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Stephanie Brooke Fields

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This study focused on vocabulary and writing skills to promote scientific literacy to align with a series of Student Growth Objectives that I set out based on student needs as specified by the Common Core. The need for a strong vocabulary background is evident especially for at-risk students who might have very little support at home. Students were not scoring well on assessments due to the lack of understanding of scientific terminology and poor study habits. The school system provided an afterschool homework help, but a majority of the eighth grade students did not take advantage of this.

To provide additional support, I restructured my class period as well as my teaching style to encompass a stronger vocabulary base by making vocabulary a focus and activities encouraging vocabulary building. Throughout the study my eighth grade students used a variety of methods and methodologies to show improvement in their knowledge of science context. This study used formative and summative assessments, observations, surveys, activities, and student perceptions of scientific terminology. I found that with increased class time spent with a variety of activities such as flashcards, jeopardy, BINGO, and other ways to review, students remembered and test scores improved as did terminology usage in student writing.
INTRODUCTION AND BACKGROUND

Vocabulary is an essential element of comprehending concepts in content areas. Many words used in science context are used to define ideas and to increase the conceptual development of the content area. Conceptual development is a major goal of science instruction “and has been summarized in the term ‘scientific literacy’ (Bennett C., 2006)”. Without a clear understanding of the language of the science content, students will experience difficulty and a lack of interest with their science materials. Providing students with inquiry strategic vocabulary strategies significantly supported their understanding and interest concerning the language of science. As a result of using engaged vocabulary strategies, it can help student’s bridge the gap between the language of the science content and the language and background knowledge that students bring to the class. “For just as science always seems to spawn surprising advances, the language also takes some unforeseen turns” (Siegfried, 2011).

I teach middle school science, grades six to eight at Woodbine Elementary School in Woodbine, New Jersey. State testing is an important part of the success of schools and students every year. The New Jersey Assessment of Skills and Knowledge for grade 8 Test (NJ ASK8), which was given at the end of April, consisted of a cumulative variety of science questions from fourth grade concepts up to eighth grade. According to Taboada, the process of students’ comprehension for content-area texts in science has been assessed largely through standardized tests (Taboada, 2001).

The focus of my research was integrating a strong vocabulary background to improve content understanding and increase vocabulary in writing. “Games are one of the
most underused tools in education” (Marzano & Pickering, 2005, p.30) My goal was to give my students a variety of ways to improve student learning specifically in vocabulary, by using various activities and devoting fifteen minutes per class to review vocabulary terms and definitions. This practice changed my activities and unit structure. Frank Smith suggests that when students memorize, they do not retain the information after the test, if they actively use vocabulary, they are more apt to understand without forgetting what was taught (Smith, 1998).

**Focus Questions**

The objective of my study was to see how will consistent vocabulary development effect student growth with increased content knowledge and writing? The research questions I focused on throughout the project were:

1) What is the impact of a vocabulary intervention on student achievement?

2) What are students’ perceptions of vocabulary activities?

**School Demographics**

The students involved in this study attend Woodbine Elementary School in Woodbine, New Jersey. It is a single school district with a population of 216 students ranging from preschool age three through eighth grade. The school district falls under the title of economically disadvantaged due to 84% of the population receiving free and reduced lunch. Woodbine Elementary School is a Title I district. Most parents have only completed a high school diploma and work locally at minimum wage jobs.

**CONCEPTUAL FRAMEWORK**

Vocabulary can teach students new ways of looking at the world and developing new concepts and understandings. There are a variety of ways to teach vocabulary and
when using guidelines and steps given below, students will become motivated word
learners to help them succeed in school. Science vocabulary is often more difficult for
students to understand because it is progressive and each area of science encompasses a
different set of concepts and vocabulary. Transforming my classroom with scientific
posters that explained and gave visual reference for terms, the room lent itself as a
teaching aid in that students were able to connect visuals with vocabulary terms being
taught. I also added fifteen minutes to the beginning of each class period using games,
flashcards, PowerPoint’s, and media to review vocabulary. The use of surveys helped to
understand where the students were struggling and gave them the opportunity to tell their
needs anonymously. I measured growth through quizzes and short-answer responses and
was able to see growth in students’ use of vocabulary.

Marzano and Pickering’s research shows that “enhancing students’ background
knowledge would be one sure, strong way to improve students’ academic performance
and narrow the achievement gap” (Marzano & Pickering, 2005). In order to be successful
there needs to be a firm comprehensive vocabulary program for students to make a
significant difference and improve academically. The more words that a student’s knows,
the higher advantage academically the student will have to succeed in school by knowing
not only more vocabulary but supplemental academic content (Marzano & Simms, 2013).

Marzano’s research shows that “enhancing students’ background knowledge
would be one sure, strong way to improve students’ academic performance and narrow
the achievement gap” (Marzano & Pickering, 2005). In order to be successful there needs
to be more comprehensive vocabulary instruction that not only increases students’ ability
to comprehend and retain what is being taught but to use the terminology throughout their
science education. In order to keep your unit or lessons focused it is important to prioritize terms into three groups: nice-to-know words, important words, and core-content words (Silver, Dewing & Perini, 2012). Morrow, Gambrell, and Pressley (2003) state that our students need “word-rich and word-aware classrooms, where new vocabulary is presented in rich listening and personal reading experiences, time is taken to stop and discuss new words, language is a part of all activities”. In order to make a difference in vocabulary building we need to dedicate a portion of our lessons to introducing and reviewing key content area terms. Deck (1952) suggests that teachers assume that students have learned through previous experiences the necessary vocabulary for topics in science. However, the nature of the problem of scientific vocabulary is twofold;

1. “The teacher must identify the words or terms which may be new or difficult”.

Focusing on vocabulary fifteen minutes a day and introducing only a few new words a week can facilitate student achievement. According to Marzano and Pickering (2005), understanding vocabulary terms make it easier for students to understand information they come across about the topic. Marzano and Pickering discuss how the importance of exposure to vocabulary through family conversations can be beneficial to children’s academic growth and be transferred to school. On the other hand, Marzano and Pickering found that if students come from a family that has few resources they will lack in opportunities to develop essential academic knowledge. Whether you come from a vocabulary rich background or not, it is important to build a strong vocabulary foundation in school. Teachers’ unit or lesson plans should build in opportunities for students to use,
understand and learn essential terms. Students need to build strategies for learning, one method is by using a sequence of four-phases or CODE:

C: “Connect or form a strong connection with these terms.

O: Organize where students understand how terms relate to one another to make a larger structure.

D: Deep-Process which when students use thinking strategies to represent the understanding of the vocabulary terms.

E: Exercise which engages students to review and practice activities to help commit new terms in long-term memories” (Silver, Dewing & Perini, 2012).

By using the CODE method vocabulary techniques, students will build essential vocabulary background knowledge to use daily and in the future. “There is a direct link between an understanding of academic vocabulary and an understanding of academic content” (Carleton & Marzano, 2010). Morrow, Gambrell, and Pressley (2003) found that students need many experiences that allow them to use words in meaningful ways, such as in writing and conversation that helps make the terminology more durable and aids in deeper learning. According to Morrow, there are two steps in which students gain control of vocabulary use. The first step is “word ownership by creating personal word books and dictionaries”. The second step is “using new words in discussion, writing, independent projects, and word play”. This puts a sense of ownership on the new terminology while transplanting new words into the students’ personal vocabularies. To create an enthusiastic environment for word learning teachers should use a variety of activities such as puzzles, word games, word calendars, books on riddles, and rhymes. Carleton and Marzano (2010) pointed out that when you are using vocabulary games, they should not
be played for fun rather, they should be seen as one part of the methodical approach to their direct vocabulary instruction practices.

An important objective when using these types of techniques is to include plenty of teacher and student discussion, because facilitating student discussion can give them an opportunity to show where they found the key terms while explaining its meaning, then write/illustrate a sentence to help them remember. Students enjoy observing their progress over time and according to Marzano (2005), using self-assessments can encourage in a non-threatening way, their level of knowledge. Another suggested process was using student vocabulary notebooks. This will give students a way to record the terms with descriptions to assist in building a thorough understanding of new terminology. The new information from the vocabulary notebook can make a significant difference and improve academics. Research revealed that if you teach related words together it can positively affect students’ learning of vocabulary terms. Morrow, Gambrell, and Pressley (2003) state that depth and breadth are the most helpful components for vocabulary knowledge. Another suggested process from Aronin (2013) recommends that each student should have ten to twelve exposures to a word, in a variety of contexts, prior to students learning the word.

Marzano gives specific examples on how to design and implement a comprehensive vocabulary program using these six steps: “Step 1: Provide a description, explanation, or example of the new term. Step 2: Ask students to restate the description, explanation, or example in their own words. Step 3: Ask students to construct a picture, symbol, or graphic representing the term. Step 4: Engage students periodically in activities that help them add to their knowledge of the terms in their notebooks. Step 5:
Periodically ask students to discuss the terms with one another. Step 6: Involve students periodically in games that allow them to play with terms” (Marzano & Pickering, 2005 p15.). By using Marzano’s six steps, students will consistently record terms and periodically add or revise their descriptions and with consistent modeling and guidance the students will generate their own depictions of what they have learned (2005).

Marzano and Carleton (2010) states that data collected in 1941 indicated “there is roughly a 6,000-word gap between students at the 25th and 50th percentile on standardized tests in grades 4-12” (p.1). They also found that since the 1980s, the estimated vocabulary difference to be anywhere between “4,500 and 5,400 words for low-versus high-achieving students”. This shows that the amount of vocabulary a student has is directly associated to their academic achievement. Marzano’s Research Laboratory’s sixty studies found that the use of academic games in classrooms can have a twenty percent point gain on standardized tests (Carleton & Marzano, 2010). Teachers need to deepen students’ understanding of the terms they were taught and in order to do that, it needs to be implemented systematically by recording and reexamining their knowledge of terms throughout the time it takes to teach the particular unit/lesson.

The inability to read with comprehension is a hindrance for pupils who are interested in science but not interested in the reading of science,. This is especially evident with students with learning disabilities. “This difficulty is largely one caused by the vocabulary of science. Thus there is need for procedures which serve to help develop an interest and desire to read with understanding and at the same time grasp the contest of the science material” (Deck, 1952, p.13). There has been a significant link between “knowing and using more words that provides students a greater conceptual
understanding with aids in a larger depth of knowledge. Marzano & Simms (2013) conclude that if you implement effective direct vocabulary instruction using frequent exposures to important words, encounters in multiple contexts, and deep or active processing of the words, students vocabulary would greatly increase. Whether the students are from low or high academic settings, using Marzano’s methods can increase students’ vocabularies while helping them gain the vocabulary content needed for success in school. Based on the research, students need a variety of exposures to vocabulary to make it meaningful. Discussion, conversation, notebooks, and games, all aid in the process of making the vocabulary more meaningful with the hope that students will continue to use it throughout future science classes.

METHODOLOGY

The focus of my study was to show student growth in science literacy focusing on vocabulary in writing, through an instructional shift from standard practices to an inquiry based learning environment. I have made a shift in educational practices with an emphasis on the need for the students to have a deeper conceptual understanding of what they learned. The implementation of this project created the need for curricular changes by merging literacy instruction with science. Students were being asked to read and analyze a greater amount of nonfiction science based text which required students to have a greater lexicon of science vocabulary. It was my goal to raise student outcomes by putting a greater emphasis on vocabulary for a deeper understanding of science and science practices. I put an emphasis on science terminology, by creating a classroom environment that encouraged scientific discussion and allowed students to use different modalities to learn and understand concepts taught. By using “inductive learning it does
more than simply introduce new vocabulary terms: it forces students to search for key attributes and relationships among word” (Silver, Dewing, & Perini, 2012, p.28). It was my premise that students, who actively discussed, study, and use vocabulary in both written and oral forms will show an increased knowledge of scientific content. This would in turn lead to a richer conceptual understanding of science, and will result in an improvement of test scores on the NJASK 8.

As a basis for the design and execution of lessons and according to Morrow, Gambrell, and Pressley (2003) A word-rich setting in which students are immersed in terminology creates an unintentional environment for incidental learning, and the development of ‘word awareness’ which can support vocabulary retention. I used a variety of methods to enhance their vocabulary including word play, activities, graphic organizers, mnemonic strategies, and games (i.e. BINGO, Jeopardy, and Flashcard Memory). By spending fifteen minutes of my forty minute class period on vocabulary development, open-ended writing prompts, and enhancing students’ background knowledge was a beneficial way to improve students’ academic performance to help narrow the achievement gap.

Participants

The participants of my study included seventeen eighth grade students. The class ethnic demographics break down as: Caucasian 16%, African American 56%, and Hispanic 28%. The gender ratio is 39% Female and 61% Male, with 22% of the class classified as learning disabled. As per the state of New Jersey definition, 78% of the class is considered economically disadvantaged. Attendance is a continuing problem; I only
used scores from students who attend school 80% of the time, as it is hard to factor in their grading when they miss too many school academic days.

**Intervention**

The need for making connections between concepts and vocabulary was an issue, the students needed more simple examples to be able to grow their knowledge from usage to understanding. The classroom was set up as a print rich environment, consisting of posters illustrating science terminology and processes, with student directed activities to encourage a deeper understanding of scientific vocabulary. I gave students assessments from the textbooks, student directed essential questions as per the science curriculum, open-ended writing prompts that were rubric graded, and had interviews with six students on astronomy criteria. Students with special needs had tiered assignments. They were challenged due to the fact they were reading below average. Lessons had to be adjusted from the standards- based lessons, with used higher scientific vocabulary to a conceptual approach with integrated vocabulary. The use of games such as vocabulary bees and BINGO, encouraged the students to use terminology more freely and in context. In addition to my curriculum, I added Scholastic Magazines- Science World, with current science topics and vocabulary which incorporated technology. I also found the use of media helpful, i.e. *Bill Nye The Science Guy*, because it was a visual and auditory reinforcement for the students. Students were encouraged to participate in academic discussion on lessons, current events as well as topics they saw on the Discovery Channel. I observed from February to April, that the students moved from memorization of vocabulary for a test to being able to express themselves both verbally and in written form.
Instruments

I focused on vocabulary enrichment and writing assessments using common words in science and that could be found on the NJ ASK8. The students were given a multiple-choice pre-test encompassing all of the material they needed to know by the end of eighth grade. The pre-test consisted of short-answer/open-ended essay questions to see how they wrote and used science vocabulary to describe their general science knowledge on topics to date. I used these scores to compare them to the post-test that was given in April. Throughout the winter and spring which is Second and Third Marking Period, I continued to assess students to see how much they retained and what topics they still struggled with. Surveys were used to show student perceptions toward science vocabulary, study habits, and using meaningful terminology. By critically evaluating this survey data, it created a direction for my classroom instruction. I challenged myself finding ways to keep student interest while spiraling their learning.

Data Collection

I collected data from a variety of sources, which are briefly outlined in Table 1.

<table>
<thead>
<tr>
<th>Focus Question: How will consistent vocabulary development effect student growth with increased content knowledge and writing?</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Questions:</td>
<td></td>
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<tr>
<td>1: What is the impact of a vocabulary intervention on student achievement?</td>
<td>Pre-Tests, Writing Samples, &amp; Student Growth Objectives</td>
</tr>
<tr>
<td>2: What are students’ perceptions of vocabulary</td>
<td>Surveys</td>
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</table>
As part of my intervention from February through April, I spent fifteen of my forty minute period practicing, reviewing, and using activities/games to enhance or retain terminology recognition. I put up posters and diagrams around the room to give students visual clues about vocabulary concepts. I also changed the formatting of my assessments due to student preferences; they preferred multiple choice due to vocabulary hints. I gave pre and post interview on astronomy terminology/ideas to measure vocabulary usage and growth. I incorporated fun activities to increase student engagement in vocabulary enrichment such as BINGO, Jeopardy, video clips, vocab bees, etc. Science magazine was another resource to help students understand science vocabulary in a more meaningful way because it dealt with real life scientific issues.

I gave a pre-test using both multiple choice and short-answer questions to measuring the students’ use of science vocabulary and the prevalence in their writing. Due to low pre test scores I decided to give the students a series of three surveys: study habits, perceptions of new test formats and classroom activities. Over six weeks I administered four vocabulary quizzes. During the second and third marking periods the students took two chapter tests. Each quiz and test had a section of vocabulary and a short written response section. Based on test and quiz results I used different teaching strategies to help reinforce concept retention. Students were given daily activities to challenge their vocabulary knowledge; class participation and discussion were an integral part of my formative assessment. These activities included but were not limited to vocabulary bees, flash cards, class discussions and dedicated vocabulary study. Prior to
the astronomy unit students were interviewed on their perceptions of astronomy concepts measuring the terminology usage. My lessons were designed to encourage use of astronomy vocabulary whenever possible. When the unit was completed, I restated the interview questions to see if the students used a greater number of science terms.

(Appendix G)

As part of my teaching practice I used flash cards, games, and observations to make the process of learning vocabulary a more engaging method. The results from surveys showed that students were not spending enough time studying, read and repeat was their preferred method of study. By adding Jeopardy, BINGO, and Vocab Bees, this forced students to focus on specific terminology as it applied to each science unit. Jeopardy created an environment where students had to visualize scientific context through group work to answer questions competitively. Periodic Table Bingo made students aware of terminology to find the specific element used and their attributes. Vocabulary Bees aided in retaining definitions of various scientific topics. This was a three-fold process where students had formative assessments, activities, and summative assessments. This provided students with engaging activities which in-turn aided in higher quiz and test scores.

DATA AND ANALYSIS

I used data collected to attempt to answer my focus questions from a variety of sources. Having analyzed my results, I was able to see the growth in vocabulary in my students’ work.

Beginning in February and continuing through April, the eighth grade students engaged in many vocabulary enriching activities to increase scientific content knowledge
as measured through pre and post testing. I generated Student Growth Objectives, to have an overall goal for my seventeen eighth graders to reach twenty percent growth in scientific vocabulary and the ability to use the correct terminology when answering science based questions. These tests included a general knowledge pre/post-test that included multiple choice and short response answers, unit chapter tests and surveys that included student perceptions of vocabulary, writing in the content area and study skills. I included the surveys to have an understanding of the deficits students had when studying and understanding scientific vocabulary.

Impact of vocabulary intervention on student achievement.

Students had an increased knowledge of content and vocabulary. Evidence from their vocabulary quizzes, chapter tests, and writing samples support this claim.

The strongest evidence for this claim comes from assessments. Between the second and third marking period my students took four quizzes to assess vocabulary understanding and growth. The average results were as followed:

- Quiz 1: 73%
- Quiz 2: 76%
- Quiz 3: 85%
- Quiz 4: 93%

The growth in scores over the second and third marking periods showed an increased understanding of vocabulary context. The students grew 20% over the six weeks from the addition of class time spent on science fluency.

There were two-part general science pre-tests given using both multiple choice and short answer questions. It was my goal that more than half my class would increase
their scores to fifty percent or higher on both post-tests. The overall goal for the open-ended pre-assessment was for my students to be able to express answers to scientific questions in a logical cohesive written form to support answers using scientific vocabulary. The pre-test multiple choice mean test score was forty-four with a standard deviation of six points, the post-test had a mean score forty-nine percent with a standard deviation of eight points. The short answer pre-test was a forty-nine percent with a standard deviation of eleven points, and the mean of the post-test was fifty-eight percent with a standard deviation of sixteen points. The students met the SGO goals by increased vocabulary knowledge as calculated by the pre and post tests.

By adding fifteen dedicated minutes of vocabulary review to my classroom practice has resulted in student growth in vocabulary knowledge. Use of class discussion, written work, and observations I was able to see growth of scientific knowledge. When students used the correct scientific terminology in the correct context, it was apparent that students understood the topics thoroughly. This was evident in comparing chapter tests and my focus question where students displayed an increased knowledge of content and vocabulary (Appendix I).

It was most apparent in chapter tests and the pre and post test results. The average score for test number one was 77% compared to an 88% average on the second test. This increase of 11% could be attributed to additional class instruction of vocabulary which I incorporated into the first fifteen minutes of class. Comparing the pre-test to the post test student’s scores showed there was a growth in vocabulary usage and understanding as demonstrated in their multiple choice questions and their short extended responses. On the post assessment eleven students scored a 44% and six students scored above a 44%.
The short-answer post-test results were, five students scored below a 50% and twelve students scored above a 50%. My Student Growth Objective goal was for 38% or seven students to score above a 50% on both of the post-tests by the April. The outcome was that five students scored above a 50% on the multiple-choice post-test and twelve students scored above a 50% on the open-ended post-test. I reached my goal for the open-ended tests but not for the multiple choice section (Appendix F).

Students’ perceptions of vocabulary activities.

Students have a positive perception of the activities used to improve their vocabulary instruction. Evidence from surveys and interviews support this claim.

I included surveys to determine students’ perceptions of vocabulary and their learning needs. The students were surveyed on three topics: study habits, writing perceptions and perceptions on an astronomy. Students’ perceptions of classroom activities showed they felt they understood the material as represented in the survey where they commented on how they felt they had performed on the test. This data provided me with a better understanding of students’ preferences of ways to study, study time, strengths and weaknesses, how they retained information using visual aids, likes and dislikes of teaching methods of vocabulary, and preferred learning methods.

The first survey was on “Student Perceptions Vocabulary Survey”. Question number one asked if the fifteen minutes of vocabulary review helped them. One hundred percent of the students agreed that the fifteen minutes of vocabulary review was beneficial. Question number two: Which activity did you prefer the best and why? The two most prevalent answers for this question were the vocabulary bee and Pictionary. The students felt that they were able to remember the words better when they had to know the
terms to win the game. In Pictionary, the students liked drawing about the terms. Several commented about using the charts in the room to “cheat”. Question number three: “How has vocabulary review helped you”. The students said it helped them remember the vocabulary better because it was a daily activity. They also felt the fifteen minute review made learning the terms easier. Many said they usually just studied for vocabulary, but the added fifteen minutes forced them to use the terminology. They commented that they were better prepared for tests and quizzes. The posters around the room were more understandable and helpful because they were more aware of the vocabulary and saw them as a reference rather than a decoration. Question number four: “Why is vocabulary important in science”? The prevalence of answers revolved around the fact that you need to know vocabulary to understand what you are learning. They also commented that it helped to do the labs correctly. Several said that the classroom lessons were more understandable. Question number five: “Do you have a better understanding of why vocabulary was important to understanding science? Explain”. They all agreed that having a better understanding of vocabulary helped. Students had a variety of comments on reasons they felt more confident. Several students commented that they understood the questions on the NJ ASK8 better and felt they had done well. They were more confident writing about science concepts and wrote more in the open-ended sections of the test. Students also commented on finding the Discovery Channel more interesting, and were impressed that they knew more about the program. The students discussed careers that involved science such as medicine and forensics.

Based on these student perceptions, the need to increase vocabulary growth was necessary for science understanding. Findings from this survey also showered that
students were more aware of science terminology in their environment. Students were more confident in answering their open-ended questions because of their increased vocabulary knowledge.

The next survey was on “Writing Perceptions” and the first question was on which writing style you prefer persuasive 42%, informational 33%, narrative 8%, and compare/contrast 17%. Question number two was on the most difficult aspect of answering the writing prompt is understanding assessment questions= 17%, remembering the information=25%, organizing information= 33% and getting information from ideas to paper= 25%. Question number three was is it easier to use a bulleted list 100%. Question number four does a picture or diagram help you in the writing process was 55% said yes and 45% said no. The short-answer survey showed that students preferred writing in both informational and argumentative form to make a point in their scientific writing. When surveyed on the most difficult aspect of answering a writing prompt the highest percentage was in organizing the information with remembering the information and formulating idea being tied for second place. This was helpful in having students structure their responses so they were in an organized manner and used correct terminology to support their answers. This survey also showed that a 100% of the students preferred to use a bulleted list. The survey also showed that 55% of the students felt that a diagram or picture helped in the writing process. I included diagrams/pictures because they give visual clues to remind students of the concept vocabulary they should use.

The third survey was “Students’ Perceptions on the Astronomy Test” with an emphasis on understanding vocabulary in test question form. Question number one was
choose which style of questions you prefer. 62% of the students preferred multiple choice questions, 0% of the students liked fill in the blank, 15% prefer true or false and 33% prefer matching. Students preferred multiple choice because it gave them vocabulary clues within the question. After taking the test with a different vocabulary format, 8% said they performed excellent, 42% well, 33% passed, and 17% felt they did poorly. The students thought the fifteen minute activities in the day provided them with a better understanding of the terminology and in-turn they felt they had done better on the test. Of the seventeen students taking the test, fourteen of the seventeen or 88% did well or passed, that is a direct correlation to how students felt they did. When asked if students felt more prepared for this test than the previous, 73% felt they were and 27% did not. Students were asked if they felt that the games or activities we did during class helped better prepare them for this test, 68% felt it did. When the students took the test after the vocabulary activities their scores rose over 10%.

**INTERPRETATION AND CONCLUSION**

My observations, surveys, writing prompts, tests and quizzes, have shown student growth with both scientific talk and larger use of vocabulary terms in writing. It was evident in my survey about the study habits that that lack of content understanding was reflected in the student assessments. When surveyed the students only studied zero to thirty minutes for exams. The survey also revealed that the main study strategies were by read, repeat, review with flashcards. This strategy was not successful as represented by their test scores. I added more practice with vocabulary during the first fifteen minutes of class after reviewing second marking period test scores which averaged at seventy-seven percent. By third marking period, after trying new strategies such as games, PowerPoint
presentations, educational movies, science rap songs, flashcards, and vocabulary bees; they improved test scores by ten percent to eighty-seven percent. This made me realize that the first fifteen minutes of interactive science vocabulary positively impacted student learning. I also worked with students on making their writing more meaningful by incorporating the correct terminology to explain science context. (Appendix G&I) The writing grew with more vocabulary development with students being able to expand on science context.

VALUE

Looking back over the course of the school year, I realized the importance of a strong understanding of scientific vocabulary due to the lack of having suitable studying conditions in the student’s homes. This increase in test scores made me realize that the fifteen minutes I spent at the beginning of each lesson helped students be successful in both formative and summative assessments. Surveys from the student’s gave me insight as to how they learned, study habits, discussions, using games, activities, flashcards, ways in which they prefer to learn. For example, flashcards replaced the students main study habits of read, write, and review and made it more engaging. The benefits of this research provided me with a change in practice for all grade levels, where I will incorporate, in the years to come, fifteen minutes of review in vocabulary and writing in the content area daily.
REFERENCES CITED


Taboada, A. (2001, December 8). Relationships of general vocabulary, science vocabulary, and student questioning with science comprehension in students with varying levels of English proficiency. Instructional Science, 40(6), 901-923.
APPENDICES
APPENDIX A

STUDENT GROWTH OBJECTIVE #1
# Student Growth Objective #1

<table>
<thead>
<tr>
<th>Grade:</th>
<th>Subject:</th>
<th>Number of Students:</th>
<th>Interval of Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Science</td>
<td>18</td>
<td>Full year</td>
</tr>
</tbody>
</table>

Name of Assessment: General Science Pre-Test Multiple Choice

SGO Type: General

Rationale for Student Growth Objective

(Please include content standards covered and explanation of assessment method.)

Students tested in September on Astronomy, Physical science, and other topics that will be taught and assessed throughout the year. Post-general science test will be given in the spring.

5.1.8.A.1: Understand Scientific Explanations- Demonstrate understanding and use interrelationships among central scientific concepts to revise explanations and to consider alternative explanations.

Student Growth Objective

38% or 7 of my 17 eighth grade students will score a 50% or greater on the post-test by the Spring.

Baseline Data

(Please include what you know about your students’ performance/skills/achievement levels at the beginning of the year, as well as any additional student data or background information used in setting your objective.)

17 eighth graders took the general science knowledge pre-assessment with a baseline score below a 44%. By using periodic assessments throughout the year they will retake the same multiple choice assessment in the spring.

Scoring Plan

Objective Attainment Based on Percent and Number of Students Achieving Target

<table>
<thead>
<tr>
<th>Target</th>
<th>Exceptional (4)</th>
<th>Full (3)</th>
<th>Partial (2)</th>
<th>Insufficient (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 45% Greater than 7 students</td>
<td>Score at 31%-45% 6-8 students</td>
<td>16% - 30% 3-5 students</td>
<td>Less than 16% Less than 3 students</td>
<td></td>
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</tbody>
</table>

Approval of Student Growth Objective

Teacher _______________________ Signature_________________ Date Submitted_______________

Evaluator ________________ Signature ________________ Date Approved _______________

Results of Student Growth Objective

(State how many students met the final assessment target)

5 students scored a 50% or higher on the multiple choice post-test.

*Data changed due to 1 student transferred

Score _______ Date ________

Teacher ___________________ Evaluator ___________________
APPENDIX B

STUDENT GROWTH OBJECTIVE #2
**Student Growth Objective #2**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Subject</th>
<th>Number of Students</th>
<th>Interval of Instruction</th>
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<tr>
<td>8</td>
<td>Science</td>
<td>18</td>
<td>Full year</td>
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<table>
<thead>
<tr>
<th>Name of Assessment</th>
<th>General Science Pre-Test: 20 short answer/essay with 13 multiple choice</th>
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</table>

**Rationale for Student Growth Objective**
(Please include content standards covered and explanation of assessment method.)

Students do not make connections between science theory and practice. Students will be able to express answers to scientific questions in a logical cohesive written form to support answers with scientific vocabulary. Students were tested in October and will take the post-test in the spring.

5.1.8. A. 3- Understand Scientific Explanations- Use scientific principles and models to frame and synthesize scientific arguments and pose theories.

**Student Growth Objective**

38% or 7 of my 17 eighth graders will score a 50% or greater on the short constructive response & extended response stressing science process & vocabulary.

**Baseline Data**
(Please include what you know about your students' performance/skills/achievement levels at the beginning of the year, as well as any additional student data or background information used in setting your objective.)

My 17 eighth graders took a short response/ open-ended pre-assessment with all students scoring below a 50%.

**Scoring Plan**

| Objective Attainment Based on Percent and Number of Students Achieving Target |
|--------------------------------|--------------------------------|----------------------------|----------------------------|-----------------------------|
| Target                        | Exceptional (4) | Full (3) | Partial (2) | Insufficient (1) |
| Greater than 45%              | Greater than 7 students | 31-45% 6-8 students | 16%-30% 3-5 students | Less than 16% Less than 3 students |

**Approval of Student Growth Objective**

Teacher __________________ Signature_________________ Date Submitted_________________
Evaluator __________________ Signature_________________ Date Approved_________________

**Results of Student Growth Objective**
(State how many students met the final assessment target)

12 Students scored above a 50% on the open-ended post-test.
*Data changed due to 1 student transferred

Score _______ Date _______ Teacher ___________________
Evaluator ___________________
APPENDIX C:

PRE & POST-TEST MULTIPLE CHOICE GROWTH
Pre & Post Multiple Choice Growth

Pre-Test

Post-Test

[Bar chart showing the comparison between Pre-Test and Post-Test for multiple choice growth]
APPENDIX D:

PRE & POST-SHORT ANSWER/OPEN-ENDED GROWTH
Pre & Post Short Answer Growth

Pre Test

Post Test

![Bar Chart](chart.png)
APPENDIX E:

SHORT ANSWER/OPEN-ENDED PRE & POST TEST SAMPLES
Short-Answer/Open-Ended Pre-Test Student Samples

For Questions 5–6, think about what happens inside your body when you eat bread.

5. Which parts of your digestive system digest bread?
   The stomach

6. Describe how the nutrients from digested bread move from the digestive organs to muscles and other tissues where they are needed.
   They moved by blood.

7. Why would a person be cooler on a hot, sunny day in a light-colored T-shirt than in a dark-colored T-shirt made of the same material?
   The dark T-shirt absorbs the sun.

8. Earth’s moon is
   A. always much closer to the sun than it is to Earth.
   B. always much closer to Earth than it is to the sun.
   C. about the same distance from the sun as it is from Earth.
   D. sometimes closer to the sun than it is to Earth and sometimes closer to Earth than it is to the sun.

Pre-Test short answer response #1A
For Questions 5–6, think about what happens inside your body when you eat bread.

5. Which parts of your digestive system digest bread?
   - Your tongue
   - Esophagus
   - Stomach
   - Large intestine
   - Small intestine
   - Rectum
   - Anus

6. Describe how the nutrients from digested bread move from the digestive organs to muscles and other tissues where they are needed.
   - They are transmitted to energy the two time substances

7. Why would a person be cooler on a hot, sunny day in a light-colored T-shirt than in a dark-colored T-shirt made of the same material?
   - Dark color attract all heat

8. Earth's moon is
   A. always much closer to the sun than it is to Earth.
   B. always much closer to Earth than it is to the sun.
   C. about the same distance from the sun as it is from Earth.
   D. sometimes closer to the sun than it is to Earth and sometimes closer to Earth than it is to the sun.
For Questions 5–6, think about what happens inside your body when you eat bread.

5. Which parts of your digestive system digest bread?

The part of your digestive system that digests bread is your stomach.

6. Describe how the nutrients from digested bread move from the digestive organs to muscles and other tissues where they are needed.

They are broken down and pushed sent to the tissues that need them.

7. Why would a person be cooler on a hot, sunny day in a light-colored T-shirt than in a dark-colored T-shirt made of the same material?

Yes because the sun attracts to dark colored shirts.

8. Earth's moon is

A. always much closer to the sun than it is to Earth.
B. always much closer to Earth than it is to the sun.
C. about the same distance from the sun as it is from Earth.
D. sometimes closer to the sun than it is to Earth and sometimes closer to Earth than it is to the sun.

Pre Test short answer response #1B
For Questions 5–6, think about what happens inside your body when you eat bread.

5 Which parts of your digestive system digest bread?

The teeth, stomach, and small intestine, plus the stomach.

6 Describe how the nutrients from digested bread move from the digestive organs to muscles and other tissues where they are needed.

They get turned into sugars and are seeping through villi in the small intestine into your bloodstream.

7 Why would a person be cooler on a hot, sunny day in a light-colored T-shirt than in a dark-colored T-shirt made of the same material?

Because the black attracts more rays to you.

8 Earth’s moon is

A always much closer to the sun than it is to Earth.
B always much closer to Earth than it is to the sun.
C about the same distance from the sun as it is from Earth.
D sometimes closer to the sun than it is to Earth and sometimes closer to Earth than it is to the sun.
APPENDIX F:

STUDENT GROWTH OBJECTIVE TEST SCORES
### Student Growth Objective Test Scores

<table>
<thead>
<tr>
<th>Student</th>
<th>Pre-Test (multiple choice)</th>
<th>Post-test (multiple choice)</th>
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APPENDIX G:

ASTRONOMY STUDENT SURVEY & PERCEPTIONS
Astronomy Student Survey & Perceptions

1. How do you determine the strength of the force of gravity between two objects?
   a. Above Level #1- Pre- It pulls it down Post- gravitational pull
   b. Above Level #2- Pre- Because we don’t float off, it pulls stuff down instead of push it up.
      Post- distance & mass
   c. At- Level #1- Pre- the mass of the object and the distance between them. Post- mass
   d. At- Level #2- Pre- Inertia Post- Inertia
   e. Below Level #1- Pre- Gravity pulls the force pushes. Post- forgot
   f. Below Level #2- Pre- The mass Post- doesn’t know

2. Explain night & day and how they occur.
   a. Above Level #1- Pre- Earth turns on its axis and when its facing the Sun its day on that
      one side and the other side its night its dark. Post- earth rotates one side of the Sun is
      facing the Sun so its day time and the other side dark and its night.
   b. Above Level #2- Pre- It takes earth to rotate in 24 hours. When the sunlit side is facing
      the sun it day and the other side is dark its night Post- it occurs because Earth rotates &
      it gets certain hours of sunlight. Night happens because there’s sunlight on the other side
      of the Earth.
   c. At- Level #1- Pre- dark side is the side the sun isn’t on, and the other side is bright
      because the sun is shining on it. Post- night is when the Sun id on the other side of the
      earth and day is when the Moon is on the other side and we see the sun.
d. At-Level #2-Pre- Rotation of the Earth and the tilt. Night is the side that doesn’t get to see the sun and the bright side gets to see the sun. Post- Earths rotates 24 hours where one side is dark and the other is facing the Sun.

e. Below Level #1- Pre- Earth spins & daylight is on one side and it is night on the other side, and then reverse it. Post- Rotation of the Earth around the Sun if its daytime it’s on that side if its night time the Sun is on the other side.

f. Below Level #2- Pre-Not sure? Post- The Earth spinning and I don’t know.

3. What causes the seasons?

a. Above Level #1- Pre-How the earth tilted. Post- the tilt on its axis

b. Above Level #2- Pre-When Earth tilts on its axis Post- The tilt of Earth’s axis.

c. At- Level #1- Pre-the way the earth goes the sun and was tilted on an axis not straight up and down which is why Florida is warmer because they are closer to the equator and its cooler in NJ. Post- tilt on Earth’s axis

d. At-Level #2-Pre-The tilt of the Earth and its axis and it going around the Sun. Post- the tilt of Earth’s axis.

e. Below Level #1- Pre-Weather & how the Earth rotates. Post- forgot

f. Below Level #2- Pre-The axis. Post- the tilt of the axis

4. What causes tides?

a. Above Level #1- Pre-The Moon Post- the Moon & how gravitational pulls on the water

b. Above Level #2-Pre- The Moon. Post- The Moon is in a certain position or phase it’s either high or low tide.

c. At- Level #1-Pre-the wind not sure? Post- Moon’s force of gravity on the Earth
d. At-Level #2 – Pre-Moon and its gravitational pull. Post- the Moon if is pulling the ocean gravitation pull

e. Below Level #1- Pre-The moon because the full moon is when it’s high tide & if it’s not a full moon its low tide. Post- The Moons gravity

f. Below Level #2 – Pre-How the moon is & it causes tides. Post- the Moon

5. What are lunar & solar eclipses?

a. Above Level #1- Pre-Lunar eclipse is when the Moon in front of the Sun. Solar eclipse he is not sure. Post- lunar is when the Moon is in front of the Sun and solar is Sun is in front of the Moon.

b. Above Level #2- Pre-When the moon is in front of the sun is lunar. Solar is sun is in front of the moon. Post- lunar is Moon between Earth & the Sun. solar is when the Earth is in between the Sun and Moon.

c. At- Level #1- Pre- lunar is the shadow of the moon and the solar the moon covers the sun. Post- lunar is when earth and sun are in the middle Sun moon and earth. Solar is when the moon covers the sun.

d. At-Level #2- Pre-Solar is when the Sun shadow gets blocked by Moon. Lunar is when the Earth blocks the Sun from the Moon. Post- lunar is when the Moon blocks the Earth from the Sun. solar is when the Earth blocks the Sun from the Moon.

e. Below Level #1- Pre-Not sure? Post- lunar moon is in front of the Sun solar means Sun is behind the moon

f. Below Level #2- Pre-Lunar eclipse is when the Moon & Sun combine to make a red circle. Solar eclipse not sure? Post- Solar the Moon and the Sun come together

6. Describe & list lunar phases. (Could not remember phases in order)
a. Above Level #1- Pre-full, half, crescent, quarter, new moon Post- New Moon, Waning Gibbous, Waxing Gibbous, Full, Waning Crescent, Waxing Crescent,

b. Above Level #2- pre-full, waxing crescent, waning, crescent, waning gibbous, waxing gibbous, new quarter, last quarter, new moon. Post- New, 1st Quarter, Waxing Crescent, Waxing Gibbous, Full, Waning Gibbous, 3rd Quarter, & Waning Crescent.

c. At- Level #1-Pre-new moon, full moon, waning gibbous, waning crescent, waxing gibbous, waxing crescent. Post- New, Waxing gibbous, waxing crescent, waning gibbous, waning crescent, first quarter, last quarter, full.

d. At-Level #2- Pre-full, waxing gibbous, waning gibbous, waning crescent, waxing crescent, new moon. Post- New, waning crescent, 1st quarter, waxing crescent, waning gibbous, waning crescent, waxing gibbous, full.

e. Below Level #1- Pre-full, new, waxing, waning, first quarter, third quarter. Post- Waxing gibbous, full, new, waning gibbous, waxing crescent, waning crescent, first quarter, last quarter.

7. Below Level #2-Pre- new, full, waxing gibbous, waxing crescent, first quarter, third quarter, waning crescent, waning gibbous. Post- full moon, new moon, waxing gibbous, 1st quarter, last quarter? What are the features & characteristics of the moon surface?

a. Above Level #1- pre-craters, dark white, gray/dark spots, hills. Post- craters, Maria, mountains, dust, Moon is cool no atmosphere.

b. Above Level #2pre—grayish color, craters, hills, rocks, round, post- Maria, Craters, rocky, and hills. Dry and cold, less gravity, no water, sunny side is warmer than dark side.
c. At- Level #1- pre-gray spots starts with an M? Moon dust, gravity on it sometimes possibly, shadows no water, hills, and empty valleys. Post- gray, Maria, craters, rocky, solid, no atmosphere, volcano, core is dead, less gravity when you drop the hammer and feather they both fall at the same time. When you stand on the moon you are not the same weight.

d. At-Level #2- pre-gray, a lot of craters, people say there’s a face but it’s from objects from outer space hitting the moon’s surface. Rocky, there are mountains maybe volcanoes? Post- rocky, solid, cold, craters, Maria, some gravity not a lot. dry

e. Below Level #1- pre-it is rocky, grayish whitish, curvy, no water, with mountains.post- solid, grayish whitish, cold, dusty, holes-craters.

f. Below Level #2- pre-It is lightish gray; there are holes with a circle wall around it, no mountains or water. Post- craters, below zero, no atmosphere.

8. How was the moon formed?

a. Above Level #1- pre-Not sure post- when the Earth was form bits of rocks floating around compressed into the Moon.

b. Above Level #2- pre- Not sure post- A collision-ring theory where a meteor collided with the Earth and what was left of it formed the Moon

c. At- Level #1- pre- giant meteorite but abnormally large and circles us. Post- a planet crashed into Earth when it was fiery and there was a ring of fire dust particles formed the moon.

d. At-Level #2 – pre-from the debris when the earth and a meteor crashed into each other the debris left from the collision from the earth formed the moon.post- an earth like sized
planet smashed into Earth and all the debris from the collision were pulled into earth’s gravity forming the Moon.

e. Below Level #1 – pre-Not sure? post-forgot

f. Below Level #2 - pre-Not sure? post-doesn’t remember

9. What are the 3 layers of the Sun?

a. Above Level #1- pre-core post- Core, Convection zone & radiation zone.

b. Above Level #2- pre-core, surface, gas, post- chromospheres, photosphere, and corona.

c. At- Level #1-pre- not sure. Post- core, photosphere, chromospheres.

d. At-Level #2 –pre- not sure.post- chromospheres, photosphere, corona.

e. Below Level #1 – pre-Not sure? post- crust, core,

f. Below Level #2 – pre-Not sure? post- crust, mantle, and core

10. Where are most asteroids located?

a. Above Level #1-pre- belt post- Between Mars & Jupiter in the Asteroid Belt.

b. Above Level #2-pre- the belt post- Asteroid Belt between Mars & Jupiter.

c. At- Level #1- pre-not sure? Post- Asteroid Belt in between Jupiter and Mars.

d. At-Level #2 – pre- asteroid belt post- Asteroid Belt is between Mars & Jupiter.

e. Below Level #1- pre-not sure? post- Asteroid Belt in between Jupiter & Mars

f. Below Level #2 –pre- not sure? post- Asteroid Belt in between Mars & Jupiter

11. What are meteorites & how are they formed?

a. Above Level #1-pre- parts of planets that fell off. Made of rock.post-Made of rocks & dust. Asteroids that came out of the asteroid belt, they hit planets, smaller they burn through Earth’s atmosphere, land creating a crater.
b. Above Level #2- pre-when chunks of asteroids break off. Post- it’s a meteoroid that enters Earth’s atmosphere & it’s formed because they formed from the asteroid belt which was a once planet broken up into pieces.

a. At- Level #1 – pre-break off of planets and hang out in space then breaks the atmosphere and come into earth. Made of rock, broken pieces of planets. Post- made of rock and other particle, breaks earth’s surface and they don’t make it to the ground they burn up before hitting earth’s surface.

b. At-Level #2- pre-heavy rocks from outer space formed by rocks hitting each other and absorbing the rocks that hit them. Post- little chunks of rock that hits earth’s surface formed by meteors that break up in the Earth’s atmosphere.

c. Below Level #1-pre- They are rocks of all different shapes.post-rocks formed all different sizes, not all of them land & not all the same size.


12. What are the characteristics that the INNER & OUTER planets have in common or differ?

a. Above Level #1- pre-Inner planets, hotter Outer are colder because they are farther away from the Sun. Outer planets are made of gas, rings, multiple moons. Post- Inner planets are small, some have atmospheres, rocky, and Mars & Earth have moons. Outer planets are big balls of gas, bigger, a lot of moons, they have rings. Pluto is smaller and it’s a dwarf planet solid & rocky.

b. Above Level #2- pre-inner have moons, indents and hills, gravity. Outer planets rings, gas, moons, less gravity.post- Inner planets small and rocky, hotter, close to the Sun.
Outer planets have a lot of moons, rings, colder, larger than inner planets, made up of gas hydrogen & helium & carbon dioxide.

c. At-Level #1-pre- Inner planets are made of Venus is made of gas, hotter material because they are closer to the sun. Outer planets cold, icy, gas, lots of moons, rings. post- Inner: they have a rocky surface, closer to the Sun; some have hills and volcanoes, valleys, seasons, and Earth & Mars have moons. Outer- Gassy surface, strong atmosphere, all have a lot moons, they have storms, made of helium & hydrogen.

d. At-Level #2- pre- Inner planets Mercury reddish brownish color with rocky surface, no water, no moons, very hot! Venus has rocky, color is gray, hot planet close to the sun as well, maybe a moon? Earth has water, rocky, perfect distance away from the sun and protected and not as hot, and has life, 1 moon. Mars brown, gray, cold, moons, rocky, no life, no water. Jupiter gasy, biggest planet in our solar system, moving storm on it all the time around the planet, orange reddish color and it has a lot of moons. Saturn is a gas giant, with a lot of moons, very windy, no life, no water, rings from leftover gas from the planet and its very cold there! Neptune has gas, blue, a lot of rainstorms, cold, a lot of moons, no life because it is too far away from the sun. Uranus has water, no life, and blue, completely covered in water no dry spots on it, a lot of moons, cold. Pluto dwarf planet, very cold it’s the last planet in our solar system, rocky, not that big, gray. They used to call it planet X before it got its name because they didn’t know what it was. post-they all have rocky surfaces, Earth has a Moon & Mars, closest to the Sun meaning hot or warm, orbits don’t take as long as the outer planets, much smaller than the outer planets. Outer= gas giants, no solid surfaces, all have moons, rings, elliptical orbits, made of hydrogen & helium, cold, no rocky surfaces.
e. Below Level #1 - pre-Mars is orange, dusty. Mercury is hot, Earth has life, water, gravity, trees, plants, animals & people. Saturn has rings & Pluto is small & really cold. post- Inner Planets- rocky & solid, Earth has a moon, Mars has a moon, warm some are hot like Mercury’s hot others are warm, Outer Planets-very large, gas, rings, lots of moons, cold because they’re farther from the sun. Pluto is the smallest one and farthest away and really cold.

f. Below Level #2 - pre-Mercury is hot, Earth has water, life, plants, and living things, Jupiter has 3 rings & is one of the biggest planets, Uranus is really cold, Pluto is small & is not a planet anymore, and very cold. post- outer planets are gas giant, rings more moons than the inner planets, inner planets are smaller solid.

13. Identify the types of objects and characteristics of the solar system/universe?

a. Above Level #1 - pre-7 planets, some have moons around them, asteroids, debris from broken stations from studying in space, billions of stars in our universe, Milky Way galaxies, and a lot of galaxies. Black holes. post- Sun, planets, asteroids in asteroid belt, outer planets, Kuiper belt, comets, galaxies, clusters, black holes.

b. Above Level #2 - pre-planets, asteroids, black holes, comets, stars, moons, galaxies. post- planets, asteroids, moons, comets, the Sun, stars, galaxies, nebulas, black holes.

c. At- Level #1 – pre-sun, planets, asteroids, meteorites, moons, comets, black holes, galaxies, more planets, stars. Post- Sun, planets, asteroids, comets, stars, nebulas, galaxies, black holes.

d. At-Level #2 - pre-stars, gas, asteroids, comets, meteorites, planets, other solar systems, 1 black hole at the center of our galaxy, matter in space, gravity, telescopes, outer universe, space probes, rocket ships. post planets, the Sun, asteroids, comets, meteoroids,
gas, dust, clusters of stars, stars, cosmic web, nebula, black hole, galaxies, worm holes, dark matter & dark energy. —

e. Below Level #1 – pre-It is dark, no gravity, planets, stars, more galaxies than just ours.
   post- Sun, planets, asteroids, meteors, stars, black hole

f. Below Level #2 – pre-There are planets; Earth has life---none others do! Most planets
   are cold, some planets have more moons than others, black holes, milky galaxy, stars,
   and meteorites. post- Sun is a star, 4 inner planets, 4 outer planets, Pluto, between Mars
   & Jupiter is the Asteroid Belt, Kuiper Belt which comets, galaxies, black hole.

14. Describe the processes that resulted in formation of stars, galaxies, and the universe.
   a. Above Level #1- pre-Big Bang Theory. post- The Big Bang
   b. Above Level #2- pre-stars start as an atom then get bigger and then turn into a star or
      planet. The Big Bang Theory post- a big explosion the spread out all of the galaxies that
      were all grouped together. The stars were formed because of dust leftover to form
      nebulas which formed star.
   c. At- Level #1 –pre- not sure. Post- The Big Bang= when dust particles came together
      forming stars, galaxies, etc.
   
d. At-Level #2 –pre-The Big Bang. post- The Big Bang= a lot of matter, gas, and dust
      exploded they formed nebulas, so much gas & dust creating stars, white dwarfs,
      eventually formed a cluster & galaxy.

   e. Below Level #1- pre-not sure? Post- The Big forgot the last word.
   f. Below Level #2 – pre-Not sure? Post- The Big Bang

15. Describe how scientists learn about the structure of the universe.
a. Above Level #1- pre-send rovers, rockets, cameras, satellites out to space to study it.
   They use math to find out how far stars are away from here. Post- telescopes, radio
   telescopes, satellites, space probes, astronauts, space shuttle, rovers.

b. Above Level #2—satellites, space station, rovers, astronauts, cameras. Post-
   telescopes, calculators for scientific notation, space shuttles, satellites, space probes,
   rovers, astronauts.

c. At- Level #1 –pre- become astronomers, look through telescopes, information from
   astronauts that go into space, send satellites, robot cars on moons and planets.post-
   telescope, satellites, space shuttle, space station, rover, space probe, astronauts, robots,
   tools.

d. At-Level #2- pre-by studying planets, stars in a deeper the farther we get in the universe
   the more we can learn. Satellites, giant telescopes, observatory, robotic probes sent out
   to tell us about the studies of the stars and planets and distant galaxies and other solar
   systems. Requires math & chemistry.post- telescopes, space probes, satellites, rovers,
   astronauts, space shuttle.

e. Below Level #1- pre-By using telescopes, astronauts, rockets, & shuttles. post-telescopes,
   satellites, robots, shuttle, space station, astronauts,

f. Below Level #2 – pre-By sending astronauts, rovers, rocket ships, telescopes, &
   satellites. post- satellites, rovers, astronauts, telescopes, space ships,

16. Why is Earth the only planet to support life?

a. Above Level #1- pre-Because we have an atmosphere, water, were in the middle so it’s
   not too hot and not too cold. post- Goldilocks Effect=Not too cold & not too hot perfectly
   placed in the solar system, atmospheres keeping in the oxygen & has water
b. Above Level #2-pre-oxygen, plants, animals, food, atmosphere, core, water, fourth planet away from the sun. Post- Oxygen, Water, Atmosphere and Goldilocks Conditions=suitable temperatures to support life.

c. At-Level #1 – pre-it only has enough oxygen which is more than any other planets, water, were located in the middle meaning were not too hot not too cold. Post- The Goldilocks Effect= water, springs, oxygen, perfect planet to live on since we have everything in order for survival and perfect temperature.

d. At-Level #2- pre-Because it isn’t too far or too close to the sun and it has a lot of water. Wherever there is water there can be life and it has to have the right atmosphere. Post- we have liquid water not too close or too far from the Sun, we have oxygen, atmosphere to protect us from Sun’s radiation, Goldilocks Effect.

e. Below Level #1-pre-We have oxygen, water, food, grass, were in the middle so it’s not too hot & not too cold. Post- oxygen, water, we’re not close to the sun not too far so it is warm.


17. Describe why even though scientists have learned a great deal about the moon and planets there are still many aspects which have yet to be discovered.

a. Above Level #1- pre-They can only go out into space for a certain period of time. Universe is huge so it’s hard to learn when our technology isn’t advanced enough and can’t go out that far. Post- our technology isn’t good enough to get out that far; we’re just getting a satellite to Pluto now.

b. Above Level #2- pre-we don’t have limited movement in space because we have to be tethered. We can only see a certain distance, use telescopes, technology isn’t as
advanced. Post- because we can’t get to some planets to see whether or not they have solid surfaces or not. We just got a satellite outside of our solar system. Pluto we don’t know what color it is since it is so far away it’s hard to get to it, 2015 we will get information back from the satellite.

c. At- Level #1 – pre-we need time and we need longer periods of time in space to learn what we can to get all the information possible. Oxygen isn’t in space. Technology is important because we need super scientists to make advanced spaceships which require money. Technologically we are not where we need to be. Post- Travel we don’t have the money to go past the moon for space gas recharging. Just got a satellite past Pluto and we don’t know what color Pluto is. Communication with earth is not there yet. Technology isn’t fully equipped yet.

d. At-Level #2 –pre- because they are too far to be discovered and too hard to survive old they are too cold or hot. Technology, they haven’t made something that can break through the atmospheres without getting destroyed or freezing up or if it’s too hot. Post- we don’t have the technology to find out what needs to be discovered. It takes a long time for satellites to get where it needs to be with information & data. We just got outside of our own solar system. Pluto were going to be there in a couple years and send back to NASA it’s color, shape, & size.

e. Below Level #1- pre-Because we sometimes can’t get there, technology is not that good because we can’t get to some planets & see what is has on there. Post- too far out, technology isn’t advanced enough, money.

f. Below Level #2 – pre-There’s no air, so we can’t survive if we try & go to other planets, which is very expensive. Post- Lack in technology.
18. How much do you think you know on a scale of 1 to 10 about Astronomy?

a. Above Level #1 - pre-7 post-7

b. Above Level #2 pre—8 post-8

c. At- Level #1 – pre-5 ½ post-7.7- improved from last time

d. At-Level #2- pre-7 post-10

e. Below Level #1- pre- 2 post-5

f. Below Level #2-pre- 6 post-7
APPENDIX H:

STUDENT SURVEY’S GRAPHS
STUDENT SURVEY’S GRAPH
Survey #1: Writing Perceptions

Figure 2A: Which style of writing do you prefer?

Figure 2B: What is the most difficult aspect of answering the writing prompt?
Figure 2C: Is it easier to use a bulleted list when writing?

Figure 2D: Does a picture or diagram help in your writing process?

Survey #2: Perceptions on Astronomy Test

Figure 3A: Choose the section you prefer best.

Figure 3B: How did you feel you did on the new test format?
Figure 3C: Do you feel you were more prepared for this test than previous tests/quizzes?

Figure 3D: Do you feel that the activities and/or games we did during class helped you prepare for this test?
APPENDIX I:

CHAPTER TEST WRITING SAMPLES
Essay

22. The three conditions needed for life as we know to exist are three things: water, oxygen and reliable temperatures. We need oxygen to breathe, also we need water to survive. And we need reliable temperatures because it can’t be too cold or too hot. Without us surviving, it needs to be just right. These conditions are found on earth because there’s oxygen to breathe and water to drink. And there isn’t a bad temperature, it’s cold during winter and hot during the summer.
The difference between a meteor, meteor and meteorites is that a meteor is what you see in the sky, the streak of light, a meteoroid breaks the Earth's atmosphere and a meteorite hits the Earth's surface.