English Learners to Non-English Learners

One sub-question that was asked as part of this action research was “How does
the use of literacy strategies affect assignment completion rates in English Learning (EL)
students as compared to non-EL students?” In order to attempt to answer this question,
the assignment completion was divided into two subgroups: EL students and non-EL
students.
Figure 4. Assignment Completion Comparison (EL vs. Non-EL), (Note: EL students $n=38$; Non-EL students $n=99$).

When the assignment completion data is broken down into the subgrouping of EL students ($n=38$) to Non-EL ($n=99$) students, there are some distinct differences. The non-EL students showed a higher on time turn in rate for most of the time periods in which data was collected, with the exception of the first round of treatment where both groups had the same turn in rate. The Non-EL students also had a higher rate of turning in completed assignments late and a lower incomplete rate (again, with the exception of the first round of treatment). The EL students had a higher percentage of missing assignments across all data collection periods, averaging 43% ($\pm 3\%$). In contrast, missing
assignments for non-EL students averaged of 33% (±2%) across all data collection periods.

In the first round of non-treatment, both groups turned in over 30% of the assignments on time (Figure 4), but in the first round of treatment, both groups dropped to under 20% of assignments turned in on time. This difference is startling, given how much time was spent on learning the vocabulary in order to understand the food web content being taught. During student interviews, when my EL students were asked about the vocabulary strategies, four of the six EL students responded positively, stating that the focus on vocabulary was helpful to their learning. One student said, “If you don’t understand a word or something you can just look back to it.” [Note: nearly all of the work done with the vocabulary words was completed using interactive notebooks. This same student also had a 0% assignment completion rate for most of the year.] Another student gave a similar response, stating that “you know how we did the roots, it was helpful because it gives the parts of the words and what they mean.” This student went from a 50% on-time turn in rate during the first non-treatment round, to a 100% turn on-time turn in rate by the end of the first treatment round. Another student responded saying that they felt “more successful because [they] understood what the words were.” Oddly enough, this particular student’s assignment completion rate dropped throughout the year.

In the second non-treatment round, there was a large difference in completed assignments returned, but both groups increased those numbers in the second round of treatment (Figure 4). The EL students increased their on-time turn in rate from 21% to 37% (non-treatment round 2 to treatment round 2). The non-EL students had a higher on-
time turn in rate, increasing from 39% in non-treatment round 2 to 46% by the end of treatment round 2.

**Student Attitude toward Learning Science**

The second sub-question in this action classroom project was “How does the use of literacy strategies affect student attitudes toward learning science?” In order to answer this question, a series of three student surveys were employed to gauge initial interest and engagement, and examine how the factors changed over time and/or as a result of exposure to the literacy strategies. The surveys were followed up by interviewing a selection of students chosen by a random stratified method, and included an equal number of EL students and non-EL students. Students were interviewed in small groups ($n \leq 3$). Figures 5, 6, and 7 show the results of the five attitude-related questions.

*Figure 5*. Responses to the Likert-style question “How much have you liked science class?” (October $n=20$; December $n=119$; March $n=107$).
Throughout the classroom research project, student opinions about science class didn’t change very much (Figure 5). It should be noted that the number of students answering this question regarding how much they liked science class in October was much lower (Figure 5, n=20) due to an error with the survey; the question was accidentally deleted by a colleague when they were reviewing it. Though lower in sample size, student opinions in October were not significantly different from the larger population responses in December or March (Figure 5), showing that the initial 20 responses were quite representative. Figure 5 also shows that the majority of students liked science class to some degree.

Figure 6. Responses to the Likert-Style question “How would you rate your effort in science class?” (October n=109, December n=119, March n=107).
Figure 6 shows that student self-reporting of effort is consistent throughout the year with little deviation. A large proportion of the students (77-81%) believe that they are consistently giving some effort, but not as much as they could. When asked “Why?”, a variety of responses came up: “I’m lazy,” “I get distracted sometimes,” “I don’t like science and I don’t really try,” “I could use my time better,” “I don't really like science, so I don't feel like I need to try as much as I do in classes I like,” or “I chose it because I goof around a lot and I know I could do better but I chose not to.” The responses suggest students were answering with reasonable honesty and that the response represents the reflective thinking of the average eighth grader. In looking closer, each of the students who said they don’t try harder because they don’t like science gave the questions displayed in Figure 7 a score of 2 or lower. Students who responded by saying their performance is lower because they are easily distracted also went on to score questions in Figure 7 with a score of 3 or higher.
Figure 7: Responses to three Likert-style survey questions, used to determine student attitude toward learning science, (October $n=109$, December $n=119$, March $n=107$).

With the questions “I like to learn about science topics” and “Science topics are interesting to learn about,” the results were quite similar (as expected). The questions were both included to provide some validation of the data. There were minor variations in the percentages from month to month, given that not every student took the survey every time; however, the differences were minimal. It is interesting to note that roughly 70% of students felt science was something they liked to learn, even if they were not interested in pursuing it as a career choice. To generate an average attitude score student answers for the previously shown questions were averaged (as each student response was on a 1-4 scale). Figure 8 shows the overall breadth of student average attitude scores.
When student responses were collated and averaged, some interesting trends emerged. The majority of students had a positive attitude towards science (as determined by a score of 2.5 or above), with approximately 67% of the students giving a positive rating, as seen by the cumulative percent line on the Figure 8. The cumulative percent line shows the accumulation of data as a percent of the whole; a score of 2.5 has a cumulative percent of the respondents at approximately 33%, indicating that 67% of the respondents had scores higher than 2.5.

To answer the second sub-question of how the literacy strategies affected attitudes towards learning science, the average scores from survey to survey were compared. A histogram was created with each survey displayed as a separate color. The cumulative
percentage was then overlaid on top of the histogram plot. This is shown in Figure 9 below.

Figure 9. Histogram of individual average attitude scores for each survey, (October \(n=109\), December \(n=119\), March \(n=107\)).

This comparison shows a large disparity in the averages reported in December. In the December survey \(n=119\), a large number of students reported an average score of 3, and much fewer students with lower average scores (under 2.5). One could surmise that student attitudes towards science were more positive in December, and that perhaps the emphasis on learning vocabulary during the first treatment round had a positive impact on how students feel about learning science. Interestingly, survey averages in
March \( (n = 107) \) were not as high. This finding was unexpected given the boost in the number of students who submitted completed assignments on time during this time frame. March also coincided with the LaVenture Middle School science fair, so perhaps students were feeling a bit overwhelmed about science at this point in time, which resulted in the lower scores.

**Correlation Between Off Task Redirection and Assignment Completion**

The third sub-question of this classroom research project was “Is there a significant correlation between time on task and assignment completion rates?” The study here hypothesized that students who did not need redirections would turn in higher amounts of assignments that was both complete and submitted on time. This hypothesis was not substantiated, as a large number of students needing little redirection did not turn in assignments on time. Contrastingly, several students needing a significant number of redirections during most class periods still submitted all of their assignments on time. For example, the point that is furthest to the top and right of the scatter plot shown in Figure 10 (indicated by the red arrow) was a student that in the first non-treatment round needed the most redirections (a daily average of 4.5 redirections). However, this student also completed 100% of their assignments, mostly outside of class. The blue data point that is on the x-axis indicated by the purple arrow shows the student that the next highest amount of redirections (with a daily average of 4 redirections during the first non-treatment round) who completed none of their assignments on time. The yellow data point that is at the top left corner of the scatter plot (indicated by the green arrow) also completed 100% of their assignments, but needed zero redirections to remain on task.
Figure 10. Correlation between the average number of redirections compared with the amount of assignments turned in on time, (N=137).

Fewer redirections does not strongly correlate to more assignments being completed and turned in on time; however, there is a weak negative correlation whereby students were more likely to turn in an assignment on time if they required less redirections. Generally, if a student turned in more assignments on time they needed fewer redirections, but that statement does not hold true if reversed.

**Attitude Compared with Assignment Completion**

The final sub-question for the classroom research project was “Is there a correlation between student attitude towards science learning and assignment completion
rates?" The scatter plot below (Figure 11) shows the overlay of assignment completion for each treatment or non-treatment round along with the average attitude score, with which survey was used shown in Table 10.

Table 10

Correlation of Assignment Completion Data with Survey for Attitude Score

<table>
<thead>
<tr>
<th>Assignment Completion Time Period</th>
<th>Average Attitude Score Used for Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Treatment Round 1 (October)</td>
<td>October Survey</td>
</tr>
<tr>
<td>Treatment Round 1 (November)</td>
<td>December Survey</td>
</tr>
<tr>
<td>Non-Treatment Round 2 (December/January)</td>
<td>December Survey</td>
</tr>
<tr>
<td>Treatment Round 2 (February)</td>
<td>March Survey</td>
</tr>
</tbody>
</table>
As Figure 11 shows, there is very little correlation between the average attitude toward learning science and the assignment completion percentage. [Note: for this scatter plot, students who did not take the survey were removed from the dataset, as the attitude score was missing.] The only time period showing a weak positive correlation between student attitudes and assignment completion was following the first treatment round, which displayed a correlation coefficient of 0.303. Overall, there is little to no correlation.
between the average attitude toward learning science and the amount of assignments a student turned in on time.

**INTERPRETATIONS AND CONCLUSION**

The use of critical reading strategies (marking the text, reciprocal reading, and jigsaw reading) correlated with a decrease in the number of off-task redirections needed and with an increase in the amount of assignments turned in complete and on time. The heavy focus on vocabulary through the use of different literacy strategies did not have the desired effect on assignment completion, but still correlated with a decrease in off-task redirections given to students. Students reported through engagement surveys that the vocabulary and critical reading strategies were helpful. This suggests that the increased use of literacy strategies has a positive effect on student engagement, though the strategies should not be used in isolation. Unfortunately, more time on task did not always translate to higher amounts of assignments completed on time.

Students learning English stand to benefit more than native English speakers from the results of this classroom research project; the EL students in this study had more off-task redirections and missing assignments than the non-EL students. Throughout the course of the project, the number of redirections given to EL students decreased more than with non-EL students, though the percent of change was similar for each. This data suggests that EL students in this cohort need more redirection than the Non-EL students in this cohort, but that the treatment periods helped to reduce the average number of redirections needed for all students.
The majority of students reported that the vocabulary and reading strategies used in this classroom research project helped them, both with understanding the content and with staying on task. There is significant value in that alone: 85% of the students that responded to the March survey \( n=107 \) responded that they felt it was helpful (9 responded with a “strongly agree” and 82 with “agree” to the statement “the critical reading strategies have helped me understand the science topics better.”

**VALUE**

This classroom research focused my attention on how to bring meaningful literacy strategies in the classroom and also showed an area in which more growth can occur. Student engagement for my science classes has been low these past few years, regardless of the content or the activities; the critical reading strategies tried in the second treatment round showed that students were more engaged in class (not only in the assignment completion and the decreased redirections, but also in my own reflections and the student surveys). Because of the results of this study, I will continue to use critical reading strategies in science class, even as we change our curriculum for the upcoming school year.

This study, in addition to new constructive conversations among my colleagues this year, has brought to my attention how classroom practices may be inequitable. If students are struggling with vocabulary or reading, a content class that uses more academic vocabulary or is text-reliant will present difficulties for that student, preventing them from easily accessing the material and feeling successful. The data collected through student surveys and interviews suggests that the structured vocabulary and
critical reading skills may be a step in the right direction in making these practices more equitable to bilingual/multilingual students.

The findings also suggest that purposeful incorporation of literacy strategies into middle school science class could be beneficial to all students. Remaining on task in class increases the number of opportunities to learn content, allows for deeper learning, cooperative learning, and other engaging strategies. Remaining on task gives students more time to complete work, even if the on time completion rates didn’t increase as hoped in this particular classroom research project. Meaningful incorporation of literacy into the content classes is essential to building reading comprehension and other literacy skills that are key to understanding the content areas. We, as content area teachers, need to build our own literacy teaching skill sets in order to facilitate this for our students, especially in populations that have a higher percentage of English Learners.

Would the assignment completion remain increased if the critical reading strategies were blended with the strong emphasis of vocabulary strategies? What would help the EL students be more successful with completing their assignments? How can I motivate the students to try their best, to complete all of their work, regardless of their language abilities? How can I increase the equity of accessibility to the content and assignments, especially for the EL students? These questions are things I will be looking at going forward and working with my colleagues to try to find answers for.


APPENDICES
APPENDIX A

INSTITUTIONAL REVIEW BOARD EXEMPTION
INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

MEMORANDUM

TO: Shauna Holcomb and Water Woolbaugh
FROM: Mark Quinn, Chief, Institutional Review Board for the Protection of Human Subjects

DATE: October 17, 2018

RE: “The Effects of Using Literacy in Science Content Strategies on Student Time on Task and Work Completion” [SH161716-EX]

The above research, described in your submission of October 12, 2018, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal Regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as: (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects’ responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects’ financial standing, employability, or reputation.

___ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

___ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

___ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

___ (b) (5) Taste and food quality evaluation and consumer acceptance studies, (i) if commercially available foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient that at or below the level and for a use found to be safe, or agriculture chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.
APPENDIX B

VOCABULARY WORDS AND ROOTS, VOCABULARY SAMPLES
### Roots:

<table>
<thead>
<tr>
<th>Root</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a-</td>
<td>Without</td>
</tr>
<tr>
<td>bio-</td>
<td>Life</td>
</tr>
<tr>
<td>eco-</td>
<td>(Greek root = house) referring to habitats</td>
</tr>
<tr>
<td>-logy</td>
<td>Study of</td>
</tr>
<tr>
<td>-troph</td>
<td>Refers to how something gains nutrients</td>
</tr>
<tr>
<td>auto-</td>
<td>Self</td>
</tr>
<tr>
<td>hetero-</td>
<td>Different; other</td>
</tr>
<tr>
<td>de-</td>
<td>Away from; down</td>
</tr>
<tr>
<td>omni-</td>
<td>All</td>
</tr>
<tr>
<td>herb-</td>
<td>Plants/grass</td>
</tr>
<tr>
<td>carn-</td>
<td>Meat/flesh</td>
</tr>
</tbody>
</table>

### Vocabulary:

<table>
<thead>
<tr>
<th>Abiotic</th>
<th>Biotic</th>
<th>Ecosystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Producer/autotroph</td>
<td>Heterotroph</td>
</tr>
<tr>
<td>Herbivore</td>
<td>Carnivore</td>
<td>Omnivore</td>
</tr>
<tr>
<td>Primary consumer</td>
<td>Secondary consumer</td>
<td>Tertiary consumer</td>
</tr>
<tr>
<td>Decomposer</td>
<td>Predation</td>
<td>Parasitism</td>
</tr>
<tr>
<td>Mutualism</td>
<td>Commensalism</td>
<td>Competition</td>
</tr>
</tbody>
</table>
**Ecosystem**: A biological community of interacting organisms and their physical environment.

**Biotic** components or biotic factors can be described as any living components that affect or are affected by other organisms or shape the ecosystem.

<table>
<thead>
<tr>
<th>Examples</th>
<th>Non-examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Example1" /></td>
<td><img src="image2" alt="Non-example1" /></td>
</tr>
<tr>
<td><img src="image3" alt="Example2" /></td>
<td><img src="image4" alt="Non-example2" /></td>
</tr>
</tbody>
</table>
**Habitat**

The place or type of place where a plant or animal naturally or normally lives or grows.

**Organism**

An individual living thing.

**Autotroph**

An organism that makes its own food.

**Heterotroph**

An organism that cannot make its own food and must obtain it by eating other animals and plants.
Symbiotic Relationships

- Wolf & bear try to get same elk
- Wolf kills deer

Predation (predator-prey)
- Parsons (tick eats from an elk)
- Parasitism (ex: remora fish hitchhikes ride w/shark; shark not affected)
- Bee gets pollen from flower; flower gets pollinated (reproduction)
<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producer/Autotroph</td>
<td>make our own food using sunlight and water.</td>
<td>Plants</td>
</tr>
<tr>
<td>Heterotroph</td>
<td>eat food directly or indirectly from the Sun.</td>
<td>People, animals</td>
</tr>
<tr>
<td>Herbivore</td>
<td>eat only plants.</td>
<td>Deer</td>
</tr>
<tr>
<td>Primary Consumer</td>
<td>eat plants (transplants).</td>
<td>Beaver</td>
</tr>
<tr>
<td>Carnivore</td>
<td>only eats meat.</td>
<td>Wolf</td>
</tr>
<tr>
<td>Omnivore</td>
<td>eats both plants and animals.</td>
<td>Elk</td>
</tr>
<tr>
<td>Secondary Consumer</td>
<td>eats the primary consumer.</td>
<td>Tick</td>
</tr>
<tr>
<td>Tertiary Consumer</td>
<td>eats the secondary consumer.</td>
<td>Eel</td>
</tr>
<tr>
<td>Decomposer</td>
<td>break down organic matter.</td>
<td>Bacteria</td>
</tr>
<tr>
<td>Word</td>
<td>Definition</td>
<td>Use in a sentence</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>abiotic</td>
<td>Without life; never alive</td>
<td>abiotic conditions like water, soil, light, air, and minerals are not alive.</td>
</tr>
<tr>
<td>biotic</td>
<td>relating to living things</td>
<td>biotic is the opposite of abiotic. Both biotic and abiotic live with us.</td>
</tr>
<tr>
<td>ecosystem</td>
<td>A biologial community of plants and animals interacting organisms; lots of parts will work together physically and chemically.</td>
<td>A ecosystem has different biotic and abiotic organisms working together.</td>
</tr>
<tr>
<td>environment</td>
<td>The surroundings or conditions in which a person, animal, plant, etc. lives</td>
<td>People or animals grow or exist in their environment.</td>
</tr>
</tbody>
</table>
APPENDIX C

WRITING TO LEARN SELECTIONS AND SAMPLES
Write to Learn

Using this food web:
- Mark the herbivore(s) with H/ Marca el herbívoro(s) con H
- Mark the omnivore(s) with O/Marque el omnívoro(s) con O
- Mark the carnivore(s) with C/Marca el carnívoro(s) con C
- Mark the producer(s) with P/Marque el (los) productor(es) con P

What do the arrows represent?/¿Qué representan las flechas?

What resource do the animals need?/¿Qué recurso necesitan los animales?

What is the purpose of a food web?/¿Cuál es el propósito de una red alimenticia?

The purpose of a food web is to show how animals need other animals for food. So, that means if we lose the most resource, most of the animals will end up dying.

What do you feel that you need more explanation about when we are talking about food webs?/¿Qué crees que necesitas más explicación cuando hablamos de redes alimenticias?

How to tell the difference between herbivores, carnivores, and producers?

What do you feel SOLID about when we are talking about food webs?/¿De qué te sientes SOLIDO cuando hablamos de redes alimenticias?

I can tell what the arrows are pointing at and what it means.
Analysis Questions

1. a. Which animals eat other animals for food?
   Coyotes and Wolf's eat animals for food.

b. Which animals compete for the same food sources?
   Elk, Snowshoe Hare, and Beaver compete for willows and Aspens are food sources.
   anything else?

c. What role does the winter tick play in the food web?
   A Tick's role is to grow on fur of Bison and elk. It is also a source for Cowbird.

d. What role did the bacteria play in the food web?
   A bacteria would be a Tick, as its source is fur for Bison and Elk.

2. Draw your Yellowstone Food Web in the space below. Use green for the producers/autotrophs; blue for the herbivores; red for carnivores and parasites; purple for omnivores; brown for decomposers.

*Get this food web stamped by the teacher before you continue. ;)*
a. Go back and add Cattle and Humans (in black) to the food web.
b. Describe how cattle and humans changed the food web.

The cattle and humans changed the food web by adding competition for the other animals for grasses for cattle and humans the produce. Is the whole web still without the animals, they wouldn't be alive.

3. People often think of grizzly bears as meat-eaters. Grizzly bears eat everything, including plants, insects, and other animals. More than 80% of their diet comes from seeds, nuts, and other vegetation (plants). Does a food web show how important a food source is to an organism? Explain your answer.

Yes, the food web does show how a food source is very to an organism. The food web shows that the animals are needing their source and without the plants (producer) they would have no food and be extinct. The food links connect and show how important the sources are. With out a producer or herbivores the whole food web can change and can be completely different.

Does it show which food source is more important to an organism over another food source?
APPENDIX D

SENTENCE AND QUESTION STEMS USED FOR

RECIPROCAL READING
Train Your Brain to Read

PREDICT

Make a prediction when:
• A title is given
• Headings are provided
• The author poses a question in the text
• The text suggests what will be discussed next

Prediction stems:
• Based on the title, I predict this is going to be about...
• I already know these things about the topic/story...
• I think the next chapter or section will be about...
• Based on... (a clue), I predict...
• Based on what ___ said/did, I predict...

QUESTION

Ask teacher-like questions:
• Who is ___?
• What is/does ___?
• When/where is ___?
• Why is ___ significant?
• Why does ___ happen?
• What are the parts of ___?
• How is ___ an example of ___?
• How do ___ and ___ compare?
• How are ___ and ___ different?
• What is most important ___?
• What is your opinion of ___?

CLARIFY

Clarify hard parts when:
• You don’t understand
• You can’t follow the text
• You don’t know what a word means

Clarifying stems:
• I don’t really understand...
• A question I have is...
• A question I’d like answered by the author is...
• One word/phrase I do not understand is...

VISUALIZE

Visualize a picture in your mind:
• When I read this, I imagine that...
• As I read, in my mind I see...

SUMMARIZE

How to do a summary:
• Look for the topic sentence
• Look for who, what, when, where, why, and how

Summary stems:
• This text is mostly about...
• The topic sentence is...
• The author is trying to tell me...

A framed summary sentence:
This story/passage about ___ begins with ____, discusses (or develops) the idea that ____, and ends with ____.
APPENDIX E
SAMPLES OF CRITICAL READING STRATEGIES
Cellular Respiration reading packet

Use text tags to annotate this packet throughout:

!=important
?≈ I have a question about this passage
*=this relates to something else I know

Instructions:
1. Use mark the text and annotate the reading passage.
2. Answer the questions at the end
3. Ask two questions of your own.

What is Cellular Respiration?

How does the food you eat provide energy? When you need a quick boost of energy, you might reach for an apple or a candy bar. But cells do not “eat” apples or candy bars; these foods need to be broken down so that cells can use them. Through the process of cellular respiration, the energy in food is changed into energy that can be used by the body's cells. Initially, the sugars in the food you eat are digested into the simple sugar glucose.

Remember that glucose is the sugar produced by the plant during photosynthesis. The glucose, such as starch, is then passed to the organism that eats the plant. This organism could be you, or it could be the organism that you eat. Either way, it is the glucose molecules that holds the energy.

ATP

Specifically, during cellular respiration, the energy stored in glucose is transferred to ATP (Figure below). ATP, or adenosine triphosphate, is chemical energy the cell can use. It is the molecule that provides energy for your cells to perform work, such as moving your muscles as you walk down the street. But cellular respiration is slightly more complicated than just converting the energy from glucose into ATP. Cellular respiration can be described as the reverse or opposite of photosynthesis. During cellular respiration, glucose, in the presence of oxygen, is converted into carbon dioxide and water. Recall that carbon dioxide and water are the starting products of photosynthesis.
How do cells accomplish all their functions in such a tiny, crowded package? Eukaryotic cells — those that make up cattails and apple trees, mushrooms and dust mites, habitants of this article — have evolved ways to partition off different functions to various locations in the cell. In fact, specialized compartments called organelles exist within eukaryotic cells for this purpose. Different organelles play different roles in the cell — for instance, mitochondria generate energy from food molecules; lysosomes break down and recycle organelles and larger molecules (called macromolecules); and the endoplasmic reticulum helps build membranes and transport proteins throughout the cell. But what characteristics do all organelles have in common? And why was the development of three particular organelles — the nucleus, the mitochondrion, and the chloroplast — so essential to the evolution of present-day eukaryotes?

What Defines an Organelle?

In addition to the nucleus, eukaryotic cells may contain several other types of organelles, which may include mitochondria, chloroplasts, the endoplasmic reticulum, the Golgi apparatus, and lysosomes. Each of these organelles performs a specific function critical to the cell’s survival. Moreover, nearly all eukaryotic organelles are separated from the rest of the cellular space by a membrane, in much the same way that interior walls separate the rooms in a house. The membranes that surround eukaryotic organelles are based on lipid bilayers that are similar (but not identical) to the cell’s outer membrane.

Like the cell membrane, organelle membranes function to keep the inside “in” and the outside “out.” This separation allows different kinds of biochemical reactions to take place in different organelles. Although each organelle performs a specific function in the cell, all of the cell’s organelles work together in an integrated fashion to meet the overall needs of the cell. For example, reactions in a cell’s mitochondria transfer energy from fatty acids and other molecules into an energy-rich molecule called adenosine triphosphate (ATP). After that transfer, the rest of the cell’s organelles use this ATP as the source of the energy they need to operate.

Because most organelles are surrounded by membranes, they are easy to visualize with magnification. For instance, researchers can use high resolution electron microscopy to take a snapshot through a thin cross-section or slice of a cell. In this way, they can see the structural detail and key characteristics of different organelles — such as the long, thin compartments of the endoplasmic reticulum or the compacted chromatin within the nucleus. An electron micrograph therefore provides an excellent blueprint of a cell’s inner structures. Other less powerful microscopy techniques coupled with organelle-specific stains have helped researchers see organelle structure more clearly, as well as the distribution of various organelles within cells. However, unlike the rooms in a house, a cell’s organelles are not static. Rather, these structures are in constant motion, sometimes moving to a particular place within the cell, sometimes merging with other organelles, and sometimes growing larger or smaller. These dynamic changes in cellular structures can be observed with video microscopic techniques, which provide lower-resolution movies of whole organelles as these structures move within cells.
Reciprocal Teaching

Purpose: The purpose of reciprocal teaching is to facilitate a group effort among students in the task of bringing meaning to the text.

Directions: Each person will read parts aloud (you decide as a group how that will happen). Within your group, each person will take a turn predicting, questioning, clarifying, visualizing, and you will work together to summarize the information. Each person is responsible for writing their own answers -- NO COPYING. Discuss your thoughts first, then independently write your answers.

Have your "Train your brain to read" bookmark out in front of you for this activity, to help with sentence stems and questions.

What can a tiny plant do that you can’t do?

This tiny plant can use the energy of the sun to make its own food. You can’t make food by just sitting in the sun. Plants are not the only organisms that can get energy from the sun, however. Some protists, such as algae, and some bacteria can also use the energy of the sun to make their own food.

Discuss your predictions as a group:

Based on this paragraph, I predict that this reading will be about

I predict this will be about the ways the plants are not getting food.

What do you already know about this topic?

What I already know is plants can give us food by sunlight.

What is Photosynthesis?

If a plant gets hungry, it cannot walk to a local restaurant and buy a slice of pizza. So, how does a plant get the food it needs to survive? Plants are producers, which means they are able to make, or produce, their own food. They also produce the "food" for other organisms. Plants are also autotrophs.

Back in the food webs unit, we used the word AUTOTROPH. Look back in your notes about what the word AUTOTROPH means.

\[ \text{AUTO=} \text{self,} \quad \text{TROPH = nourishing} \]

An Autotroph is an organism that makes their own food

Give four examples of autotrophs.

1) Plants
2) Trees
3) Grass
4) Flowers

Get this list approved by Ms. Holcomb before you continue on.
Autotrophs are the organisms that collect the energy from the sun and turn it into organic compounds. Using the energy from the sun, they produce complex organic compounds from simple inorganic molecules. So once again, how does a plant get the food it needs to survive?

Through photosynthesis, Photosynthesis is the process plants use to make their own "food" from the sun's energy, carbon dioxide, and water. During photosynthesis, carbon dioxide and water combine with solar energy to create glucose, a carbohydrate (C₆H₁₂O₆), and oxygen.

The process can be summarized as: in the presence of sunlight, carbon dioxide + water → glucose + oxygen.

Glucose, the main product of photosynthesis, is a sugar that acts as the "food" source for plants. The glucose is then converted into usable chemical energy, ATP, during cellular respiration. The oxygen formed during photosynthesis, which is necessary for animal life, is essentially a waste product of the photosynthesis process.

Actually, almost all organisms obtain their energy from photosynthetic organisms. For example, if a bird eats a caterpillar, then the bird gets the energy that the caterpillar gets from the plants it eats. So the bird indirectly gets energy that began with the glucose formed through photosynthesis. Therefore, the process of photosynthesis is central to sustaining life on Earth. In eukaryotic organisms, photosynthesis occurs in chloroplasts. Only cells with chloroplasts—plant cells and algal (prolifer) cells—can perform photosynthesis. Animal cells and fungal cells do not have chloroplasts and, therefore, cannot photosynthesize. That is why these organisms, as well as the non-photosynthetic protists, rely on other organisms to obtain their energy. These organisms are heterotrophs.

Write a summarizing sentence for this page (2 at most).
Plants use photosynthesis to create their own food by using light, carbon dioxide, and water. When they take these three components in, they release oxygen and glucose. Glucose turns to ATP during cellular respiration and oxygen gets taken in by animals.
Write the chemical formula of photosynthesis:

\[ 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light} \rightarrow \text{C}_6\text{H}_12\text{O}_6 \]

Explain why there are the large 6's in front of the letters. (Do some research, if needed.)

To show that there is 6 carbon dioxide, water, and oxygen molecules

\# of Molecules

Explain why there are the little numbers after the letters. (Do some research, if needed.)

\# of Atoms

Do some research and draw a model of each molecule. (carbon dioxide, water, oxygen, glucose)

<table>
<thead>
<tr>
<th>CO₂</th>
<th>H₂O</th>
</tr>
</thead>
</table>

Reflect: Before March, I knew this about photosynthesis:

That plants need sunlight, water, and carbon dioxide to survive.

Now, I know this about photosynthesis:

That autotrophs do photosynthesis by taking energy from the sun, water, and carbon dioxide and convert it into oxygen and glucose and they turn glucose into ATP.
APPENDIX F

STUDENT ENGAGEMENT SURVEYS

(INITIAL, AFTER FIRST ROUND OF TREATMENT,)
Science Engagement Initial Survey
Thank you for providing your honest response. Reminder: your answers will be confidential and your participation is voluntary; non-participation will not affect your class grade in any way.

1. How would you rate your effort in science classes in the past? (before 8th grade) Mark only one oval.
   - 1-No effort
   - 2-A little bit of effort, but not a lot
   - 3-Some effort, but not as much as I could have
   - 4-As much effort as possible

2. How would you rate your effort you PLAN TO GIVE in 8th grade? Mark only one oval.
   - 1-No effort
   - 2-A little bit of effort, but not a lot
   - 3-Some effort, but not as much as I can
   - 4-As much effort as possible

3. Why did you choose your answer for the previous question? (About effort for 8th grade science)

   __________________________________________

   __________________________________________

   __________________________________________

4. I like to learn about science topics.
   Mark only one oval.
   - 1-Really disagree
   - 2-Somewhat disagree
   - 3-Somewhat agree
   - 4-Really agree
5. (Choose the answer that best finishes the sentence about YOU) When I am in science class... 
Mark only one oval.

- I work as hard as I can
- I do some work, but I could use my time better
- I only do a little work
- I don’t do my work.

6. Why? (Follow-up to "When I am in science class....")

7. (Choose the answer that best finishes the sentence about YOU) When the science classwork is hard, I usually.... 
Mark only one oval.

- Ask for help, or use resources I have access to
- Try to figure it out myself
- Give up
- Other: __________________________________________

8. Science topics are interesting to learn about. 
Mark only one oval.

- 1-Really disagree
- 2-Somewhat disagree
- 3-Somewhat agree
- 4-Really agree

Myself as a Science Reader
Thank you for providing your honest response. Reminder: your answers will be confidential.

9. Where do you think you are as a reader? (Think about your RI tests that you do in your language arts class) 
Mark only one oval.
10 **Do you think your reading ability hurts or helps you learn science?** *Mark only one oval.*

- [ ] Hurts -- it makes it harder to learn science
- [ ] Helps - It makes it easier to learn science
- [ ] Neither -- it doesn't make it harder or easier to learn science

11. **What do you wish your science teacher would do to help you read better in science class?**

12. **What have you LIKED about science class in the past?** (before 8th grade) (Check all that apply)

   *Check all that apply.*

   - [ ] Labs/Hands-on activities
   - [ ] Science Fair
   - [ ] Reading/Writing
   - [ ] Projects
   - [ ] The topics we learned about
   - [ ] Other: ____________________________

13. **What other things did you like that were not listed in the question above?** (Other things you liked)
14. What have you DISLIKED about science class in the past? (Before 8th grade) (Check all that apply)

*Check all that apply.*

- [ ] Labs/Hands-on activities
- [ ] Science Fair
- [ ] Reading/Writing
- [ ] Projects
- [ ] The topics we learned about
- [ ] Other: ____________________________

15. What other things did you dislike that were not listed in the question above? (Other things you disliked)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

16. What do you do well with in science class? (in the past years)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

17. What do you struggle with in science class? (in the past years)

________________________________________________________________________
Your name will not be used in reporting the data.

18. First Name

19. Last Name

20 Class Period *Mark only one oval.*

- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7
Science Engagement Survey (after treatment round 1)
Thank you for providing your honest response. Reminder: your answers will be confidential and your participation is voluntary; non-participation will not affect your class grade in any way.

1. How much have you liked science class (this school year only)? Mark only one oval.
   - 1-Really disliked
   - 2-disliked some
   - 3-Liked some
   - 4-Really liked

2. How would you rate your effort in science class? (in 8th grade only) Mark only one oval.
   - 1-No effort
   - 2-A little bit of effort, but not a lot
   - 3-Some effort, but not as much as I could have
   - 4-As much effort as possible

3. Why did you choose your answer for the previous question? (About effort for 8th grade science)
4. I like to learn about science topics.  
Mark only one oval.

1-Really disagree
2-Somewhat disagree
3-Somewhat agree
4-Really agree

5 I would consider a job in a science-related field. Mark only one oval.

1-Really disagree
2-Somewhat disagree
3-Somewhat agree
4-Really agree

6. Why did you answer that way about science-related jobs?

7. (Choose the answer that best finishes the sentence about YOU) When I am in science class...  
Mark only one oval.
I work as hard as I can
I do some work, but I could use my time better
I only do a little work
I don't do my work.

8. Why? (Follow-up to "When I am in science class....")

9. (Choose the answer that best finishes the sentence about YOU) When the science classwork is hard, I usually.... Mark only one oval.

   - Ask for help, or use resources I have access to
   - Try to figure it out myself
   - Give up
   - Other:

10 What could Ms. Holcomb do to help you stay on task in class?

11. Science topics are interesting to learn about. Mark only one oval.

   - 1-Really disagree
   - 2-Somewhat disagree
   - 3-Somewhat agree
   - 4-Really agree
Myself as a Science Reader
Thank you for providing your honest response. Reminder: your answers will be confidential.

12. The vocabulary strategies that we have used in the past five weeks have helped me understand the science topics better. Mark only one oval.

☐ 1-Strongly Disagree
☐ 2-Disagree
☐ 3-Agree
☐ 4-Strongly Agree

13. What would make the vocabulary easier to learn?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

14. The writing to learn (to summarize what we have learned) has helped me understand the science topics better. Mark only one oval.

☐ 1-Strongly disagree
☐ 2-Disagree
☐ 3-Agree
☐ 4-Strongly agree

15 Have any of these strategies helped you stay on task in class? Mark only one oval.

☐ Yes
☐ No
16. Why or why not?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

17. What could Ms. Holcomb do to help you learn science topics better?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

18. What do you wish Ms. Holcomb would do to help you read better in science class?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Science Success

Thank you for providing your honest response. Reminder: your answers will be confidential.

19. What do you do well with in science class? (This year only)
20. What do you struggle with in science class? (This year only)

21. First Name

22. Last Name

23. Class Period *Mark only one oval.*

- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7
Science Engagement Survey (after treatment round 2)

Thank you for providing your honest response. Reminder: your answers will be confidential and your participation is voluntary; non-participation will not affect your class grade in any way.

1. How much have you liked science class (this school year only)? Mark only one oval.
   - 1-Really disliked
   - 2-disliked some
   - 3-Liked some
   - 4-Really liked

2. How would you rate your effort in science class? (in 8th grade only) Mark only one oval.
   - 1-No effort
   - 2-A little bit of effort, but not a lot
   - 3-Some effort, but not as much as I could have
   - 4-As much effort as possible

3. Why did you choose your answer for the previous question? (About effort for 8th grade science)

4. I like to learn about science topics.
   Mark only one oval.
   - 1-Really disagree
   - 2-Somewhat disagree
   - 3-Somewhat agree
   - 4-Really agree
5 I would consider a job in a science-related field. **Mark only one oval.**

- 1-Really disagree
- 2-Somewhat disagree
- 3-Somewhat agree
- 4-Really agree

6. Why did you answer that way about science-related jobs?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

7. (Choose the answer that best finishes the sentence about YOU) When I am in science class...
   **Mark only one oval.**

- I work as hard as I can
- I do some work, but I could use my time better
- I only do a little work
- I don't do my work.

8. Why? (Follow-up to "When I am in science class....")

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

9. (Choose the answer that best finishes the sentence about YOU) When the science classwork is hard, I usually.... **Mark only one oval.**
Ask for help, or use resources I have access to
Try to figure it out myself
Give up
Other: ________________________________

10 What could Ms. Holcomb do to help you stay on task in class?

11. Science topics are interesting to learn about. Mark only one oval.
   - 1-Really disagree
   - 2-Somewhat disagree
   - 3-Somewhat agree
   - 4-Really agree

Myself as a Science Reader
Thank you for providing your honest response. Reminder: your answers will be confidential.

12. The vocabulary strategies that we have used in this school year have helped me understand the science topics better. Mark only one oval.
   - 1-Strongly Disagree
   - 2-Disagree
   - 3-Agree
   - 4-Strongly Agree

13. What would make the vocabulary easier to learn?
14. The critical reading strategies that we have used in the past six weeks have helped me understand the science topics better. (marking text, discussion points) *Mark only one oval.*

- [ ] 1-Strongly Disagree
- [ ] 2-Disagree
- [ ] 3-Agree
- [ ] 4-Strongly Agree

15. Why or why not?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

16. The reciprocal teaching strategies that we have used in the past six weeks have helped me understand the science topics better. *Mark only one oval.*

- [ ] 1-Strongly Disagree
- [ ] 2-Disagree
- [ ] 3-Agree
- [ ] 4-Strongly Agree

17. Why or why not?
18. Have any of these strategies helped you stay on task in class? Mark only one oval.

☐ Yes
☐ No

19. Why or why not?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

20. What could Ms. Holcomb do to help you learn science topics better?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

21. What do you still wish Ms. Holcomb would do to help you read better in science class?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Science Success
Thank you for providing your honest response. Reminder: your answers will be confidential.

22. What do you do well with in science class? (This year only)

23. What do you struggle with in science class? (This year only)

**Untitled Section**

Your name will not be used in reporting the data.

24. First Name

25. Last Name

26. Class Period *Mark only one oval.*
APPENDIX G

STUDENT INTERVIEW QUESTIONS
(Say) May I record you for the purpose of writing out your responses later?
This interview is a follow-up to the survey that you did in class recently. Your participation is voluntary, and if you choose to not participate, your grade in class will not be affected in any way. Are you willing to participate?

Tell me more about your effort in science class.

Do you feel like you are successful in science? Why/why not? Have you always felt this way? How long have you felt this way?

What is easy about science for you? Why do you think that is?

What is not easy about science for you? Why do you think that is?

What have science teachers done in the past that have helped you learn?

What have science teachers done in the past that have helped you stay on task in class?

What have science teachers done in the past that have helped you complete class work?

Describe what you feel when you are working on something that is hard in science class.

Describe what you do when work is hard in science class.

(After Round 1)
Tell me what you think about the vocabulary strategies we have used in the last four weeks.

Have the vocabulary strategies been helpful for you? Why or Why not?
In what way have these strategies changed how you think or feel about science?
(In what ways have they been helpful?) (How could they be more helpful?) (Have they helped you stay on task? why/why not?) (Have they helped you complete work? why/why not?)

Tell me what you think about the writing strategies we have used in the last four weeks.

Have the writing strategies been helpful for you? Why or why not?
In what way have these strategies changed how you think or feel about science?
How? Why/why not?
(How could they be more helpful?) (Have they helped you stay on task? why/why not?) (Have they helped you complete work? why/why not?)

Has anything else changed in the last four weeks that has helped you stay on task?
Complete more work?

(After Round 2)
Tell me what you think about the critical reading strategies we have used in the last four weeks.

Have these strategies been helpful for you? Why or why not?
In what way have these strategies changed how you think or feel about science?
How? Why/why not?
(In what ways have they been helpful?) (How could they be more helpful?) (Have they helped you stay on task? why/why not?) (Have they helped you complete work? why/why not?)

Tell me what you think about the reciprocal teaching we have tried in the last four weeks.
Has this been a helpful strategy for you? Why or why not?
In what way have these strategies changed how you think or feel about science?
How? Why/why not?
(In what way was it helpful?) (How could that be more helpful?) (Did that strategy help you stay on task? why/why not?) (Did this help you complete work? why/why not?)

Has anything else changed in the last four weeks that has helped you stay on task?
Complete more work?