THE EFFECTS OF USING LITERACY-BASED LEARNING STRATEGIES
WITH A GROWTH MINDSET INTERVENTION ON STUDENTS’
PERFORMANCE ON STATE STANDARDIZED
BIOLOGY CONCEPTS

by

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DEDICATION, ACKNOWLEDGEMENT

I would like to dedicate this paper to my husband, Tom, and my children, Emma, Anna, and Richie, from whom my study has stolen many precious hours. I would also like to thank my students who have put in the extra time and work to help me complete the research. I would also like to acknowledge my colleagues at Mifflin County High School and in the MSSE program that have helped me along the way.
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ABSTRACT

My goal as a teacher is to inspire students to become life-long learners and it starts with providing them with the tools and mindset in which they can use for life’s challenges. Learning and test success can both be achieved when students are provided effective learning strategies and growth mindset in which they are more cognizant of how their brains and actions can lead to learning and success. A mindset is a belief system built on one’s perceptions of ability and intellect. Students rarely have a chance to explore or change their personal beliefs about intellect and learning in a high-stake testing environment. The Pennsylvania State Keystone Biology Exam is a state mandated test that students are required to take at the closure of the Biology I course I taught to tenth grade students. This study investigated the use of a literacy strategy called, close reading (where students interact with the text) and a growth mindset intervention on student performance on biology concepts. It also investigated their attitudes and motivations during the intervention.

Students’ performance scores were greater with the intervention and their motivations were centered on effective learning strategies. Growth mindset and the literacy strategy, close reading, increased achievement and validated the choices of the students. Students were empowered to apply effort and work for self-improvement in the instructional setting. I followed the lead of the students and realized that it was gratifying to fill the role of facilitator instead of instructor. Growth mindset intervention and the close reading literacy strategy provided transferable skills and a belief system that students can use toward contributing to a society set in the information age.
INTRODUCTION

The topic of this project is to deliver a growth mindset intervention and to implement reading strategies to determine the effect on students’ understanding of biology concepts. My goal as a teacher is to inspire students to become life-long learners. The goal becomes challenging when the students and teachers are met with the pressure of year-end, high stakes, mandatory state exams for Biology. These state standardized exams are a byproduct of the Common Core State Standards (CCSS).

Pennsylvania adopted the Common Core State Standards in 2012. The Common Core State Standards emphasize reading for meaning. This practice involves text rendering at a level of rigor higher than most science content area instructors are used to addressing in their classrooms. Integrating the CCSS has led to an increasing emphasis on standardized tests in Pennsylvania. The Pennsylvania Department of Education has a graduation requirement of a passing performance for the standardized end of course exam in Biology. In effect, if students do not receive passing scores on the test, they will not receive a high school diploma. In addition, students’ performance on state standardized tests are integrated into school district and teacher evaluations.

The Pennsylvania School Performance Profile (SPP) is a part of the Educator Effectiveness System evaluating teachers and principals. The SPP provides a school level academic score for public schools (Pennsylvania Department of Education, n.d.). A portion of the SPP score is generated by the academic achievement of the students’ performance on the end of the year standardized tests called the Keystone exams. There are three Keystone exams that students take by the end of their tenth-grade year. The courses with the curriculum for this content are referred to as trigger courses. Trigger
courses in Pennsylvania are English, Algebra and Biology. Individual teacher
evaluations are also determined by students’ academic achievement on the Keystone
exams in the trigger courses. As a result, teachers and administrators have a vested
interest in increasing students’ performance due to these rating profiles.

The Pennsylvania Keystone Biology Exams consist of two modules: Module A-
Cells and Cell Processes, and Module B- Continuity and Unity of Life. Each module has
four state approved assessment anchors that drive instruction for Biology during the
school year (Appendix A). Significantly, the curriculum that is created to meet testing
requirements is not viable for all levels of students to learn at a mastery level in one
school year. The testing format is structured so the majority of the questions require the
students to reference informational text to find answers. The challenge for teachers is to
develop engaging and meaningful instructional strategies that align with the state testing
standards and constructs of the exam.

This study occurred in the Mifflin County School District (MCSD) located in
rural central Pennsylvania. In 2011 the school district consolidated its two high schools
into one Mifflin County High School. Mifflin County High School consisted of grades
10 through 12 and had a student population of 1,217 students. The district-wide student
population was 5,087 and is approximately 98% Caucasian, 1% African American with
the remaining 1% consisting of Hispanic, Latino and other. Approximately half of the
student population was eligible for the national free and reduced lunch program. MCSD
had a current passing rate of 66.3% on the Keystone Biology Exam. However, this
number was not a true reflection of the challenges faced by students and teachers in the
high school. The junior high school in MCSD tracked students who are deemed
advanced into Biology I for ninth grade. Their passing rate was 93.3% while the high school passing rate was 51.6% for the students taking Biology I in tenth grade. The participants involved in this study included 51 students in three heterogeneously grouped sections of Biology I class in tenth grade at Mifflin County High School.

The construction of the Keystone exam is literacy based with many reading passages and text dependent analyses. Students need comprehension skills in order to answer the accompanying multiple choice and constructed response questions. The students’ achievement and passing rate is determined by their ability to interact with and render the text. One of the issues facing students is that many students are not at grade level in their reading. Therefore, these students enter the test at a distinct disadvantage. Their test performance may not reflect their content knowledge, but rather it may reflect their reading comprehension ability. When students are measured by their performance on the test they lose interest in school and confidence in their ability for performance tasks (Dweck, 2006).

There are many literacy strategies to facilitate the in-depth student interaction with texts that assist with comprehension. A close reading strategy is a literacy strategy in which the students will read a text with a specified purpose. The idea is to read for a general glance and narrow the focus to specific details in the passage to promote better conceptual knowledge. Annotation is a part of the close reading process in which the students interact with the text. Students will highlight important points, generate questions and surmise thoughts to be written in the margins of the informational text. Close reading also has a social component for students to share and curate their own personal framework for knowledge. Lastly, text dependent questions send the reader
back to the text again to provide evidence for their answers given, a process which scaffolds critical thinking.

In conjunction with providing close reading strategies for standardized exams, a look at the students’ belief systems about themselves and their abilities can facilitate a positive effect on their performance. Throughout my years as a teacher, I have heard the phrase, “I am not a good test taker,” used by students to explain away a poor test grade. This attitude is even more worrisome because high stakes tests today can impact a students’ academic career by the state requiring proficiency on the Keystone Exam to receive a High School diploma. Performance on standardized tests determines if students are tracked into the ninth grade Biology I class or the later tenth grade Biology I class. Good, Aronson and Inzlicht, (2003) found that students’ performance on standardized tests do not predict abilities of future achievement because of stereotype threat. The tracked tenth grade students may be self-confirming their abilities based on the grouping in which they are placed, called stereotypic threat. Changing students’ belief system about their intellectual abilities can lead to positive effects that will impact life-long learning awareness as well as test performance.

Many social-psychological interventions that focus on intellect being malleable can change students’ perspective of school and learning (Yeager & Walton, 2011). A growth mindset is a social-psychological intervention that targets students’ beliefs about their potential intellectual abilities. Growth mindset is the incremental intelligence view in which a student’s intellect is not fixed and it will improve with effort. Social – psychological interventions that focus on incremental intelligence along with specific literacy interventions will serve as a framework for this project. The focus was to
improve students’ conceptual understanding (performance on standardized tests) and show a growth mindset perspective to become life-long learners.

My primary focus question for this project was the following: What are the effects of implementing a close reading strategy with a growth mindset intervention on biology students’ performance and understanding of concepts? Close reading is a reading comprehension strategy that is explicitly taught and involves reading with a purpose by necessitating careful analysis of the informational text supplied. Since standardized tests for biology threaten to disenfranchise students from education by mandating a graduation requirement, I posed the following subquestion: What are the effects of combining reading strategies with a growth mindset intervention on students’ attitude and motivation? In addition, teacher performance ratings, based on students’ performance on the Keystone exam, create a high stress environment. Consequently I posed the following subquestion: What are the effects of combining reading strategies with a growth mindset intervention on teachers’ attitude and motivation?

I have established a support team that offered assistance with the development of this project. Thomas A. Butler, Ph. D. has participated in all levels of education since 1991. He has been a cornerstone in my educational development and offered sound advice throughout this project. In addition, my MSSE project advisor and academic advisor, Peggy Taylor, my co-project advisor, Heather Dietz and my science reader, Louise Mead brought a critical eye to the project development.
CONCEPTUAL FRAMEWORK

Cordon and Day (1996) investigated the use of learning strategies by students on standardized tests and found that explicitly-taught comprehension strategies were used more in standardized testing situations than on classroom-assigned reading assignments. When students have the tools to successfully navigate the reading of informational text for meaning they value the act of becoming a participant in society (Cummins, 2013; Katz & Carlisle, 2009). Literacy strategies that have been the norm in language arts for 65 years now have become a necessity for content area instruction due to the composition of standardized exams. Text rendering of informational/expository text that involves details and factual statements rich with terms is less likely to be interpreted with contextual meaning (Fang & Pace, 2013). Informational texts use vocabulary words that are not frequently encountered by the student because they are content specific. In addition, students may encounter comprehension problems due to implicit meanings that do not connect to the text directly or to the text dependent questions being asked (Fang & Pace, 2013). Introducing new text styles and strategies into the classroom involves bringing to light awareness for both the teacher and the student.

Literacy strategies need to be explicitly taught to students (Williams, Stafford, Lauer, Hall, & Pollini, 2009; Ragevich & Perin, 2008). With explicit instruction and practice students will become self-regulating and transfer the use of these strategies to other tasks and situations (Stoeger, Sontag, & Ziegler, 2014). According to Cummings (2013), teaching for close reading needs to be explicit and is most effective when integrated naturally into the content learning process. Botel (2015) also states, “Informational texts that are whole and written for authentic proposes in the world and
brought into the classroom, usually make better reading materials than fragments or material written or rewritten strictly for school use” (p.123).

Close reading is a literacy strategy that can improve reading comprehension as measured by standardized and experimental texts (Katz & Carlisle, 2009). Students are more motivated when they have strategies to facilitate comprehension with text that allow them to read for meaning (Katz & Carlisle, 2009). Naturally-aware readers will incorporate prior knowledge, identify pertinent text language and find purpose in the reading. Lecturing or written guides are not effective in teaching students to interact with text in a substantial way. Effective learning occurs when students are coached continually while provided the opportunity to co-construct information drawn from various texts over the school year (Botel, 2015).

Close reading strategies can be taught with varying degrees of text interaction. It is a process that has the student read, interact with and revisit the text with a purpose, while constructing deeper meaning. This is usually done with annotations and text dependent questions. Best practices for close reading allow students to co-construct knowledge through social interactions, text annotation, and text dependent questions.

Social interaction via open dialogue creates an environment where students are creating knowledge based upon several interpretations and perspectives. Text annotations bring focus to the meaning of the text by underlining, highlighting and writing question or connections (Katz & Carlisle, 2009; Castilleja, 2011). Text dependent questions make the purpose for reading clear, resulting in students’ revisiting the text and reading for deeper analysis. Text-dependent questions should require students to search, infer and make text dependent judgments (Lapp, Grand, Moss, & Hohnson, 2013). Close reading
strategies coupled with student’s positive belief system can enable the effective use of these strategies on standardized tests.

Psychological interventions are more effective when they work in conjunction with other structures in the learning environment, such as well-defined literacy strategies. The psychological intervention works to change students’ mindsets allowing a greater prospect for learning opportunities with the use of the taught strategies (Yeager & Walton, 2011). In addition, Manson (2004) found that teaching text strategies that are used in combination with metacognitive strategies is more effective than teaching text strategies alone. Students working within a belief system that intellectual ability is something that can be improved are more likely use the strategies they have been taught to improve their skills (Dweck, 2006).

Social-Psychological intervention targets students’ subjective experiences in school. The incremental theory of intelligence is explained by Dweck (2006) as a growth mindset. Dweck identifies the growth mindset as a view of intelligence being malleable, thus students’ believe poor performance is accredited to lack of effort and poor strategy rather than an intellectual deficit. The contrasting fixed mindset is viewed as intelligence being unchangeable and students are more likely to attribute setbacks to lack of innate ability. Targeting students’ thoughts, feelings and beliefs affects student achievement (Yearger & Walton, 2011). For example, Blackwell, Trzesniewski, and Dweck (2007) found that a growth mindset intervention raised achievement for middle school math students over the course of an academic year. Other groups of students typically stereotyped as difficult to educate (low socio-economic, racial minorities and gender) performed higher on standardized tests with incremental intelligence intervention that
redirected the negative blame for setbacks from self to the content (Good, Aaronson, and Inzlicht, 2003).

The Common Core State Standards have sought to raise standards for teaching and learning across the nation. The approach used to implement the CCSS by Pennsylvania is to increase performance requirements on the increasing number of standardized tests taken by students. In Dweck’s (2006) book, she states the effects of both lowering and raising standards but make a poignant statement, “Simply raising standards in our schools without giving students the means of reaching them, is a recipe for disaster. It just pushes the poorly prepared and poorly motivated students into failure and out of school.” (p. 194). Yeager and Walton (2011) conclude that social-psychological interventions unleash a potential for students to tap into the learning opportunities that are being used in schools such as specific learning strategies that are a part of current reforms. Literacy strategies such as close reading can provide the learning tools than can be used on standardized tests to improve performance.

METHODOLOGY

To address the high-stakes state standardized exam that was given in Biology as an end course assessment, I used a literacy strategy called close reading and a Social-Psychological intervention called growth mindset. Close reading involved a focus on interacting with the text by using annotations, verbal think-alouds and text dependent questions. Students’ beliefs about their intellectual ability can limit performance on standardized tests. I implemented a growth mindset intervention to focus on brain plasticity improving motivation and work ethic. Several authors’ have found that revealing students beliefs about intelligence and providing explicit literacy strategies
which students have the tools to use for success on standardized tests allowed the students to perform better in a high-stakes testing situations (Good, Aaronson, & Inzlicht, 2003 and Yearger & Walton, 2011).

Participants

The Biology I course is required for graduation and it has a state mandated end of the course assessment called the Keystone Biology Exam. Mifflin County High School offered Biology I to non-advanced tracked students in tenth grade. Non-advance tracked students can be generalized as low to mid performing, vocational tracked, students with Individualized Education Plans (IEP), and students not planning on attending a post-secondary education. The participants in this study were tenth graders taking Biology I. I used three of my five Biology I classes taught during the spring of 2016. The average age of the students was 15 years old. There were 35 males and 16 females in the 3 classes of Biology. The students were heterogeneously mixed with 3 of the 51 participants having Individual Education Plans in place for learning needs. The demographics of the classes were representative of the school in which the majority of students were Caucasian and of low to medium socio-economic status.

Project Treatment

To answer the research focus question and subquestions, a nontreatment unit and two treatment units were used with the intent to compare student performance and motivation. The nontreatment unit, chemical basis for life, was taught with traditional instruction using group work, notes, labs and independent practice. The treatment consisted of two units, which were cell transport/homeostasis and bioenergetics. The
growth mindset intervention was explicitly taught prior to the first treatment unit as shown in Table 1.

Table 1

Table 1

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<th>Implementation Time of Nontreatment and Treatment Units Incorporating the Growth Mindset Intervention and Close Reading Strategy</th>
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<tr>
<td>Explicit instruction for growth mindset/ close reading</td>
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<tr>
<td>Treatment unit- Cell Membrane/Homeostasis with growth mindset and close reading</td>
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<tr>
<td>Treatment unit- Bioenergetics with growth mindset and close reading</td>
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Growth mindset was reinforced through both treatment units by bringing awareness to students’ self-talk, actions, goal setting and reflections. In addition, teacher feedback fostered growth mindset awareness and was continued through both treatment units. The close reading strategy was first implemented to teach the explicit neuroscience portion of the growth mindset intervention. Close reading was used various times throughout the treatment units to focus on content material.

At the beginning of the treatment unit the students participated in a growth mindset intervention that involved a survey, explicit instruction on neuroscience and close reading an article. Growth mindset strategies continued to be reinforced in both treatment units through student reflection and goal setting. Mindful of research that found students who were praised for grades tended to display lower task performance, and persistence compared to an effort praise group (Mueller & Dweck, 1998), feedback in my
Action Research intervention was given according to the effort displayed by students. To minimize the approval seeking behavior of students referencing grades, test scores were reported on assessments as raw growth scores only. The growth scores were calculated by each student to reinforce a connection to individual improvement according to the work and effort they applied.

The literacy strategy of close reading is a strategy that needs to be explicitly taught and reinforced with practice so the students benefit from the process (Rupley, Blair & Nichols, 2009). Close reading is labor intensive for the students and requires prolonged class time. For this reason I incorporated only three per unit from varying sources. One of the texts used for close reading was an informational passage from a textbook. A second text used was from an authentic source such as a newspaper or periodical and the third text used was from a lab taught in the unit. Each time the close reading strategy was implemented, the students were given the article to read for a general preview. The second read was to annotate the text finding main ideas or making connections to previous knowledge. The final read involved various scenarios of verbal sharing or reporting, finding evidence for text dependent questions or summarizing the main idea.

**Data Collection Tools**

A standardized testing tool was used called Classroom Diagnostic Tools (CDT). It is an assessment tool developed for the Pennsylvania Department of Education with each question on the assessment specifically aligned to the Pennsylvania State Standards. The CDT is a computer adaptive test (CAT) in which the computer determines the next student question based on the previous student response. The CAT uses this follow-up
response to generate the unique student performance report showing the relationship to the state standards. Each student got a unique set of multiple choice questions, and a diagnostic report was created showing each student’s understanding and abilities aligned to the standards. The CDT was first administered early in the school year to establish a baseline performance score. It was administered a second time after the nontreatment unit and a third time after the completion of both treatment units.

The diagnostic report that I used was called the Individual Learning Progression Map which provided a snapshot for each student’s areas of strengths and weaknesses on the eligible content (Pennsylvania Department of Education, n.d.). In addition, teacher generated pre and posttreatment content assessments (Appendices B-D) were given for each intervention unit. Teacher-made tests allowed for a more narrow focus on the assessment anchors as well as providing the students with practice answering text-dependent constructed-response type questions. The teacher-made tests were analyzed using a normalized gain score. The normalized gain measures the fraction of the available improvement that is obtained by the student (Hake, 1998). Both of these assessment tools helped determine the effects of using literacy-based instruction with a mindset intervention on student performance on state standardized biology concepts. The CDT and pre and posttreatment content assessments showed the growth and understanding of the standard as clarified in anchor assessments by each student.

Prior to the intervention all students took a survey about their beliefs related to their intellect and perceived ability to determine their mindset (Appendix E). A post survey with varying questions about ability beliefs and motivation was given at the completion of the intervention units (Appendix F). The mindset survey was adapted by
using similar survey questions from Mindset Works (n.d.) to ensure that the proper
protocol for eliciting a fixed or growth mindset. A numerical scale was adapted from a
mindset survey used by Forin School District (Diehl, 2008). Pretreatment and
posttreatment mindset surveys had equal amounts of growth and fixed mindset questions,
but the post survey had varying language. The different wording of the posttreatment
survey is to account for bias. Once students are explicitly taught about growth mindset
they will pick up on the key phrases that identify a fixed mindset verses a growth
mindset. Each mindset survey was set up with a Likert scale of four choices in which the
choices are numbered from zero to three. The numerical scale was used to produce a
total score. The total score classified the student as strong growth mindset, growth
mindset with fixed ideas, fixed mindset with growth ideas and strong fixed mindset. The
pre and posttreatment survey classification helped to identify a change in belief systems
about intellectual ability.

Student observational rubrics (Appendix G) were used to gather data on students’
mindset pre and posttreatment. The observation rubric was adapted from the Effective
Effort Rubric offered by Mindset Works (n.d.) in their educator tool kit. The
observations recorded were based on how students reacted to various classroom tasks.
Two students from each class were observed. These students were chosen according to
their response to the mindset survey, one from the growth mindset fixed ideas category
and one from the fixed mindset category. The fixed mindset category student
representation was simply determined by the person with the lowest score on the survey,
but the growth mindset student representation was determined by a purposeful selection
of students that had a good attendance record and demonstrated some collaborative
abilities. Each student was observed twice during the nontreatment unit and twice for each treatment unit. The student observation rubrics helped determine if students’ actions corresponded to their belief systems as identified from the mindset survey. It is common for students to identify with the growth mindset because this will be considered a positive behavior. The observations determined if a change in belief systems carried over to a change in actions.

Student interviews were used to determine the effects of combining reading strategies with a growth mindset intervention on students’ attitudes and motivations. Interviews were conducted once for the nontreatment unit and once for the treatment units. Three students from each class for a total of nine students were chosen based on availability for participation in interviews. Those students that had study halls in conjunction with my preparation period were a best fit to gather timely responses to the interview questions. These students represented basic, proficient and advanced performance levels according to the initial CDT scores. The interview questions (Appendix H) allowed the students to verbalize their perceptions and beliefs as related to their actions in relation to intellect and challenging situations. Interview questions also exposed their thoughts about the close reading strategy. The mindset survey, observations and interviews worked together to look for trends in student responses and actions as it relates to their attitude and motivations for learning content in Biology. The research methodology for this project received an exemption by Montana State University’s Institutional Review Board (Appendix I), and compliance for working with human subjects was maintained.
I kept a journal of my reactions and motivations throughout the pretreatment and posttreatment units. Journal prompts (Appendix J) were used to direct my reflective thought towards the effects of reading strategies and a growth mindset intervention on teacher motivation and attitude. I also used a teacher observation rubric (Appendix K) to generate a second perspective of teacher motivation and attitude. I was observed by a department colleague who was the instructional coach and secondary science coordinator. The teacher observation rubric was created from aligning the journal prompts to expected behaviors of a motivated teacher. Teacher actions and interactions were determined to be positive or negative with respect to verbal language, body language and teaching strategies. The teacher feedback portion of the observation rubric was adapted from Mindset works (n.d.). Observations were done three times, once during the pretreatment unit and once for each of the posttreatment units. The observation rubric was used for both the nontreatment and treatment units to log teacher interactions with students, teacher actions and verbal teacher-student feedback. Observations were an important tool to determine if my journal responses were indicative of my true actions in the classroom. Personal thoughts and observations were analyzed to look for aligned or nonaligned trends.

Data were collected from various sources to address the research questions (Table 2). Therefore, no single data collection source was entirely responsible for my conclusions. The use of the CDT and teacher-made content test were used to determine the potential growth in achievement due to the interventions, while student observations and interviews focused on the students’ attitude and motivation. The teacher reflection journal and observation put a focus on the teacher motivation.
Table 2
Data Triangulation Matrix

<table>
<thead>
<tr>
<th>Focus Question</th>
<th>Data Source 1</th>
<th>Data Source 2</th>
<th>Data Source 3</th>
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<tbody>
<tr>
<td><strong>Primary question:</strong> What are the effects of using literacy based instruction strategies with a growth mindset intervention on students’ performance on state standardized Biology concepts?</td>
<td>Base line score on Classroom diagnostic tool (CDT)</td>
<td>Pre/post unit assessment I</td>
<td>Pre/post unit assessment II</td>
</tr>
<tr>
<td><strong>Secondary question:</strong> What are the effects of combining reading strategies with a growth mindset intervention on students’ attitude and motivation?</td>
<td>Pre and posttreatment student observation rubrics</td>
<td>Pre and posttreatment student surveys</td>
<td>Pre and posttreatment student interviews</td>
</tr>
<tr>
<td>What are the effects of combining reading strategies with a growth mindset intervention on teachers’ attitude and motivation?</td>
<td>Pre and posttreatment observations</td>
<td>Teacher weekly reflection journal</td>
<td>Pretreatment and posttreatment units</td>
</tr>
</tbody>
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DATA AND ANALYSIS

Effects of Close Reading and Growth Mindset on Student Understanding of Biology Concepts

All students took a state standardized practice test called Classroom Diagnostic Tools (CDT) to establish a baseline of student knowledge on the content standards for the state Keystone Biology exam. The ranges of the scores are designated by color on the learning reports as shown in Figure 1.

![Figure 1](image)

*Figure 1. Classroom Diagnostic Tool reporting ranges for student scores. Red was identified as areas of need; Green and Blue were identified as strengths to build on.*

Standards are broken down into eight categories for the Keystone Biology Exam,(Appendix A). These standards were reported in pairs on the diagnostic report that was used to collect data on student performance, called the Individual Learning Progression Map (Appendix L). Individual student reports provided insight into the
specific areas of strength and weakness on the eligible content of the state standards. The paired standards of interests for the nontreatment content unit were Basic Biological Principals/Chemical Basis for Life. The standards for treatment content units were Bioenergetics/Homeostasis and Transport. Student scores on the CDT were analyzed to look for trends when comparing the initial testing score for the nontreatment and treatment content, which was referred to as the baseline score. The percent increase of the statistical mean for the nontreatment post score was 1% greater than the baseline score, while the percent increase of the statistical mean for the treatment post score was a 12% greater than the baseline score. The performance on the nontreatment content standards showed growth but stayed within the red range, identified as areas of need. The performance treatment content standards also showed growth and moved from the red range to the green range, identified as strengths to build on.

The baseline scores for the nontreatment unit showed the students had greater prior knowledge with this content than with the treatment content. Student knowledge of the nontreatment content had a greater spread than the student knowledge of the treatment content. The nontreatment CDT post scores had a larger spread between the upper quartile and lower quartile with the upper quartile range increasing while the lower quartile range was very similar to the baseline lower quartile range. Comparing the treatment CDT baseline scores to the treatment CDT post scores exhibited a large difference in the median scores. The lower quartile for the post scores were above the median for the baseline scores representing the treatment content. The inner quartile range for the treatment content suggests that almost 75% of these students scored above their earlier performance on the initial baseline testing session. The box plots for each of
the post CDT scores for the show the upper quartile for the for the treatment post score was only a three point difference from the median of the nontreatment post CDT score.

The comparison of student performance on the CDT for the nontreatment and treatment baseline and post test scores can be seen in Figure 2. The growth of the nontreatment and treatment scores is also displayed.

Figure 2. Box Plots of the nontreatment and treatment baseline scores and post scores, including growth of nontreatment and treatment performances, (N=51).

Growth scores were determined for the nontreatment and treatment content. There was a much larger growth in scores for the treatment content. The median growth for the nontreatment content showed a growth of zero points and the median for growth
of the treatment showed a growth of 146 points. Fifty percent of the student scores for the treatment content had growth above 50% of the student scores for the nontreatment content. The testing environment for the nontreatment post CDT score was disrupted due to technology difficulties while taking the online test.

Pretests and posttests were given for the content in the nontreatment unit and the treatment units. The treatment content consisted of two units due to the intensive class time requirements for the Action Research intervention of close reading and growth mindset. Comparison of the student pretests for the nontreatment unit and treatment units showed variability in prior content knowledge. The nontreatment pretest has a much larger spread of performance scores compared to the treatment pretest one. The treatment pretest two had a larger median score, 21.4% greater, demonstrating a much higher level of initial knowledge with this content. Each pre and posttest was examined using a box plot to view the median, maximum and minimum including upper and lower quartiles of the student performance scores. The graphic representing the analysis for the data is shown in Figure 3.
Figure 3. Box plots of the pre and posttest for the nontreatment and treatment groups, \( (N=51) \). The median represents where the two boxes meet for the 25\(^{th}\) and 75\(^{th}\) percentile.

The posttests were also variable in performance relative to the difficulty of the concepts being taught. The nontreatment posttest had less variability than the pretest including a much higher median. The first posttest for the treatment unit had a much larger spread than the pretest with a large variability in the lower quartile, where as posttest two for the treatment unit had the highest median score. These data were vital to compare the pretests and the posttests of the nontreatment and treatment units relative to
prior knowledge and posttest performance. The nontreatment test had the greatest median increase of 85% and the treatment unit tests had an average increase of 57.5%. However, treatment test two had the least amount of spread for the posttest meaning that most of the students performed in a closer range of the median compared to the nontreatment unit test.

Another method to compare the pre and posttest performance was to calculate normalized gain scores for the nontreatment and treatment units. The median of the nontreatment and treatment test one were similar. Treatment test one had a larger variability in the lower quartile. This unit occurred in the winter when there were many inclement weather disruptions. The many delays and cancellations provided an unfavorable circumstance in which this test was taken. The gain score for the treatment two test had a median well above the others. Test two of the treatment unit had almost 75% of the students with larger gains than 50% of the students in the nontreatment unit and treatment unit test one. The gain scores for each unit exam can be seen in Figure 4.
Figure 4. Box Plots of the normalized gain scores from the pre and posttests of nontreatment and treatment groups, \(N=51\). The median represents where the two boxes meet for the 25\textsuperscript{th} and 75\textsuperscript{th} percentile.

The Effect of Reading Strategies and Growth Mindset on Student Motivation and Attitude

Surveys comprised of questions to elicit responses that would determine students’ initial mindsets prior to the research intervention were given to all students. A comparison of the initial mindset survey to the posttreatment mindset survey indicated that there was a shift in the mindset of the students. The majority of the students, 82\%, started with a belief system that was fixed or incorporated fixed ideas with a growth mindset. The post survey revealed 63\% of the students had a fixed mindset or fixed ideas with a growth mindset. Thirty-seven percent of the students increased their mindset
survey score from pre to post survey while two percent of the students decreased their mindset survey score. The overall mindset shifted from the fixed mindset growth ideas category to growth mindset fixed ideas. The student with an initial growth mindset fixed ideas shifted to strong growth mindset. The shift in student mindset for the nontreatment and treatment units are shown in Figure 5.

![Mindset survey results for nontreatment and treatment groups, (N=51).](image)

Specific questions from the mindset survey were analyzed from pre to posttreatment. These questions were present in both the pre and post surveys and they focused on eliciting beliefs about effort/work and intelligence. Both of these specific categories, work/effort and intelligence, used a growth mindset indicator question and a fixed mindset indicator question. The scale range was from zero to three with three being
the number that indicates growth mindset. Three represented strongly agree for the growth mindset indicator and strongly disagree for the fixed mindset indicator. The change in scored response for these specific questions provided information that alluded to a connection the students made between the increase of work/effort and the increase in intelligence. There was shift in response to these specific questions that lead to an increase of average scores. More students agreed with the growth mindset question and more students disagreed with the fixed mindset question for both effort/work and intelligence categories. The average change in response to specific questions for nontreatment and treatment units about are shown in Figure 6.

Figure 6. The average numerical response for specific questions in the mindset survey for the treatment and nontreatment surveys, (N=47).
Student observation rubrics were used to record actionable behaviors that supported a shift in mindset. Nontreatment unit observations \((N=6)\), revealed a pattern of fixed mindset and mixed mindset behaviors with no growth mindset behaviors observed.

Table 3 shows the examples of observed behaviors for the nontreatment unit.

Table 3

<table>
<thead>
<tr>
<th>Mindset</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Mindset</td>
<td>Students choose lower level practice so they did not mess up and fail.</td>
</tr>
<tr>
<td></td>
<td>Students avoid challenges for lab set up.</td>
</tr>
<tr>
<td></td>
<td>Several students will not attempt practice activity.</td>
</tr>
<tr>
<td></td>
<td>Student asks, “How many points is this worth so I cannot do some and be OK with my grade?”</td>
</tr>
<tr>
<td>Mixed Mindset</td>
<td>Student asks, “What do I need to do to get the correct answer?”</td>
</tr>
<tr>
<td></td>
<td>Student will only do what is asked and no more.</td>
</tr>
<tr>
<td></td>
<td>Student will ask questions about learning, but not in front of other students.</td>
</tr>
<tr>
<td></td>
<td>Student says, “I don’t get it, I am not smart!”</td>
</tr>
<tr>
<td></td>
<td>Students will complete work independently but stay in comfort zone with previous success.</td>
</tr>
<tr>
<td>Growth Mindset</td>
<td>No behavior was observed.</td>
</tr>
</tbody>
</table>

Student observations for the treatment unit were recorded after the explicit lessons on mindset took place and throughout content instruction. Treatment observations \((N=6)\) had numerous behaviors that were indicators of both fixed and growth mindset, but the most observed behaviors were indicative of a growth mindset. Table 4 shows examples of student observations for the treatment units.
Table 4.  
*Examples of Student Observed Behaviors for the Treatment Units (N=6)*

<table>
<thead>
<tr>
<th>Mindset</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Mindset</td>
<td>New method of creating notes leads to frustration and giving up for two students.</td>
</tr>
<tr>
<td></td>
<td>Student says, “Everyone is smarter than me except me!”</td>
</tr>
<tr>
<td></td>
<td>Student avoids challenging situations and remains in comfort zone by avoidance.</td>
</tr>
<tr>
<td></td>
<td>Student passes off mistake as a joke.</td>
</tr>
<tr>
<td>Mixed Mindset</td>
<td>Student chooses comfort zone, but admits mistakes so he can fix paper.</td>
</tr>
<tr>
<td></td>
<td>Many students attribute failures to their choice of work level and effort before a test, but not applying strategies.</td>
</tr>
<tr>
<td></td>
<td>Tasks are not independent without prompting. Students’ actively choosing seats and environment in the classroom that are beneficial for their learning.</td>
</tr>
<tr>
<td>Growth Mindset</td>
<td>Student comments, “Growth mindset shows you what you are capable of.”</td>
</tr>
<tr>
<td></td>
<td>Many students chose the review that was challenging.</td>
</tr>
<tr>
<td></td>
<td>More than one student completed work even though it was not graded.</td>
</tr>
<tr>
<td></td>
<td>Students use phrases such as, “What idea am I lacking to answer this question?” and “How do I figure out where this belongs?” instead of explicitly asking for the correct answers.</td>
</tr>
<tr>
<td></td>
<td>More active participation by volunteering even when they are making mistakes.</td>
</tr>
<tr>
<td></td>
<td>Several students making clearer choices of what is needed for them to learn a task by reflecting on their specific deficits and learning styles.</td>
</tr>
<tr>
<td></td>
<td>Student seeking and using new and different learning strategies.</td>
</tr>
</tbody>
</table>
Student interviews took place after the completion of the nontreatment unit and the treatment units. The interview responses were coded into five categories: intellect perception, motivations, response to challenges, perception of reading, and use of strategies. These categories were created from the student responses to interview questions (Appendix H). The recorded responses revealed common themes that were categorized for analysis.

Students from the higher achieving group viewed smarter students as equals. These students also viewed challenges and reading an article more than once as optional based on interest. Most students from the high achieving group were motivated by grades with the exception of one who viewed grades as a tool for improvement. Strategy use was not recognized often by high achieving students. They did reference the dislike of being wrong, and Interest was frequently stated as a reason to try harder.

The middle to low achieving students viewed smarter students as people who could help them or do the work for them. Challenges were not optional for this group as they would stick to what they already knew for a completion task. Reading articles multiple times was also based on interest similar to the high achieving students. Also like the high achieving students, grades were a big motivator and poor grades caused negative emotions. The low to middle achieving students were able to recognize and identify the strategies they used for difficult assessment questions. One student presented with an apathetic attitude towards difficult assessment questions. Student interview data for the nontreatment unit are in Table 5. The data are examples of quotes that demonstrated the trends in response to the coded categories.
Table 5

*Student Response Examples to Interview Questions for the Nontreatment Unit (N=9)*

<table>
<thead>
<tr>
<th>Categories</th>
<th>High achieving students</th>
<th>Medium to Low Achieving Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of Intellect</td>
<td>“I would choose smarter students to work with so they will stay on task like me.”</td>
<td>“I would choose smarter students to work with in group so they can help me.”</td>
</tr>
<tr>
<td>Response to Challenges</td>
<td>I would choose a higher level task only if interested.”</td>
<td>“I would choose the easy level to get my grade up.”</td>
</tr>
<tr>
<td></td>
<td>“I would choose a level that can be completed.”</td>
<td></td>
</tr>
<tr>
<td>Perception of Reading</td>
<td>“I will read many times to understand”</td>
<td>“I will read more if interested”</td>
</tr>
<tr>
<td>Articles</td>
<td>“I will read multiple times only if interesting.”</td>
<td></td>
</tr>
<tr>
<td>Motivations</td>
<td>“Studying for grades makes me anxious.”</td>
<td>“I do more work in classes that I have bad grades in”</td>
</tr>
<tr>
<td></td>
<td>“Bad grades tell me I need to work more.”</td>
<td>“I feel bad when I get a bad grade.”</td>
</tr>
<tr>
<td>Strategy Use</td>
<td>“I try more will classes I like.”</td>
<td>“I skip a hard question, no big deal.”</td>
</tr>
<tr>
<td></td>
<td>“I skip a hard question because wrong makes me feel bad.”</td>
<td>“I will use chunking.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I will use process of elimination”</td>
</tr>
</tbody>
</table>

Student interviews for the treatment units were also coded into categories that were the same as the nontreatment unit. One additional category was added to code the student responses to the mindset intervention. The interview data are in the form of quotes from student responses after the last unit of the treatment. The quotes are representative student examples in the identified category. Students in both the high achieving group and the middle to low achieving group were very similar in their
responses. Intellectual perception was focused on how other students’ intellects could be beneficial for them to learn as individuals. Challenging assignments were prioritized by students according to the amount of time allotted for their completion. Students were willing to work on a task longer to understand it but not at the expense of losing points for not turning it in on time.

All students were still very much grade motivated after the treatment intervention, however there was a variety of reasons, such as parent approval and post-secondary goals. Negative body language such as eye rolling and groans indicated that reading informational articles was still viewed as negative by the students. The students were however able to make positive connections of multiple readings of the article such as increased interest and understanding. Students preferred a variety of close reading strategies with highlighting representing the majority. All students identified the close reading strategy as beneficial to use on the Keystone Exams. The mindset intervention was perceived as positive for the students for a variety of reasons such as a change in work ethic and resiliency. Representative responses are listed in Table 6 according to student ability levels and categories.
Table 6  
Student Response Examples for Interview Questions for the treatment units (N=9)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Higher achieving students</th>
<th>Middle to low achieving students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of Intellect</td>
<td>“I want to work with higher ability students so the work will eventually come easier to me later.”</td>
<td>“I would like to work with students who are similar ability to get the work done right.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“If I cannot understand smarter students in a group I will not learn, they will move on without me.”</td>
</tr>
<tr>
<td>Response to Challenges</td>
<td>“I will work to understand and assignment but if it is due I will just turn it in so I do not get points marked off.”</td>
<td>“I will choose the easier task and work on it just to get it done.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“My idea is to get is done if I have little time, but if I had more time I would spend more time on the task.”</td>
</tr>
<tr>
<td>Perception of Reading Articles</td>
<td>“It is long, but I like learning new things about this stuff so I will get extra articles.”</td>
<td>“I don’t like reading, but the more times I read the article the more I understand.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Reading is difficult for me, but the article was more interesting when we read it more times.”</td>
</tr>
<tr>
<td>Motivations</td>
<td>“I need good grades for college.”</td>
<td>“I am motivated by parent’s approval of good grades.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I need good grades to get into the Army”</td>
</tr>
<tr>
<td>Strategy Use</td>
<td>“Very likely to use these strategies on the Keystones they are helpful.”</td>
<td>Yes, I will use highlighting, it helps to identify the key points.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“It sometimes helps, I will use them now that we have used them in class.”</td>
</tr>
<tr>
<td>Perception of Mindset</td>
<td>“I realize that more effort makes me want to know what I don’t know.”</td>
<td>“More willing to understand, I made me think I could be smarter.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I started handing stuff in.”</td>
</tr>
<tr>
<td></td>
<td>“It helps me realize how my brain works to learn new things and what strategies I could use.”</td>
<td>“Failing means to keep trying.”</td>
</tr>
</tbody>
</table>
The interviews for the nontreatment and treatment units were very telling in student attitude and motivation. There was a change in intellectual perception. The nontreatment indicated students perceive intellect as a competitive personal ranking. The treatment interviews revealed a readiness to collaborate with students of various intellect for personal benefit. Willingness to identify and use strategies was more apparent in the treatment unit. Most students remained grade motivated from the nontreatment to treatment units, but the reasons were more related to personal future goals. Reading informational texts maintained a negative perception; however the students made connections between increased interest and understanding when the articles were read multiple times.

Close Reading and Growth Mindset Effects on Teacher Motivation and Attitude

A teacher journal with daily guiding prompts (Appendix J) was used to determine how my attitude and motivation changed throughout the nontreatment and treatment units. Daily reflection with the guiding prompts was essential to identify trends of motivation and attitude change that could be attributed to the intervention instead of the normal daily challenges teachers encounter. The journal was started at the beginning of the nontreatment unit and continued daily until the final assessment of the treatment unit.

Once the journal was complete I coded positive responses and negative responses into several categories. The first category followed a journal prompt, identifying the positives of the day’s lesson. The nontreatment unit had less accounts of positive responses. The majority of the positive responses recorded referred to the ability of teacher to adjust lessons to students’ understandings and levels of engagement. The treatment entries had 172% increase of positive responses from the nontreatment unit
with reference to student engagement, on task student behavior and focused student work. One notable entry was, “The students’ reception of practice work was one of willingness and comfort to allow them to make attempts in high-stake situations where failure is a possibility.” The positive entries in the treatment unit were from a more student-focused perspective rather than teacher ability or involvement. The second category, characterization of students’ attitudes and reactions, produced different results for the positive versus negative coding. The nontreatment unit had equal positive and negative observations while the treatment group had a 71% increase in positive observations compared to negative observations. The negative treatment observations were similar to behaviors of the negative nontreatment entries in regards to student attitudes. The frequency of the positive and negative journal entries in respect to categories can be seen in Table 7.

<table>
<thead>
<tr>
<th>Question Categories</th>
<th>Nontreatment positive entries</th>
<th>Nontreatment negative entries</th>
<th>Treatment positive entries</th>
<th>Treatment negative entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positives of the day’s lesson</td>
<td>11</td>
<td>NA</td>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>Students’ attitudes and reactions</td>
<td>3</td>
<td>3</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Challenges of the day’s lesson</td>
<td>NA</td>
<td>16</td>
<td>NA</td>
<td>24</td>
</tr>
<tr>
<td>Self-Rating</td>
<td>3</td>
<td>8</td>
<td>14</td>
<td>6</td>
</tr>
</tbody>
</table>
Examples of negative student reactions include student disinterest, lack of engagement and complaints about why they needed to know the material. Some noted positive students’ reactions for the treatment included students choosing more challenging work, less resistant to doing work even though it was not graded, requesting to sit in a better spot in the classroom, students asking for strategies not answers in problem solving and a student stating, “I could not wait for class today!”

The third category referred to challenges of the day’s lesson. The treatment units had a 50% increase in challenges from the nontreatment unit, however the challenges that were identified had very different contexts (refer to Table 7). The nontreatment unit had challenges that related to student disinterest, off task behavior and wanting explicit answers to questions. Challenges in the treatment unit related to making the students feel comfortable with getting the wrong answers, teaching critical thinking by having the students make notes instead of copying notes, and creating learning situations in which students could think, create and edit all while covering the content. The nontreatment unit and the treatment units shared a few instances of students being grade motivated.

The majority of the challenges recorded for the treatment units centered on trying to redirect student motivations from getting grades for a completion task to self-gauging how they are learning a task. One journal entry states, “Changing the school culture from grades as being an indicator of learning and success to individual student growth is overwhelmingly frustrating for me as a teacher.” Toward the end of the treatment unit the challenges started to focus on the pace of content and moving through the curriculum to prepare for the Keystone Biology Exam. This was incited by the nature of discussions at the science department meetings that centered on consequential motivations for
students and faculty comparisons of where they were in the curriculum. The entries in the journal at this point were mostly referencing the amount of content that I had yet to cover before the next online standardized practice test, called the CDT.

The self-rating category of the journal reflections were rating stress, attitude and interest of the daily lesson. The negative reflections of the nontreatment and treatment units were similar in topic such as, moving through the content to teach to the test, attempting to motivate students by grades and realizing that I lectured the majority of the class just to say I covered the content. The negative treatment reflections were all logged within the last eight days of the treatment unit as the date of the Keystone Exams grew nearer. Positive entries for the treatment units were commonly referenced when lessons were prepared and delivered as student-centered and my role was one of a facilitator. Additional positive entries included students demonstrating active learning by asking questions, completing tasks that were not graded, demonstrating excitement for class, high student engagement, students attempting difficult or challenging work, and my ability to make a meaningful connection for the students about brain growth and lesson structure that included student practice activities.

The teacher observation rubrics were coded for both the nontreatment and treatment units as to the frequency of observed actions and verbal comments. I had more negative interactions during the nontreatment unit, but I maintained an equal positive interaction for both the nontreatment and treatment units. Teacher actions were more learning focused during the treatment unit compared to the nontreatment unit. However, reference to grades also appeared equal for both units. Teacher feedback for the nontreatment had no difference between process and ability; however the treatment unit
had a considerable larger number of observations relating to process feedback compared to the ability feedback. The information from the teacher observation rubric is shown in Table 8, as to frequency of observed actions and examples of verbal comments.

Table 8
*Frequency of Teacher Observed Actions and Examples of Verbal Comments for Nontreatment and Treatment Units*

<table>
<thead>
<tr>
<th>Observations</th>
<th>Nontreatment</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher/Student Interactions</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>- positive</td>
<td>“Good, Good, Good”</td>
<td>“That is a good question to ask to find more information.”</td>
</tr>
<tr>
<td>Teacher/Student Interactions</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>- negative</td>
<td>“Use your Brain before you turn in an assignment”</td>
<td></td>
</tr>
<tr>
<td>Teacher actions</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>- grade motivated</td>
<td>“Use these strategies as cheats on an exam to answer higher level questions”</td>
<td>“Work through this strategy to maximize points on the constructed response for the Keystone Exams”</td>
</tr>
<tr>
<td>Teacher actions</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>- learning motivated</td>
<td>“reading, writing and speaking it will help you problem solve”</td>
<td>“Determine your area of focus and challenge level to grow you brain.”</td>
</tr>
<tr>
<td>Teacher Feedback</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>- Process oriented</td>
<td>“Great job, will you share your thoughts with the class?”</td>
<td>“Mistakes are how you learn”</td>
</tr>
<tr>
<td>Teacher Feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Ability oriented</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>“We learned this yesterday so everybody should get it quick”</td>
<td>“You got it, great job”</td>
</tr>
</tbody>
</table>
INTERPRETATION AND CONCLUSION

To address the literacy design component of the state standardized Keystone Exams teachers and administrators alike will be interested in the methods employed in this study to improve the essential literacy skills needed to develop better conceptual understanding and achieve higher test scores. Literacy based instruction combined with a growth mindset intervention had a positive effect on student performance on standardized Biology concepts. This study verified a growth in student performance on the Classroom Diagnostic Tools test with the close reading strategy and mindset intervention.

Additional quantitative data for the pre and posttests for the content of the nontreatment and treatment units was divided. The nontreatment unit assessment had a larger gain than the treatment unit assessment one. Multiple interruptions of the structured school day due to inclement weather created discontinuity in instruction and the assessment for test one in the treatment unit. This could have affected the results by a reduction of in-class student review time and increased time between the instruction and assessment. The treatment unit assessment two was indicative of an increased gain score well above the other two assessments.

The nature of instruction needed for the close reading literacy strategy is time consuming for both students and instructor. The longer the students used the close reading strategies the more familiar they became with the strategies and used them more effectively, showing an improvement of the gain score for the second unit of the treatment assessment. In addition, a growth mindset intervention is reflective and process oriented to allow for a personal belief shift in students. The delayed improvement in the
gain score for assessment two of the treatment unit could be indicative of the need to be exposed to growth mindset strategies over a period of time.

This study provides evidence that the combined close reading strategy and growth mindset intervention had positive effects on students’ attitudes and behaviors. The data from the mindset survey supported a shift in student mindset from a fixed mindset toward a growth mindset. The largest shift was from the students that already possessed growth mindset beliefs but had some fixed ideas to have a strong growth mindset. Data from specific survey questions supported an increase in student beliefs that increased work and effort can lead to increased intelligence. Qualitative data from student observations showed a drastic change in student behavior. During the nontreatment unit no growth mindset behaviors were observed, but during the treatment units the observed behaviors were overwhelmingly indicative of a growth mindset. Students’ self-talk and actions indicated they were more geared toward the process of self-improvement. Student interviews also supported a positive change in attitude and behavior. The close reading strategy was mentioned by all students as valuable to use on the standardized exam. An increased level of interest and understanding was also identified by students as a benefit of the close reading strategy even though reading still maintained a negative perception by the students. Student Motivation remained grade oriented throughout both the nontreatment and treatment units, but students found the mindset to be helpful in the learning process.

Growth mindset intervention and the use of a literacy strategy had a positive effect on teacher attitude and motivation. Both the teacher observations and self-reflective journal supported a more positive learning environment for the students and
teacher. Positive entries were more numerous for the treatment units compared to the nontreatment unit. The most motivating positives were the students’ reactions to the lessons in the treatment units. One student commented during the instruction on the neuroscience portion of the mindset intervention, “I could not wait for this class today and I usually don’t care.” The positive student responses lead to a more exciting and student-centered classroom. The challenges were more numerous in the treatment units, but they were in the context of working within a system that uses grades and standardized test scores to determine a student’s success rather than growth and learning. Teacher observations also provided data that supported a growth mindset intervention and reading strategy were beneficial for teacher attitude and motivation. Teacher actions during the treatment units were more learning motivated and focused toward the student learning process instead of ability.

VALUE

This Action Research study has clarified the importance of teacher instruction that explicitly teaches learning strategies and the learning process to empower students to become independent learners. The close reading strategy provided tools that students are willing to use on the state standardized exams. The growth mindset provided an understanding of the learning process that was not exclusive to a few students but a ubiquitous process that can be done by all. When students were given the tools and the understanding of the process of learning it had a huge impact on student actions. Students were more willing to work out of their comfort zone, engage in difficult tasks and do work that was not directly related to their grade.
Learning and the learner became a focus for instruction. This became a challenge for me to plan my instruction to integrate literacy strategies, growth mindset and to make sure I covered the content to prepare the students for an end of the year standardized exam. I did realize that learner-focused instruction and teaching to the test do not have to be mutually exclusive. However, I was mindful that teaching for growth and understanding did not provide an opportunity to cover the all the tested content in-depth.

Students were more receptive to teacher-planned activities and practice work when they could understand the reasoning of how it helped them grow as learners. Mindset instruction and literacy skills not only increased achievement but it gave validity to student choice within the instructional setting. Students choose more purposeful and focused work that correlated with their areas of need for content understanding and also played to their strengths as learners. One low achieving student stated a simple summation, “It really is not that difficult to do the work, it actually gets easier the more you do.”

In a high stakes testing environment where the structure of the Pennsylvania Keystone Exams have a large literacy component it would be beneficial, practically essential, for teachers and students to be in a growth mindset setting that incorporated literacy strategies. A growth mindset of both teacher and student offers an avenue and purpose that is conceivable by all students so challenges can be met on all levels.

Essential connections of the learning process involving effort and strategy create learners that become contributors in society.

This intervention not only changed my own mindset but will lead to changes in my teaching style and perceptions. There was an organic transformation by the students
and myself that drove the classroom to become more learning and learner-focused. The facilitator role of a teacher, I think, is now vital in the information age of the education system.

I will implement the growth mindset intervention at the beginning of the next school year and reinforce it throughout the entire year. I will incorporate multiple learning strategies, but keep a focus on the close reading strategy to provide skills and stamina for the standardized course exams. Providing students with a growth mindset belief system and strategies that translate to life-long learning is my goal as a teacher. I believe after 20 years of teaching, I have found the indispensable tool that all teachers should have in their tool box if they want to become a positive part of childrens lives growth mindset.
REFERENCES CITED


APPENDICES
APPENDIX A

KEYSTONE BIOLOGY ASSESSMENT ANCHORS
Module A- Cells and Cell Processes

Assessment Anchor

BIO. A.1 Basic Biological Principals
BIO. A.2 The Chemical Basis for Life
BIO. A.3 Bioenergetics
BIO. A.4 Homeostasis and Transport

Module B Continuity and Unity of Life

Assessment Anchor

BIO. B.1 Cell Growth and Reproduction
BIO. B.2 Genetics
BIO. B.3 Theory of Evolution
BIO. B.4 Ecology
APPENDIX B
BIOMACROMOLECULES TEST
BioMacromolecules  Unit Test

Please do not write on test and place answers on answer sheet only.

1. All biological macromolecules are similar except for
   A. The monomers that make them up
   B. That they function to carry out life processes
   C. The designation of being a macromolecule
   D. That they are found in cells

2. The building block of nucleic acids are __________ and the building block of carbohydrates are ________.
   A. Fatty Acids, Sucrose
   B. Fatty Acids, Monosaccharides
   C. Monosaccharides, Fatty Acids
   D. Nucleotides, Monosaccharides

3. When comparing the atoms that make up carbohydrates with the atoms that make up lipids, which of the following is true.
   A. Both macromolecules are made primarily with a backbone of Oxygen
   B. Carbohydrates are made of carbon and lipid are made of lipidon
   C. Both molecules are made up of Carbon, Hydrogen, and Oxygen
   D. Carbohydrates are full of calcium

4. Which of the following is NOT an example of a lipid?
   A. Wax
   B. Fat and Oil
   C. Cellulose
   D. Steroids

5. The monomer for RNA and DNA is
   A. nucleic acids
   B. nucleotides
   C. Amino Acids
   D. glucose

6. Which of the following is NOT a function of lipids?
   A. Waterproofing
   B. Long Term energy storage
   C. Structure in the cell membrane
   D. Carries genetic information
A. 7. The main function of lipids is _________ energy storage and the main function of carbohydrates is ____________ energy storage. Long term, short term   C. Long term, long term
B. Short term, long term   D. short term, short term

8. Proteins are intricate structures that are determined by the sequence of Amino Acids. What other macromolecule do proteins depend on to determine their structure and function?
   A. proteins
   B. lipids
   C. carbohydrates
   D. nucleic acids

9. Three days after an organism eats some meat, many of the organic molecules originally contained in the meat would be found in newly formed molecules of
   A. glucose
   B. protein
   C. starch
   D. oxygen

10. Which word best completes the blanks in the two sentences below?
Organic compounds, such as proteins and starches are too _______ for them to be used by our cells. Proteins are digested into ____________ and starches (carbohydrates) are digested into ____________.
   A. LARGE, Simple Sugars, Amino Acids
   B. SMALL, simple sugars, Amino Acids
   C. LARGE, Amino Acids, Simple sugars
   D. SMALL, Amino Acids, Simple sugars

11. Which statement concerning simple sugars and amino acids is correct?
   A. They are both wastes resulting from protein synthesis
   B. They are both building blocks of starch.
   C. They are both needed for the synthesis of larger molecules
   D. They are both stored as fat molecules in the liver.

12. Which of the following type compounds is unlike the other three?
   A. Wax
   B. Saturated Fat
   C. Phospholipid
   D. polysaccharide

13. Which pair of terms is NOT correctly matched?
A. nucleic acid - DNA
B. Polysaccharide - carbohydrate
C. Amino Acid - lipids
D. Lipids - Phospholipids

14. Which of the following is/are not a purpose of carbohydrates?
   a. Short term energy
   b. Long Term fat storage
   c. Structure in plants
   d. Cell signaling

15. Plant energy storage is called starch and the animal energy storage is called____.
   A. glycogen
   B. cellulose
   C. Starch
   D. chitin

16. The proper levels of blood sugar, called _____, is a way our bodies maintain homeostasis.
   A. fructose
   B. glucose
   C. galactose
   D. lactose

17. The diagram below represents the synthesis of a portion of a complex molecule in an organism.

Which row in the chart could be used to identify the building blocks and product in the diagram?

<table>
<thead>
<tr>
<th>Row</th>
<th>Building Blocks</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>starch molecules</td>
<td>glucose</td>
</tr>
<tr>
<td>B</td>
<td>amino acid molecules</td>
<td>part of protein</td>
</tr>
<tr>
<td>C</td>
<td>sugar molecules</td>
<td>ATP</td>
</tr>
<tr>
<td>D</td>
<td>DNA molecules</td>
<td>nucleotide</td>
</tr>
</tbody>
</table>
18. Two proteins in the same cell perform different functions. This is because the two proteins are composed of

(1) chains folded the same way and the same sequence of simple sugars
(2) chains folded the same way and the same sequence of amino acids
(3) chains folded differently and a different sequence of simple sugars
(4) chains folded differently and a different sequence of amino acids

19. The diagram below represents two molecules that can interact with each other to cause a biochemical process to occur in a cell.

![Diagram of Molecule A and Molecule B]

Molecules A and B most likely represent

A. a protein and a chromosome
B. an enzyme and a substrate
C. a carbohydrate and an amino acid
D. an antibody and a hormone

20. The structure of lipids called triglycerides are

A. One ester molecule and three fatty acids
B. One fatty acid and three glycerols
C. Four glucose molecules
D. One glycerol and three fatty acid chains

21. Name the lipid found in cell MEMBRANES that makes up the majority of the structure.

A. Cellulose
B. Phospholipid
C. Triglyceride
D. Waxes

22. All of the following are associated with Saturated fatty acids chains except

A. Solid
B. Single bond
C. Tightly packed
D. Found in plants

23. The portion of a membrane phospholipid that is polar is the _____
A. Phosphate head
B. Fatty acid tails
C. Unsaturated fatty acid tail
D. There is not part that is polar

24. All of the following are common functions of proteins except…
   A. messengers in the body
   B. high energy molecules
   C. provide structure in the body of animals
   D. are enzymes to speed up chemical reactions

25. If many Amino acids that have hydrophobic properties are side by side in the polypeptide chain this will cause the chain to react how?
   A. to move in an alpha helix
   B. to form a beta pleat
   C. to go towards the watery environment
   D. to move away from the watery environment

26. Nucleic acids and Proteins share the shape of the ______
   A. beta pleated sheet
   B. tertiary level
   C. gamma rays
   D. Helix

27. The variable part of an amino acid is the _____ group.
   A. R group
   B. Beta group
   C. amino group
   D. alpha group

28. The variable part of the Nucleic acid is the _____.
   A. phosphate group
   B. nitrogen base
   C. deoxyribose sugar
   D. Ribose sugar

29. Enzymes function to speed up chemical reactions, they act as a _______
   A. Amino acid
   B. active site
   C. inhibitor
   D. catalyst

30. Enzymes belong to what biological group of macromolecules?
   A. carbohydrates
   B. lipids
   C. protein
   D. nucleic acids
31. The molecule below is...

A. a saturated fatty acid  
B. a saturated triglyceride  
C. an unsaturated fatty acid  
D. an unsaturated triglyceride

32. Potatoes have a large amount of
A. Cellulose  
B. Glycogen  
C. Triglyceride  
D. Starch

33. The information macromolecule that STORES information about how to run the cell is called...
A. Cellulose  
B. DNA  
C. RNA  
D. Nucleus

34. How many different amino acids are there?
A. 1  
B. 10  
C. 20  
D. hundreds

35. What type of reaction links monomers together to form polymers?
A. Hydrolysis  
B. Dehydration Synthesis  
C. Digestion  
D. Exothermic

36. Which of the following characteristic make carbon suitable for forming the backbone to biological molecules?
A. IT is a rare element  
B. IT is an element that will form 4 covalent bonds  
C. IT is an element the is highly reactive  
D. IT is a friendly element that shares electrons easily
APPENDIX C

RESPIRATION AND PHOTOSYNTHESIS TEST
Multiple Choice: Fill in the letter of the best answer for each question on your scantron.

1.) A squirrel gathers nuts to eat during the winter. The squirrel is an example of a(n)
   A. Heterotroph
   B. Autotroph
   C. Plant
   D. Supertroph

2.) What cells in the body does the process of cellular respiration take place?
   A. lungs
   B. heart
   C. skin
   D. all of the above

3.) Which of the following carry out cellular respiration?
   A. Humans
   B. Trees
   C. Bacteria
   D. All of the above

4.) What are the reactants of cellular respiration?
   A. Glucose and carbon dioxide
   B. Carbon dioxide, water, and energy
   C. Glucose and oxygen
   D. Energy, glucose, and oxygen

5.) When a phosphate group is broken off from an ATP molecule, _____.
   A. A substantial amount of energy is released
   B. An enzyme is formed
   C. Energy is stored
   D. An angel gets it's wings

6.) Some organisms that live in the intestines of cows do not require oxygen to survive. Which of these describes the process by which these organisms obtain energy?
   A. Photosynthesis
   B. Aerobic Respiration
   C. Anaerobic Respiration
   D. Mitosis

7.) Which of the following processes occur in the mitochondria?
   A. Photosynthesis
   B. Aerobic respiration
C. Mitosis
D. Both A and B

8.) After running for 27 miles, Suzie’s legs begin to ache and burn. The process that Suzie’s muscle cells are experiencing is called_____.
A. Respiration
B. Photosynthesis
C. Alcoholic Fermentation
D. Lactic Acid Fermentation

9.) The equation for cell respiration is
A. glucose + oxygen $\rightarrow$ carbon dioxide + water + ATP
B. carbon dioxide + oxygen + sunlight $\rightarrow$ water + glucose
C. water + carbon dioxide + sunlight $\rightarrow$ glucose + oxygen
D. glucose + water + sunlight $\rightarrow$ carbon dioxide + oxygen

10.) Cyanide is a poison that prevents mitochondria from using oxygen. As a result, mitochondria cannot produce
A. Lipids
B. Sugar
C. ATP
D. Minerals

11.) In a recent experiment, scientists studied the effects of increased carbon dioxide levels on the growth of pine trees. The scientists observed that increased levels of carbon dioxide led to an increase in the average size of the tree trunks. The increase in growth and additional creation of CO2 is a result of the process of what?
A. Osmosis
B. Cellular respiration
C. Photosynthesis
D. Both B and C

Matching

For questions 12-13 please select the amount of ATP produced by each process. You may use some more than once and may not use others at all.

12.) Anaerobic respiration
A.) 0 ATP
B.) 2 ATP
C.) 4 ATP
D.) 32 ATP

13.) Aerobic Respiration

14.) The ___________ of photosynthesis are the ___________ of cell respiration
15.) What is the purpose of photosynthesis?
   A. To make Oxygen for Heterotrophs to breath
   B. To trap the suns energy into chemical energy (glucose)
   C. To trap energy from glucose in the form of ATP
   D. To destroy CO2

16.) What is the purpose of cell respiration?
   A. To make CO2 for Heterotrophs to breath
   B. To trap the suns energy into chemical energy (glucose)
   C. To use energy from glucose to make ATP for homeostasis
   D. To destroy CO2

17.) What needs to be present in a cell to further drive the process of aerobic respiration?
   a.) ATP
   b.) Glucose
   c.) Chemical Energy
   d.) oxygen

18.) The equation for photosynthesis is
   A. glucose + water + sunlight → carbon dioxide + oxygen
   B. carbon dioxide + oxygen + sunlight → water + glucose
   C. water + carbon dioxide + sunlight → glucose + oxygen
   D. glucose + oxygen → carbon dioxide + water + sunlight

19.) The major light absorbing pigment in plant photosynthesis is _____.
    A. Carotenoid
    B. Chlorophyll
    C. Chloroplasts
    D. Beta Carotene

20.) Most of the energy used by life on earth originally comes from _____.
    A. Sun
    B. Rotation of the earth
    C. Moon
    D. Fossil fuels

21.) The scientist said that a plant in the dark would starve to death. What molecule would it be unable to make?
    A. CO₂
    B. H₂O
    C. Protein
D. \( \text{C}_6\text{H}_{12}\text{O}_6 \) (Glucose)

22.) What molecule is energy for a cell that acts like a rechargeable battery?
A. Glucose
B. ARP
C. ATP
D. Sunlight

23.) If photosynthesis takes place in the________ then aerobic respiration occurs in the _________
A. Cell membrane, mitochondria
B. Grana, thylakoids
C. Chloroplast, mitochondria
D. Chloroplast, cell membrane

24.) The process of photosynthesis takes place in the _____ of the cell.
A. ATP
B. Chloroplast
C. Mitochondria
D. Cell membrane

25.) Where does a plant get its ‘food’ from for the process of respiration?
A. From the Soil
B. It makes its own Glucose
C. From the Sun
D. A plant does not need to go through respiration

26.) What type of energy is found in glucose?
A. Light energy
B. Heat energy
C. Chemical energy
D. Electrical energy

27.) What makes ADP different from ATP?
A. ATP has been “decharged”
B. They are both the same
C. ATP has one less phosphate
D. ADP has one less phosphate

28.) True (A) or False (B): In chlorophyll, the green color is being reflected, not absorbed.

29.) Why can’t prokaryotes do aerobic respiration
A. Not enough Carbon Dioxide
B. Do not have Chloroplast
30.) Why do we breathe harder during exercise?
   A. Our body needs more energy and needs more Oxygen in order to break down the Glucose
   B. Our body needs Oxygen to keep us from having to much CO2
   C. Our body needs more energy and creates more Oxygen to break down the Glucose
   D. Our body needs more energy and needs more Carbon Dioxide in order to break down the Glucose

31.) If a plant had a disease in the chloroplast, which molecule would they not make?
   A. Glucose
   B. Lipids
   C. Protein
   D. CO2

32.) ATP has _____ energy than ADP.
   A. Less
   B. More
   C. The same

33.) What portion of their food do Bean plants get by making it inside their bodies?
   A. All
   B. Some
   C. None

34.) A tree is a(n)
   A. autotroph
   B. heterotroph
   C. treetroph
   D. consumer

35.) Which statement regarding cellular respiration is correct?
   A. Cellular respiration in plants occurs only during the day.
   B. All living organisms carry out cellular respiration.
   C. Fungi and bacteria carry out cellular respiration only.

36.) Autotrophs gain energy from ____________to begin ____________.
    a. sunlight, Photosynthesis
    b. Photosynthesis, ATP
    c. sunlight, Respiration
    d. Respiration, ATP
The Carbon Cycle

Carbon (C) is the basis of life on Earth. Scientists consider 99.9% of all organisms on the planet to be carbon based life. Those organisms need carbon to survive. Whether the carbon is in the form of a sugar or carbon dioxide gas, we all need it. Unlike energy, carbon is continuously cycled and reused. The Earth only has a fixed amount of carbon. The carbon cycle is the ultimate form of recycling.

Use terms from what we learned in class to construct sentences that are valid and make sense. NO shovels here, so do not make up information.

1. Describe how photosynthesis and cell respiration are a part of a cycle that makes life possible. 5 points
APPENDIX D

CELL MEMBRANE AND TRANSPORT TEST
Cell membrane and transport Test

Place all answers on the answer sheet. Do Not write on the test.

1. Diffusion occurs because
   a. Molecules constantly move and collide with each other
   b. The concentration of a solution is never the same throughout a solution
   c. The concentration of a solution is always the same throughout a solution
   d. Molecules never move or collide with each other

2. When the concentration of molecules on both sides of a membrane is the same, the molecules will
   a. Move across the membrane to the outside of the cell
   b. Stop moving across the membrane
   c. Move across the membrane in both directions
   d. Move across the membrane to the inside of the cell

3. Which means the particles of transport requires input of energy from the cell?
   a. Diffusion
   b. Osmosis
   c. Facilitated diffusion
   d. Active transport

4. The diffusion of water across a selectively permeable membrane is called
   a. Osmotic pressure
   b. Osmosis
   c. facilitated diffusion
   d. active transport

5. An animal that is surrounded by fresh water will burst because the osmotic pressure causes
   a. water to move into the cell
   b. water to move out of the cell
   c. solutes to move into the cell
   d. solutes to move out of the cell

   The diagram below represents an event that occurs in the blood.

   ![Diagram of cell A with an arrow pointing to another cell]

6. Which statement best describes this event?
   a. This is the process of diffusion
b. This is the process of exocytosis
c. This is the process of endocytosis
d. This is the process of osmosis

7. What macromolecule makes up the majority of the structural integrity of the plasma (cell) membrane?
   a. Glycolipids
   b. Phospholipids
   c. Lipids
   d. Proteins

8. Which statement below is true regarding the cell membrane
   a. The cell membrane is made up of wax
   b. The cell membrane is made up of phospholipids with a hydrophobic head and hydrophilic tail
   c. The cell membrane is made up of phospholipids with a hydrophilic head and hydrophobic tail
   d. Prokaryotes do not have a phospholipid bilayer

The picture below shows osmosis occurring inside of a beaker after a cheek cell was put in

9. Which way is the water going to move?
   a. In
   b. Out
   c. Neither Way

First person in class to stand up and proclaim their love of biology gets a bonus point.

10. What will happen to the cell?
    a. Explode
    b. Shrink
    c. Melt
    d. Nothing

11. Describe the solution in the beaker that the cell is in compared to the cell?
    a. Hypertonic
    b. Hypotonic
12. Diffusion is the movement of molecules from
   a. An area of low concentration to an area of high concentration.
   b. An area of high concentration to an area of low concentration.
   c. An area of equilibrium to an area of low concentration
   d. All of the above

13. The diffusion of water through a selectively permeable membrane is called _____.
   a. Active transport
   b. Facilitated diffusion
   c. Osmosis
   d. Cellular respiration

14. The above picture shows materials being moved from an area of low concentration to an area of high concentration, this is called
   a. Facilitated Diffusion
   b. Passive Transport
   c. Active Transport
   d. Both A and B

15. Passive transport includes
   a. Osmosis and active transport
   b. Diffusion and exocytosis
   c. Osmosis and diffusion
   d. Endocytosis and exocytosis

16. The process in which the membrane creates a vesicle and takes in materials is called (shown to the right)
   a. Osmosis
   b. Facilitated Diffusion
   c. Endocytosis
   d. Exocytosis
17. The picture above is showing
   a. Active transport
   b. Facilitated diffusion
   c. Isotonic
   d. All the above

18. Letter A (to the right) is pointing to a
   a. Phospholipid
   b. Carbohydrate
   c. Protein
   d. Fatty Acid

19. **True or False:** Osmosis requires energy input.
   a. True
   b. False

Use the following information and diagram for numbers 20-21.

Starch turns blue-black in the presence of iodine solution. A selectively permeable dialysis sac containing starch solution is placed into a beaker of iodine solution.

20. If the dialysis sac is permeable only to iodine, what will the solutions in the beaker and sac look like after two hours?
   a. The iodine solution in the beaker will turn blue-black. The starch will not change.
   b. The starch solution in the dialysis sac will turn blue-black. The iodine will not change.
c. Neither solution will turn blue-black.
d. Both solutions will turn blue-black.

21. Which of these processes is demonstrated by the experiment shown in the picture above?
   a. Active transport
   b. Endocytosis
   c. Diffusion
   d. Cellular respiration

22. Spartina, a grass, stores large amount of salt in its root cells. This makes the salt concentration in its roots greater than that of the surrounding water. What most likely occurs in response to this salt concentration?
   a. Salt moves into the roots
   b. Water moves into the roots
   c. Nutrients move out of the roots
   d. Water moves out of the leaves into the air

23. Raisins are grapes that have shriveled. If you wanted to make a raisin without the use of the sun, you could make it by placing a grape cell into a _____ solution.
   a. Hypertonic
   b. Isotonic
   c. Hypotonic
   d. None of the above

24. The process in which the membrane creates a vesicle and removes materials from the cell
   A.) Osmosis
   B.) Facilitated Diffusion
   C.) Endocytosis
   D.) Exocytosis

True or False Use A for true and B for false.

25. A red blood cell placed in pure water will shrink

26. Once equilibrium is reached, roughly equal numbers of molecules move in either direction across a semipermeable membrane, and there is not further changes in concentration on either side of the membrane.

27. If an IV solution is hypertonic the blood cells in a persons’ body will swell up and burst.

28. Contractile vacuoles for paramecium are important for osmoregulation so they can pump water out of the cell in a hypotonic environment.

29. The phospholipids will allow nonpolar and small molecules to diffuse across the membrane.

30. Active transport requires energy for molecules to move down the concentration gradient
Cell membrane and transport test. 5 pts. MEDIUM

Constructed Response. Use information from the test to construct an answer with the use of appropriate ‘nerd’ terms. Reminder; use RACE, restate the question, Answer what the question is asking, Cite any information, Explain or give an Example.

Passive and Active transport both transport molecules. One uses energy to move molecules or large objects against their concentration gradient.

1. How do facilitated diffusion and Ion pumps differ since they both use proteins?

2. How are facilitated diffusion and Ion pumps similar?
Cell membrane and transport test. 5 pts.  HOT

Constructed Response. Use information from the test to construct an answer with the use of appropriate ‘nerd’ terms. Reminder; use RACE, restate the question, Answer what the question is asking, Cite any information, Explain or give an Example.

Passive and Active transport both transport molecules. One uses energy to move molecules or large objects against their concentration gradient.

1. Compare the role of concentration gradients in passive and active transport.

2. What is the function of membrane proteins in cellular transport?
APPENDIX E

MINDSET SURVEY PRETREATMENT
Mindset Survey Pretreatment


To what extent do you agree or disagree with these statements: Please read carefully and check the box

<table>
<thead>
<tr>
<th>Questions</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Students will always be better at certain subjects than at others.</td>
<td>SA</td>
<td>A</td>
<td>D</td>
<td>SD</td>
</tr>
<tr>
<td>2. You can always change how smart you are.</td>
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<td></td>
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<tr>
<td>3. People are born smart because they have smart parents.</td>
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<tr>
<td>4. Artistic talent can be learned by anyone.</td>
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<tr>
<td>5. GOOD athletes have it in their genetics, they are born that way</td>
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<tr>
<td>6. Math is much easier for students with a math brain.</td>
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<tr>
<td>7. You can work harder to get smarter.</td>
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<tr>
<td>8. No matter what kind of person you are, you can always change substantially.</td>
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<tr>
<td>9. Trying new things is stressful for me and I avoid it.</td>
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<tr>
<td>10. Some students are good and kind, and some are not – it’s not often that they change.</td>
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<tr>
<td>11. I appreciate when people, parents, coaches, teachers give me feedback about my performance.</td>
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<tr>
<td>12. I get upset when I am told how to improve a skill.</td>
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<tr>
<td>13. All students in this class are capable of the same amount of learning.</td>
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</tr>
<tr>
<td>14. You can learn new things, but you can’t really change how intelligent you are.</td>
<td></td>
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<tr>
<td>15. An important reason why I do my school work is that I like to learn new things.</td>
<td></td>
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<tr>
<td>16. Truly smart students do not need to try hard to earn good grades.</td>
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</tr>
</tbody>
</table>

**Totals**

Participation in this research is voluntary and participation or non-participation will not affect a student’s grades or class standing in any way.
Key

1. ability mindset – fixed
2. ability mindset – growth
3. ability mindset – growth
4. ability mindset – growth
5. ability mindset – fixed
6. ability mindset – fixed
7. ability mindset – growth
8. personality/character mindset - growth
9. ability mindset – fixed
10. personality/character mindset – fixed
11. ability mindset – growth
12. ability mindset – fixed
13. ability mindset – growth
14. ability mindset – fixed
15. ability mindset – growth
16. ability mindset - fixed

Scoring

Growth Questions

1. Strongly agree – 3 points
2. Agree – 2 points
3. Disagree – 1 points
4. Strongly disagree – 0 point

Fixed Questions

1. Strongly agree – 0 point
2. Agree – 1 points
3. Disagree – 2 points
4. Strongly disagree – 3 points

Strong Growth Mindset = 48-37 points
Growth Mindset with some Fixed ideas = 36-24 points
Fixed Mindset with some Growth ideas= 23-11 points
Strong Fixed Mindset= 10-0 points

APPENDIX F

MINDSET SURVEY POSTTREATMENT
Mindset Survey Posttreatment


To what extent do you agree or disagree with these statements: Please read carefully and check the box

<table>
<thead>
<tr>
<th>Questions</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intelligence is something very basic about you that doesn’t change very much.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. No matter how much intelligence students have they can change it quite a bit if they want to.</td>
<td></td>
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<tr>
<td>3. Students can change how intelligent they are.</td>
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<tr>
<td>4. Music talent can be learned by anyone</td>
<td></td>
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</tr>
<tr>
<td>5. Only a few students will be truly good at sports – they have to be “born with it.”</td>
<td></td>
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</tr>
<tr>
<td>6. I cannot be successful in all the subjects in school.</td>
<td></td>
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<tr>
<td>7. The harder you work at something, the better you will be at it.</td>
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</tr>
<tr>
<td>8. No matter what kind of student you are, you can always change substantially.</td>
<td></td>
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<td></td>
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<tr>
<td>9. I try things even if I might fail.</td>
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<tr>
<td>10. Some students are good and kind, and some are not – it’s not often that people change.</td>
<td></td>
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</tr>
<tr>
<td>11. When I run into a problem I try to figure out what went wrong.</td>
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<tr>
<td>12. I often get angry when I get feedback about my performance.</td>
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</tr>
<tr>
<td>13. I like to be grouped with people who are better than me at a task.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. You can learn new things, but you can’t really change how intelligent you are.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. One of my goals in class is to learn as much as I can.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Truly smart students do not need to try hard.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Participation in this research is voluntary and participation or non-participation will not affect a student’s grades or class standing in any way.
Key

17. ability mindset – fixed
18. ability mindset – growth
19. ability mindset – growth
20. ability mindset – growth
21. ability mindset – fixed
22. ability mindset – fixed
23. ability mindset – growth
24. personality/character mindset - growth
25. ability mindset – fixed
26. personality/character mindset – fixed
27. ability mindset – growth
28. ability mindset – fixed
29. ability mindset – growth
30. ability mindset – fixed
31. ability mindset – growth
32. ability mindset - fixed

Scoring

Growth Questions

5. Strongly agree – 3 points
6. Agree – 2 points
7. Disagree – 1 points
8. Strongly disagree – 0 point

Fixed Questions

17. Strongly agree – 0 point
18. Agree – 1 points
19. Disagree – 2 points
20. Strongly disagree – 3 points

Strong Growth Mindset = 48-37 points
Growth Mindset with some Fixed ideas = 36-24points
Fixed Mindset with some Growth ideas= 23-11 points
Strong Fixed Mindset= 10-0 points

APPENDIX G
STUDENT OBSERVATION RUBRIC

<table>
<thead>
<tr>
<th>Actions</th>
<th>Fixed</th>
<th>Mixed</th>
<th>Growth</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice and applying strategies</td>
<td>Avoids practice. Uses ineffective strategies.</td>
<td>Student will practice but setbacks make them quit. Will only work at things they are good at.</td>
<td>Willing to practice and appears to enjoy the task. Create or apply many strategies and ask for new ones</td>
<td></td>
</tr>
<tr>
<td>Asking Questions</td>
<td>Does not ask questions and usually says “don’t get it”</td>
<td>Asks questions with the purpose of the answer to be given to them.</td>
<td>Questions are directed and specific challenging the text or task and teacher?</td>
<td></td>
</tr>
<tr>
<td>Taking on challenges</td>
<td>Avoids challenges</td>
<td>Challenges are taken only when there is previous experience with success.</td>
<td>Looks forward to the next challenge</td>
<td></td>
</tr>
<tr>
<td>Learning from mistakes</td>
<td>Sees mistakes as failures and proof that you are not smart. May hide or lie about mistakes.</td>
<td>May admit mistakes but lack the strategies to learn from them.</td>
<td>Mistakes are only temporary setbacks and welcomes feedback for reflection</td>
<td></td>
</tr>
<tr>
<td>Perseverance (focus on task)</td>
<td>Little persistence on learning goals and tasks. Gives up easily.</td>
<td>Continue with tasks only with prompting and support.</td>
<td>Displays a confidence to complete task and “stick to it”</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H
STUDENT INTERVIEW QUESTIONS
Pretreatment

1. If you could choose your group partners would you choose students who are smarter than you or not as smart as you? Please explain why?
2. Do you think the challenge questions are for smart people only? Yes or No? Why?
3. When you choose lab or test practice are you more likely to choose the mild, medium or hot level? What affects your choice? Have you changed with the different content that I teach?
4. When reading an article or passage how many times will you read the text?
   a. How willing are you to read over an article several times to make sure you understand the text?
5. How do grades affect your motivation to study new content?
6. If you do not know the answer to a test question do you spend more time on those questions or do you skip them?
   a. If you spend more time what strategy do you use to determine the answer?
   b. If you skip them what is the reason?

Posttreatment

1. What type of people do you prefer to work with in a group, peers of similar, lower or higher ability?
   a. What characteristic do they have that you like?
   b. Do you consider them smart?
2. When given a choice of completion tasks will you go for the ones you think are easy or difficult?
   a. Easy task: Can you explain what may determine your choice?
   b. Difficult task: Do you like to learning new things or are you afraid of the effect on your grade?
3. How do you feel when given a reading assignment?
4. When doing the close reading exercise compare how you felt in the beginning to how you felt after the 4th time?
5. In the process of close reading what was most beneficial: text annotation, pair share, answering questions, for best learning the material.
6. How likely are you to reread a section of text and use the close reading strategy on a test?
7. Identify a motivation to work hard in class
   a. Threat of not graduating due to keystone tests
   b. Poor grades
   c. lack of approval
   d. other
8. Did you find the mindset information helpful? Why or why not?

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.
INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00001065

MEMORANDUM

TO: Kimberly Forsythe and Peggy Taylor

FROM: Mark Quinn

DATE: November 2, 2015

RE: "The Effects of Using Literacy Based Instructional Strategies with a Growth Mindset Intervention on Students' Performance on State Standardized Biology Concepts" (KF110215-EX)

The above research, described in your submission of November 2, 2015, 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:

_________ (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.

_________ (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 that is not exempt under paragraph (b)(2) of this section, if: (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) (6) Taste and food quality evaluation and consumer acceptance studies, if (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural 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 J
TEACHER JOURNAL PROMPTS
1. What were the challenges of day’s lesson?

2. What were the positives of the day’s lesson?

3. Characterize students’ attitudes/reactions toward the lesson.

4. Were there surprises or concerns that became apparent?

5. My take away from today’s lesson was…

6. Rate interest, stress and attitude today.
APPENDIX K

TEACHER OBSERVATION
Teacher interaction with students

<table>
<thead>
<tr>
<th>check</th>
<th>Activities</th>
<th>frequency</th>
<th>comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teacher greets students by first name and refers to personal experience in the conversation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher make eye contact with students when addressing them as a group or individuals</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher used positive connotations when referring to students’ behavior</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher uses negative connotations when referring to students’ behavior</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teachers Actions

<table>
<thead>
<tr>
<th>check</th>
<th>Activities</th>
<th>frequency</th>
<th>comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teacher expresses negative body language</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher expresses positive body language</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher refers to tasks/content as necessary for preparation for the standardized test or achievement of grades</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher refers to tasks/content as a way to increase learning or interest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher incorporated new teaching strategies or students learning strategies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher Comments for growth mindset and fixed mindset

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Language used</th>
<th>Examples</th>
<th>comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feedback given in the form of ability, talent and skill</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reference: * “you are smart at that”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “This is your strength, you are good at this”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “you have the skills, but you have to try harder”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feedback given in the form of effort, process and strategy use</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reference: * “let’s build on the skill we have to improve our learning”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “What strategy can be used to solve or practice the information”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “You started out knowing a lot, so let grow what we know about this topic”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX L

INDIVIDUAL LEARNING PROGRESSION MAP
### Administration:
2015/2016 Classroom Diagnostic Tools

**District:** MIFFLIN COUNTY SD  
**School:** MIFFLIN COUNTY HS  
**Teacher:**  
**Student Group:** Biology I  
**Map Configuration:** Biology  
**Student:**  
**Grade:** 10

### Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MODULE 1:</strong> Cells and Cell Processes</td>
<td>Basic Biological Principles/ Chemical Basis for Life</td>
</tr>
<tr>
<td><strong>MODULE 2:</strong> Continuity and Unity of Life</td>
<td>Bioenergetic/Homeostasis and Transport</td>
</tr>
<tr>
<td><strong>MODULE 3:</strong> Cell Growth and Reproduction/ Genetics</td>
<td>Cell Growth and Reproduction/ Genetics</td>
</tr>
<tr>
<td><strong>MODULE 4:</strong> Theory of Evolution/Ecology</td>
<td>Overall Score</td>
</tr>
</tbody>
</table>

### Scores

<table>
<thead>
<tr>
<th></th>
<th>BASIC BIOLOGICAL PRINCIPLES/ CHEMICAL BASIS</th>
<th>BIOENERGETIC/HOMEOSTASIS AND TRANSPORT</th>
<th>CELL GROWTH AND REPRODUCTION/GENETICS</th>
<th>THEORY OF EVOLUTION/ECOLOGY</th>
<th>Overall Score</th>
<th>Test Date</th>
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<tbody>
<tr>
<td><strong>9/14/2015</strong></td>
<td>940</td>
<td>1050</td>
<td>951</td>
<td>1084</td>
<td>1007</td>
<td>03/14/2016</td>
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<tr>
<td><strong>1/19/2016</strong></td>
<td>834</td>
<td>994</td>
<td>865</td>
<td>1115</td>
<td>945</td>
<td>01/19/2016</td>
</tr>
<tr>
<td><strong>3/14/2016</strong></td>
<td>1006</td>
<td>1007</td>
<td>1118</td>
<td>949</td>
<td>1022</td>
<td>09/14/2015</td>
</tr>
</tbody>
</table>