

THE EFFECTS OF GUIDED WRITING STRATEGIES ON SCIENCE JOURNALING
SKILLS OF MIDDLE SCHOOL STUDENTS

by

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

of

Master of Science

in

Science Education

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DEDICATION

This is dedicated to my entire family, my husband and children, whom have supported, have gone without, and facilitated the completion of this major endeavor.

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INTRODUCTION AND BACKGROUND

For the past eight years I have taught science at Veterans Memorial Intermediate School in Vineland, New Jersey. It is located within a Title I school district and has a student population of approximately 550, grades 6 through 8. The approximate cultural composition of the student population is 50% Latin American, 26% Caucasian, 23% African American, and 1% Asian (State of New Jersey, 2013). More than half of the student population qualify for free and reduced lunches. The school services many students that belong to low-income, English Language Learner households due to the high immigration rate because Vineland is a large agricultural community. Students have a wide range of learning abilities, with the majority of students falling in the low end proficient range according to standardized state test scores. Students exhibit limited reading comprehension and writing skills, many of which have been exited from bilingual or English as a Second Language (ESL) programs.

I have often wondered how I could help my students gain a deeper understanding of the concepts we cover in class. Often times, students appear to be interested, motivated, and genuinely excited about the concepts during classroom lab activities and discussions, only to show later that comprehension and retention of important concepts lapsed. During later assessments, students fail to recall the key components of previous lessons and are unable to recollect and explain the covered material in a coherent, correct manner.

Journals are an important part of science. As real-life scientists use them to take notes while conducting research, students use them to take notes, ideas, and concepts during class time to help with information recall at a later time. However, despite the

consistent use of journaling and note taking, students still have difficulty recalling important key concepts and extending them into classroom applications or other scenarios. How could I facilitate the understanding of concepts and have students' gain deeper understanding that they can later remember and apply? My goal was to help students utilize strategies that will help gain a deeper understanding of material covered and help retention of information, which will improve my effectiveness as a teacher.

The focus question of my project was, *What are the effects of using guided writing strategies, such as creative captions with graphics and the use of graphics along with journaling, on seventh grade students' understanding of ecology concepts?* To help support my capstone project, the following subquestions were addressed.

1. What are the effects of using guided writing strategies on students' long-term memory?
2. What are the effects of using guided writing strategies on students' journaling skills?
3. What are the effects of using guided writing strategies on students' attitude and motivation?

CONCEPTUAL FRAMEWORK

Journaling in science is a way to document ideas and thought processes, record data, draw diagrams, jot down questions, almost anything as it relates to the science classroom. Student journals are record of growth of each individual student as they learn, explore, and synthesize material throughout the year. It should serve as a place to brainstorm and reference alike. Journaling can take place in various forms such as writing, drawing, or the combination of both. The important aspect of journaling in my

class is for the student to feel comfortable to express ideas that will facilitate learning.

The science journal is the item no student should be without and should be the first thing they take out when doing any science. A student's science journal should serve as reference, a handbook (Klentschy, 2008).

The use of journaling in the science classroom has long been a practice for students to records observations, ideas, and notes. Through the use of journals, students model what scientists do while conducting investigations by recording information and data. They routinely use journals to take their notes on inquiries, vocabulary, class activities, ideas, and lessons. Science notebooks can be another tool teachers use to encourage student participation and thereby improve learning (Young, 2003). Children use journals to help make sense of their familiar surroundings, whether experienced or imagined (Shepardson & Britsch, 2000).

Children often use drawing as a creative outlet, and provided the proper environment such as the use of guided writing and graphics, they thrive on expressing thoughts through diverse methods instead of just writing to represent their ideas. When permitted to add their own graphic depictions, children allow a window into their thoughts and methods of learning. Children can transfer their ideas into drawings, allowing the teacher to view how they see the world, how they organize phenomena, and how they experience the world around them, "they give teachers access into students' thinking – what they do and don't understand, what misconceptions they have, and the organizational skills they are using" (Gilbert & Kotelman, 2005, p. 29). However, student illustrations need to have specific requirements in order to prove effective.

According to a study on descriptive drawing, student graphic representations should be accompanied by explanatory text in order to be effective, because the illustrations help the learner create a cohesive mental model from the words and images (Edens & Potter, 2003). Therefore, student drawings should be accompanied by specific information that facilitates the retention of important concepts from lessons. Student drawings are also an effective tool for the teacher. Drawings can serve as both pre- and post-assessment tools and provide an important representation of a student's understanding (Chang, 2012).

The use of guided-writing strategies while using science journals allows students to think, write, and visualize science concepts, as a result, possibly facilitating long-term recall. The purpose of the guided writing is to provide the material to help students write in their own words (Lan, Hung, & Hsu, 2011). Techniques and strategies that were included in guided writing were modeling, shared writing, revising and editing. Traditionally, students are presented with information in a textbook and through auditory methods, such as discussion and lecture. However, these types of methods do not necessarily allow for all students to learn; they need to be able think scientifically and develop their own thinking skills. Even though guided, students should be more proactive in their learning, not just receptors of the material being presented (Saban, 2010). The teacher can use pictures, videos, or other visual media to help students work out what they want to say before the writing process begins. Initial review of student drafts offers an opportunity for the teacher to see any misconceptions students may have and is therefore able to address these directly. After writing is completed, a revision is incorporated and the final writing piece is accomplished by carrying out a series of drafts.

Guided writing strategies provide opportunities for students to make connections between what they were learning and how they chose to write about it (Klentschy, 2008).

Writing permits students to use science vocabulary and terms, offering a sense of professionalism as they are using technical terms and science terms (Gilbert & Kotelman, 2005). Once students are accustomed to the technical language and use it repetitively, they form connections that will remain for an elongated period of time. Guided writing techniques of teacher modeling, instruction, student created illustrations, practice and feedback consistently allows for students to be actively engaged in the writing process. Research on writing has shown that students achieved significant gain using these types of writing activities (Barbot, Randi, Tan, Levenson, Friedlaender, & Grigorenko, 2013).

Using a science journal routinely helps establish a protocol. Journals are used for structured writing that accompanies the scientific method and also free writing that expresses reflection, feelings and thoughts (Nesbit, Hargrove, Harrelson, & Maxey, 2004). It is through this practice that leads students to feel confident and comfortable sharing and developing thoughts through writing. Guided writing strategies positively impacted students' journaling skills. In one study, teachers noted that students that used journaling skills frequently transferred those writing skills to more formal writing assignments (Gilbert & Kotelman, 2005). Established writing routines set a level of expectation with students, which produced a familiar environment that facilitated expressions and ideas through writing. Student journaling skills can be varied, however maintaining certain skills helped students stay within parameters and allowed for easier assessment and review from the teacher.

Student journals are set up with specific components to aid in research and writing process. To begin, students pose questions with a purpose, allowing them to identify and focus on the investigation. Next, students make predictions based on prior knowledge. During this step, teachers can identify and analyze any pupil misconceptions. Once completed, students move on to the planning and procedures where they will describe materials and steps needed for an inquiry. Now, the students will use writings or drawings to record their inquiry experience during the observation and data section. Finally, students will reflect and summarize to finish their journal entry. After the inquiry, student should reflect on the research and write an objective summary that addresses the initial question of the investigation. In addition, students can record additional questions that can be used as an extension for future related inquiries (Mintz & Calhoun, 2004).

The use of journals and writing strategies has affected students' attitude and motivation. Students use the journal to record and share ideas, ultimately empowering them as a student scientist with an educational drive to comprehend and succeed. The journal is viewed as a tool for students to put together their own understanding of concepts (Gilbert & Kotelman, 2005). Previous investigations on the use of journals found that journaling increased student participation in learning and provided them with improved self-worth (Shepardson & Britsch, 2000). A study completed on a Multiple Intelligence approach to teaching science, showed that student achievement and attitudes towards science was greatly improved after using techniques that appealed to different types of learners (Kaya, Dogan, Gokcek, Kihc, and Kihc, 2007). The writing component to journaling is the verbal-linguistic intelligence, while the use of graphics appeals to

spatial-visual learners. Students who were able to conceptualize the material felt more confident in their level of understanding and were more motivated to participate and became more engaged in their own learning process. One study completed on study strategies for science concept learning showed that students who drew pictures during lessons scored higher on comprehension posttest than students who did not apply this technique and who did not guided study strategies (Hsieh & Cifuentes, 2006).

METHODOLOGY

Students selected for the treatment intervention were 116 seventh graders ($N = 116$), with approximately 23 of those students in special education. Students complete a 40 minute class period daily in science. The ecology unit was completed during the third marking period of the year that ran from January 20, 2015 to April 15, 2015. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained (Appendix A).

For this project, three lessons were observed to note the effects of using guided writing strategies such as creative captions with graphics and the use of graphics with journaling on students' understanding of ecology concepts. Also, noting the effects of using guided writing strategies on students' long-term memory of ecology concepts, the effects of using guided writing strategies on students' journaling skills, and effects of using guided writing strategies on students' attitude and motivation was studied. Data were collected using three different sources for each question. By using data triangulation, student and teacher perspectives were collected. This provided both

qualitative and quantitative data to appropriately answer the focus questions and subquestions (Table 1).

The introduction lesson to the ecology unit was a lesson in populations and communities. In the first nontreatment lesson on living things and their environments, students identified what organisms acquired from their environments, the two main parts of an organism's habitat, and how ecosystems were organized. Students were introduced to the lesson by reading a brief article on the mating songs of lemurs and how they identify their own species.

A classroom discussion occurred and students began to work on the assigned pages and noting vocabulary terms in their journal, a part of the journal writing requirement that was graded according to the Journal Rubric (Appendix B). The Journal Rubric was handed out to students in the very beginning of year and serves as a guideline for students to properly meet the requirements of a science classroom journal. The rubric breaks down the different components that students need to have in journals such as dated entries, vocabulary using students own words as well as student drawn diagrams and illustrations. The Journal Rubric scores were used before and after the treatment to determine if student use of journal increased and if the quality of writing indicated improvement.

Questions assigned in students' books usually require short answer responses and were found directly within the reading. Students were also encouraged to answer all questions in complete, restated form. The pages that were not completed during the 40 minute class period needed to be completed for homework and were checked the

following day. All pages were reviewed and students had the opportunity to correct all responses.

Prior to the introduction of the unit, students completed the Ecology Unit Preassessment (Appendix C) which contained a multiple choice questions, completion, short answer response and essay questions. Students completed the test after the treatment lessons to calculate normalized gains to see if their levels had improved.

Students also completed Student Interview Questions (Appendix D). The Student Interview Questions consisted of several open ended, short response questions to evaluate student likes and dislikes in science, their opinion on writing in journals, and what would motivate them to use journals more. The open response questions allowed students to elaborate on their responses and incorporate any ideas they felt were relevant. Student Interview questions results of pre and post-treatment responses were analyzed to note any changes to students self evaluation in stated areas.

Students also completed the Student Survey Questionnaire (Appendix E). This survey provided statements pertaining to student self evaluation on remembering science concepts, writing ability and confidence, taking notes, remembering concepts, and using drawings to aid in understanding. Student Survey Questionnaire was scored pre and post-treatment using a Likert scale of *Strongly Agree* (4), *Agree* (3), *Disagree* (2), and *Strongly Disagree* (4). Survey results of pre and post-treatment responses were analyzed to note any changes to students self evaluation in stated areas noting the change in frequencies by looking at normalized gains made.

The following lesson was the treatment lesson on populations. Students identified the factors that caused populations to change in size and what limited their growth. The

first intervention lesson on populations was introduced by presenting the problem of prairie dog populations in certain parts of the country. A short classroom brainstorming session took place, listing student suggestions on the board. As part of the treatment, students were asked to write a short passage in their journals on what might cause the prairie dog population to drastically increase, using the suggestions displayed on the board. The guided writing strategy was used by writing an introductory sentence on the board; this modeled a topic sentence for the students to begin their writing piece. A list suggesting the use of at least three reasons for prairie dog population increase and then students were required to support those three reasons with additional details with an example, and completed the writing piece with a closing statement. Students had an opportunity to revise their writing piece as we moved along in the lesson and were given a reflective time at the end of a period to add concepts they learned that day.

The key concepts for this lesson were that populations increase in size due to birthrate and immigration and decrease in size due to death rate and emigration. To further support these main ideas, the treatment included having student created illustrations with captions. Students were asked to pick their favorite animal and draw them within their habitat. The requirements in their diagram were to include factors that might cause that population to increase and decrease. Not only did students have to identify birth, immigration, death and emigration, but they also needed to include the factors that would cause these to occur. For example, if a herd of caribou had an influx on immigrating animals, what were the reasons why these animals displayed this type of behavior? Students continued with completing the vocabulary terms in their journals and

the rest of the pages for homework. The assignment was reviewed as in the nontreatment lessons.

The final treatment lesson was on the interactions among living organisms and included information about adaptations, competition and predation, and the different types of symbiosis. Students also used guided writing model, with examples provided by the teacher, to write about natural selection and explain how the elephant now have long trunks. As part of the treatment, students were also asked to include four factors in their explanation: variability in a species, inheritable traits, selection, and time. Once completed, students were asked to draw eight illustrations with a one sentence caption that summarized their graphic. Students had the same components in their journals as in the previous treatment lesson (Appendix F).

Table 1
Data Triangulation Matrix

Focus Question	Data Source 1	Data Source 2	Data Source 3
<p><i>Primary Question:</i> 1. What are the effects of using guided writing strategies such as creative captions with graphics and the use of graphics with journaling on students' understanding of ecology concepts?</p>	Preunit Assessment and Postunit Assessment	Pre and Postunit Interview	Pre and Postunit Survey
<p><i>Sub-Questions:</i> 2. What are the effects of using guided writing strategies on students' long-term memory of ecology concepts?</p>	Post and Delayed Unit Assessment	Post and Delayed Unit Interviews	Post and Delayed Unit Surveys
<p>3. What are the effects of using guided writing strategies on students' journaling skills?</p>	Preunit Assessment and Postunit Assessment on student journals	Pre and Postunit Interview	Pre and Postunit Survey
<p>4. What are the effects of using guided writing strategies on students' attitude and motivation?</p>	Pre and Postunit Survey	Teacher Observations during both nontreatment and treatment units	Pre and Postunit Interview

DATA AND ANALYSIS

Pretreatment and posttreatment data were collected for one nontreatment and two treatment units. Data collected during the preunit and postunit assessments were used to calculate the normalized gain scores for pretreatment and posttreatment unit assessment.

The results of the preunit and postunit assessments on the Ecology Unit (Appendix C) yielded a positive result indicating that 80% of the students experienced at least a 50% gain in assessment score ($N = 115$). All students gained understanding. Additionally, more than 57% of students achieved a normalized gain of 70% or more in the postunit assessment, indicating a high normalized gain ($>.7$). The mean normalized gain was 73% from the preunit assessment mean score of 34% to the postunit assessment mean score of 82% (Figure 1).

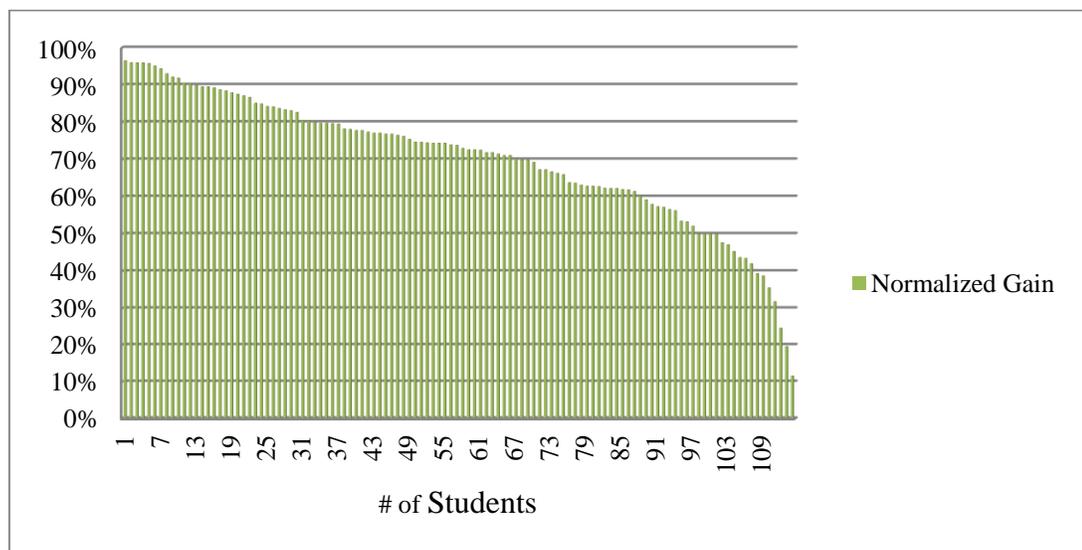


Figure 1. Students' normalized gains of Ecology Unit assessment, ($N = 115$).

The second source of data collected ($n = 29$) was collected using a pretreatment and posttreatment Student Survey Questionnaire assessing student opinion on various topics such as writing, taking notes, the usefulness of illustrations and student created drawings (Figure 2). In the area of remembering science concepts, the percentage of students to *Agree* increased from 52% to 69% showing a 17% decline in confidence in this area. Student enjoyment in writing showed no marked increase in students who

Agree or *Strongly Agree*. The largest change in frequency in this question was a 14% increase in students who *Disagree*.

Confidence in writing abilities survey indicated a drop in student confidence. There was a 14% increase in students who *Strongly Disagree*. Students confidence levels who *Agree* fell from 51% to 41%, demonstrating a 14% decrease in this category. Student confidence also appears to make decrease after the treatment in the area of taking notes on their own. Students who *Agree* with having trouble taking notes on their own increased 39% from 10% to 49%.

The last area surveyed was to note if illustrations helped students remember concepts. Pretreatment responses indicated that 79% students felt that illustrations in the book helped them remember concepts in lessons. However, posttreatment responses indicated that 55% of students did not feel as if illustrations in the book were helpful showing a 24% decrease in agreement. Pretreatment, 62% of students *Agree* or *Strongly Agree* that self created illustrations were useful in retaining concepts from lessons. Posttreatment also suggested the same with 83% of students in the *Agree* or *Strongly Agree* category, showing an increase of confidence in this category by 21%.

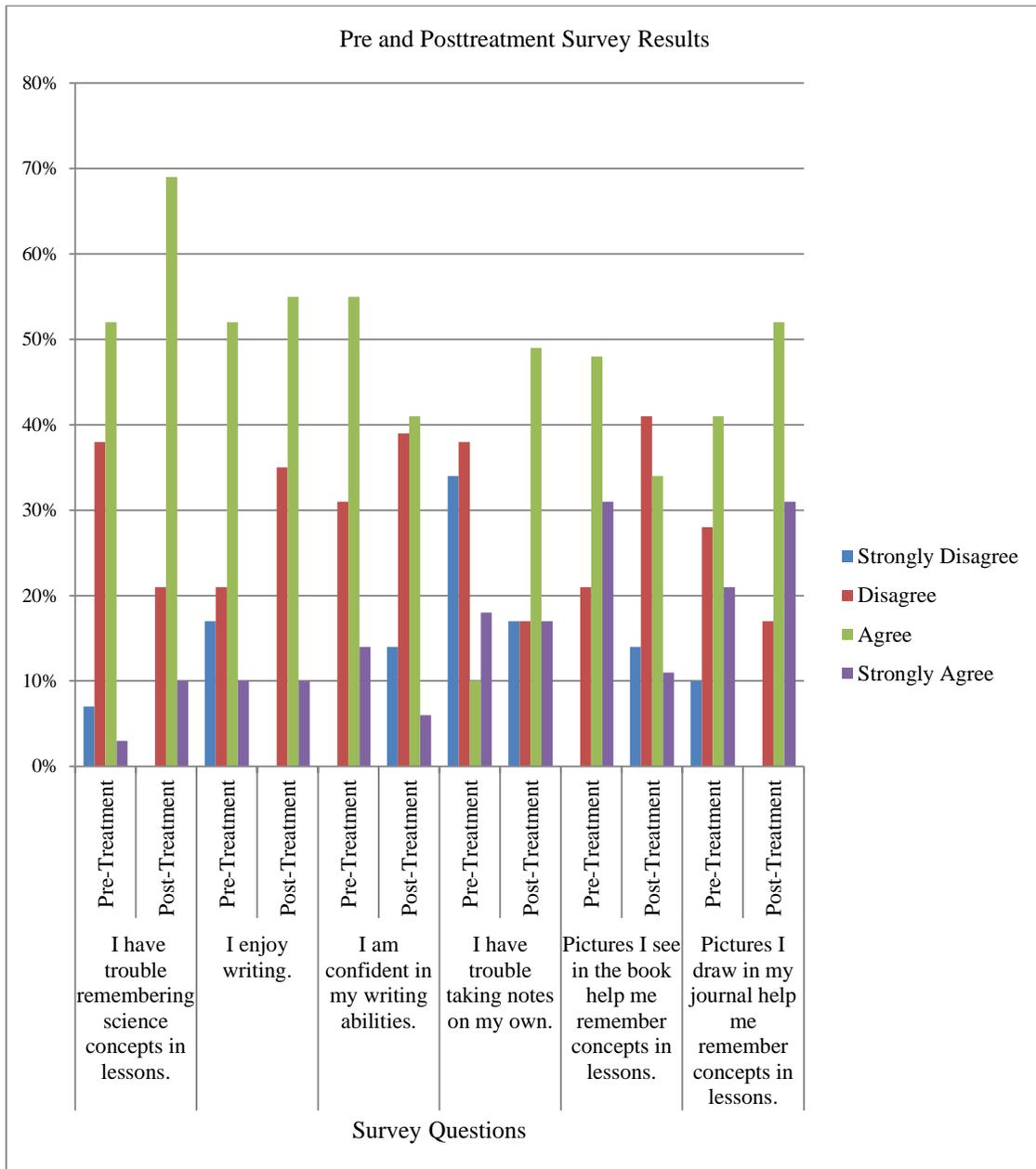


Figure 2. Pre and posttreatment student survey results, ($n = 29$).

Student interviews were conducted as a third data source with a sample population ($n = 10$). There was little difference between pretreatment and posttreatment student responses along with delayed interviews that were completed three weeks after the last treatment lesson. However, students were better able to articulate clearer

responses to the posttreatment interview than the pretreatment interview questions. All students stated they liked science and their favorite parts of science were the labs/activities. Most students stated, “They are fun.” One student stated, “I remember what we did in the lab and it doesn’t feel like school work.” However, when asked what their least favorite part of science class, all students responded with writing. One student responded, “The worst part is all the explaining, especially lab sheets because you have to be very careful to explain and use examples. Labs would be more fun if we didn’t have to do the lab sheets.”

Students journal grades were also used as a data source ($N = 115$). Normalized gains were used to calculate the change between pretreatment and posttreatment journal grades. The mean score of gain was 26%, demonstrating a low achievement level. The majority of students, 67%, showed a 0% increase in gains. However, 31% of these students scored 100 on both pretreatment and posttreatment journal assessments. Another 58% of students in this zero gain category scored very well with an 85 on both pretreatment and posttreatment journal assessments, the second highest possible grade on journals. Nineteen percent of total students achieved a 100% normalized gain score in the journal assessment. All these students increased from the pretreatment score of 85 to the posttreatment assessment score of 100.

Students interviewed felt that the journals were a useful tool in their science learning, but students did not show a change in motivation in writing in their journals. When questioned about their least favorite part about science class, students responded with overwhelming similarities. Students all agreed that the least favorite part of science is the writing. Students were also asked what would motivate them to write in their

journals more. Three students stated that copying notes from the board would make them write more in their journals. While another student stated, "I would write more information in my journal if I could use my notes during tests." Despite the treatment of guiding students to use graphics as a way of recording information (Figure 3), only one student mentioned using the journal more if they were allowed to draw pictures or diagrams as answers or notes.

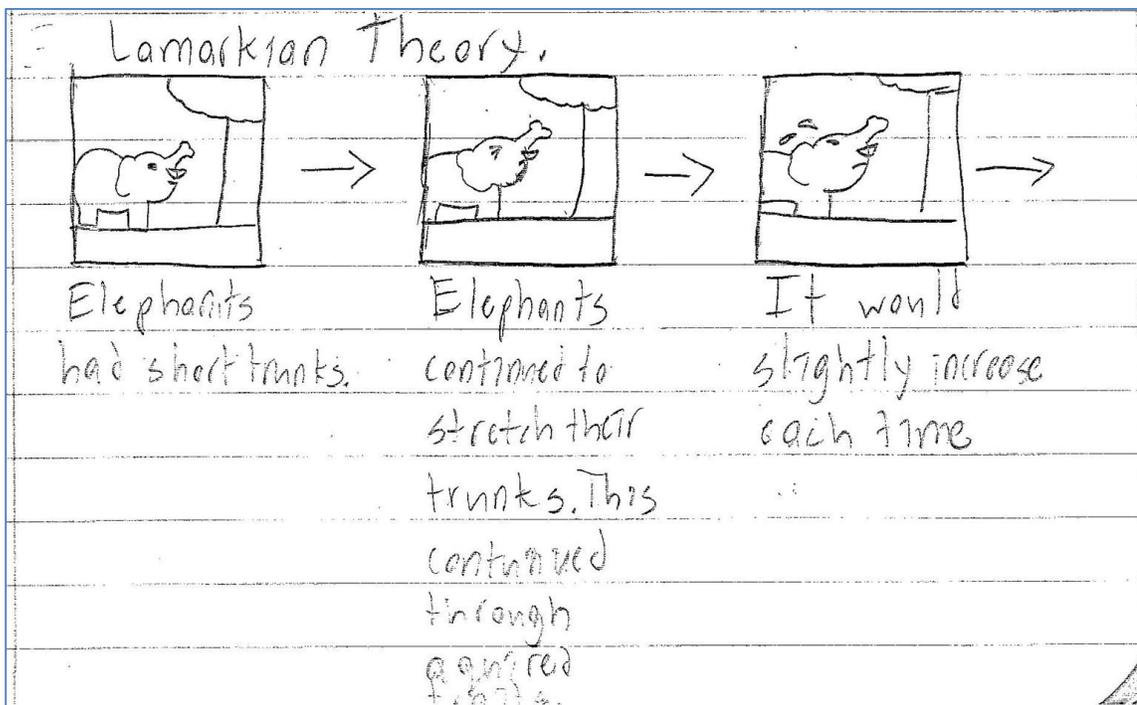


Figure 3. Student made diagram in journal.

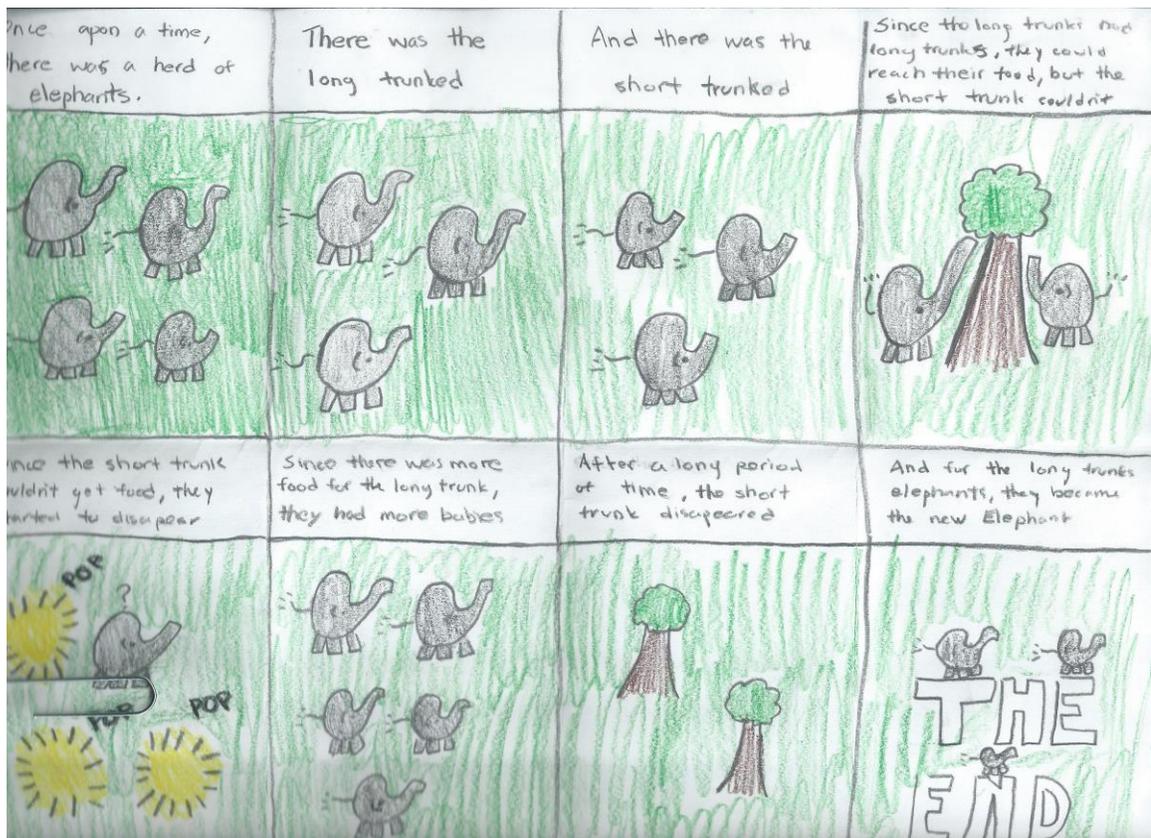


Figure 4. Student work sample.

During the nontreatment unit, I wrote a comment in my teacher journal stating, “Students need constant refocusing on written assignments. Students often stop and look around the room to see what others are doing, ask to go to the bathroom, and often doodle all over journal pages.”

Student motivation and attitude appeared to increase during treatment units. A comment in teacher journal stated, “Students are engaged and writing in journals. Students need less redirecting and bathroom break request have almost diminished. Students ask questions that are pertinent to material being presented. Writing has a clear focus.” Providing students with guided writing techniques increased student motivation and improved attitudes during writing sessions.

INTERPRETATION AND CONCLUSION

The goal of this project was to determine the effects of guided writing strategies such as creative captions with graphics and the use of graphics with journaling with journaling on students understanding of ecology concepts. The preunit and postunit assessment normalized gains on the Ecology Unit Test revealed that student achievement after treatment units were high. It was not easily distinguished what was the influencing factor to the high gains in understanding.

The project also sought to determine the effects of guided writing on students' long-term memory of ecology concepts. Analyzing delayed assessments of student journals and writing samples, the data showed students retained much of the concepts by use of students' drawings and short descriptive captions. Additionally, the delayed student samples indicated an increased understanding of the concepts than were demonstrated during the guided writing activity. The guided writing strategies had a positive effect on the students' long-term memory

Along with students' long-term memory, this project set out to determine the effects of using guided writing strategies on students' journaling skills. The treatment had positive effects on student journal grades for students that needed to improve in that area. Students who already had high journal grades showed little or no gains. These students were students who already shown a high degree of journal skills by achieving grades of 85 or 100 in the posttreatment assessment of student journals. The students obtained the most gains were the students who needed to improve. The treatment appeared effective in helping improve journaling skills.

The final goal of this project was to see the effects of using guided writing strategies on students' attitude and motivation. Student interviews revealed an increase in students who *Agree* to enjoying writing. Despite this response on the survey, responses on the student interview did not reveal an increase in writing motivation even with using pictures or diagrams. Students still revealed that their least favorite part of science class was writing. This could be in part due to student expectation of what should occur in science class. Students feel as if writing is part of language arts curriculum and not science. Despite students being engaged during guided writing, this did not carry over when the teacher was not actively participating in the writing process. Students were most motivated when they knew the exact objectives for their writing. The guided writing strategies did not increase or affect student attitude or motivation except during the periods of time the treatment was in progress.

Guided writing strategies such as creative captions with graphics had some positive effects on students' understanding of ecology concepts, long-term memory of concepts and students' journaling skills. Even so, this project could have been improved to provide more concise data. For my first improvement, I would make more formative assessments to gather data from each unit as opposed to just a pretreatment and posttreatment summative assessment. This would allow insight as to which unit students made the most gains.

Another improvement that could be made is more specific questions in the survey and interview questions. I would ask more specific questions on the content of the lessons and more why students do like writing in science. Including more specific questions on content and long-term retention would help pinpoint what helps students

retain information. Finally, it would be beneficial to conduct this same project on other concept units to investigate if it was the strategies used or the content material that led to the gains in student understanding.

VALUE

Writing is a challenge for many students. Teachers often have difficulties in getting students to write fluently and articulately. This project allowed me to identify some teaching techniques that positively affected the students' writing and how I can further this project to identify other factors that may improve student writing and motivation. I will include more guided writing in all my lessons so students become more accustomed to writing within the science curriculum. Students were more motivated to write in their journals when they felt they knew what they should be writing about. Teacher guidance on what key components should be included helped students focus on the key concepts. I feel working closely with a language arts teacher on a regular basis will help improve my skills as a teacher of writing and improve my working relationship with my fellow colleagues.

In the past I focused solely on science concepts, not realizing that students' writing skills were lacking and they were confused on what information they should attempt to record in their notes. Simplifying the writing tasks by giving key point to focus on and allowing them to draw pictures, helped students hone into the information they needed. Including the use of graphics and caption allowed students who were weak in writing skills and enjoyed drawing to really participate in their learning. Students who did not like to draw were able to improve their writing.

Student motivation seemed to improve when my motivation was high. During time of high student/teacher engagement, students were more focused. Planning lessons that allow me to interact more with the students is a good motivator for me and my students. I see that my students' attention and motivation largely depends on my attention level and how involved I am with their learning.

As a result of this action-based project I have changed as a teacher for several different reasons. First, I have become aware of my students' needs for recording information including writing support. Despite the fact they spend double the amount of time in language arts than science, writing skills do not directly transfer to other subject areas. Students need help recording and sorting important information. Some students are reluctant to draw because they feel their drawing skills are lacking. Encouraging drawing as an alternative method of recording ideas helped students these students move past their lack of confidence. Many of these students became more confident in their drawings and made vast improvements. Secondly, more frequent formative assessments are better indicators of student learning instead of summative assessments. I feel if I had completed formative assessments during this action-based project, I would be better able to identify the factors that positively affected students learning. Another insight I gained in the project is the importance of teacher reflection. Last, I feel I am a big motivating factor for my students. If I am engaged and motivated, my students are as well. I guide the milieu in my classroom. Children may not understand the importance or value of what they are learning. A teacher's role in student learning is far more important than just the presentation of the concepts, teacher enthusiasm in the materials being presented is an important component of learning.

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APPENDICES

APPENDIX A
IRB EXEMPTION



INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
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MEMORANDUM

TO: Emily Diaz-Chard and John Graves
FROM: Mark Quinn, Chair *Mark Quinn CJ*
DATE: November 17, 2014
RE: "The Effects of Guided Writing Strategies on Student Journaling Skills of Middle School Students [ED-C111714-EX]"

The above research, described in your submission of November 17, 2014, 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, (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 B
JOURNAL RUBRIC

Journal Rubric

√ ++ = 100% (exceptional!)

- Consecutive dated entries with titles and neatly written.
- All ideas are related to science, classroom discussions, or labs, use of illustrations and diagrams.
- All vocabulary and lessons is labeled, complete and neat.
- Responses to DO NOW are restated, highly detailed, shows additional curiosity, thought, or ideas, and more in-depth research.
- Front and back of all pages are used

√ + = 85% (very good!)

- Consecutive entries and titles.
- Few/some ideas, all related to science, classroom discussions, or labs, no student illustrations.
- Most vocabulary is complete and neat, definitions taken from book.
- Responses to DO NOW are restated, detailed, and shows some curiosity, thought, and research.

√ = 75% (passing)

- Missing 3 or more entries
- DO NOW not restated or answered completely
- Some vocabulary complete.

√ - = 50% (needs improvement)

- If a student receives this grade, a consultation or one-on-one conference is scheduled between the student and the teacher.

APPENDIX C
ECOLOGY UNIT ASSESSMENT

Name: _____ Class: _____ Date: _____

ID: A

Ecology Preunit Test**Multiple Choice***Identify the choice that best completes the statement or answers the question.*

- _____ 1. An organism's habitat must provide all of the following EXCEPT
- food.
 - water.
 - predators.
 - shelter.
- _____ 2. The nonliving parts of an ecosystem are called
- populations.
 - organisms.
 - biotic factors.
 - abiotic factors.
- _____ 3. To produce their own food, algae and plants use the abiotic factors sunlight, carbon dioxide, and
- soil.
 - salt.
 - water.
 - bacteria.
- _____ 4. A population is all the members of one species living in a particular
- area.
 - habitat.
 - ecosystem.
 - community.
- _____ 5. A group of antelope leaving the herd in search of better grassland is an example of
- immigration.
 - emigration.
 - increasing birth rate.
 - decreasing death rate.
- _____ 6. If you count 20 beetles in a garden measuring 5 square meters, the population density of the beetles is
- 100 beetles per square meter.
 - 20 beetles per square meter.
 - 5 beetles per square meter.
 - 4 beetles per square meter.
- _____ 7. An organism's particular role in its habitat, or when and how it survives, is called its
- carrying capacity.
 - ecosystem.
 - competition.
 - niche.

Name: _____

ID: A

- _____ 8. All of the following are examples of limiting factors EXCEPT
- food.
 - soil.
 - space.
 - weather conditions.
- _____ 9. Which of the following is an example of a predator adaptation?
- a porcupine's needles
 - a shark's powerful jaws
 - a frog's bright colors
 - a plant's poisonous chemicals
- _____ 10. A hawk building its nest on an arm of a saguaro cactus is an example of
- commensalism.
 - mutualism.
 - parasitism.
 - predation.
- _____ 11. The place where an organism lives and that provides the things the organism needs is called its
- habitat.
 - population.
 - species.
 - community.
- _____ 12. Which of the following is a biotic factor in the prairie ecosystem?
- water
 - sunlight
 - soil
 - grass
- _____ 13. The behaviors and physical characteristics of species that allow them to live successfully in their environment are called
- habitats.
 - limiting factors.
 - biotic factors.
 - adaptations.
- _____ 14. The struggle between organisms to survive in a habitat with limited resources is called
- competition.
 - predation.
 - symbiosis.
 - parasitism.
- _____ 15. Population density is defined as
- an approximation of a number, based on reasonable assumptions.
 - the number of individuals of a population in a specific area.
 - the number of individuals moving into a population.
 - the smallest level of ecological organization.

Name: _____

ID: A

- ___ 16. The largest population that an environment can support is called its
- carrying capacity.
 - limiting factor.
 - birth rate.
 - death rate.
- ___ 17. An early winter frost preventing further growth in a tomato garden is an example of
- carrying capacity.
 - a limiting factor.
 - a biotic factor.
 - indirect observation.
- ___ 18. The smallest unit of ecological organization is a single
- population.
 - community.
 - organism.
 - ecosystem.
- ___ 19. Which of the following is an example of a population?
- the cats and dogs in your neighborhood
 - the bushes and grass in a park
 - the rocks in a rock collection
 - the gray wolves in a forest
- ___ 20. All the different populations that live together in an area make up a(n)
- organism.
 - community.
 - species.
 - ecosystem.
- ___ 21. The study of how things interact with each other and with their environment is called
- ecology.
 - photosynthesis.
 - community.
 - biotic studies.
- ___ 22. When a flea is living on a dog, the dog is the
- parasite.
 - host.
 - predator.
 - prey.
- ___ 23. Mutualism, commensalism, and parasitism are the three types of
- symbiotic relationships.
 - predation.
 - competition.
 - prey adaptations.

Name: _____

ID: A

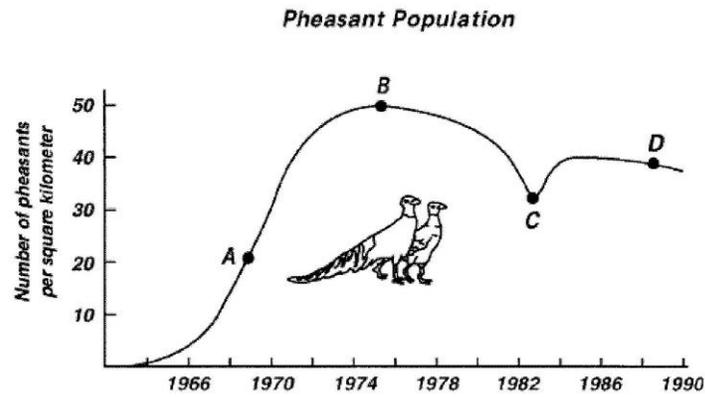
Completion*Complete each statement.*

24. The part of an ecosystem where an organism lives and feeds is called the organism's _____.
25. Nutrients in the soil from decaying remains of animals is a(n) _____ factor of an organism's habitat.
26. All the biotic and abiotic factors in an area together make up a(n) _____.
27. The main way that populations increase in size is through the _____ of offspring.
28. A lack of places to build nests is an example of _____ as a limiting factor for a population of birds.
29. The thick fur of a polar bear is a(n) _____ that allows the bear to live successfully in its environment.
30. Water, sunlight, and soil are _____ factors in an ecosystem.
31. A group of zebras breaking off from a herd decreases the size of the herd population through _____.
32. If food is scarce, it becomes a(n) _____ factor that prevents population growth.
33. Prairie dogs, snakes, and grass make up a level of ecological organization called a(n) _____.
34. The study of how living things interact with each other and with their environment is called _____.
35. A hawk building a nest on the arm of a cactus without hurting the cactus is an example of the symbiotic relationship called _____.

Name: _____

ID: A

Short Answer

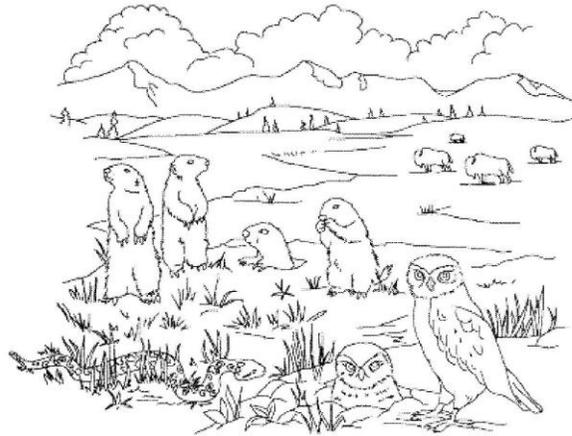


36. What happened to the pheasant population between Point B and Point C?
37. What was the approximate population density of pheasants at points A, B, and D?
38. How was the pheasant population changing at Point A?
39. Which letter marks the peak of the pheasant population?
40. What are some possible explanations for the change in pheasant population between Point B and Point C?
41. In 1990, a large resort hotel was built on the island where these pheasants live. Explain how this might have affected the pheasant population.

Name: _____

ID: A

Prairie Ecosystem



42. What is the smallest unit of organization in an ecosystem? Give one example from the diagram.
43. List three biotic resources and two abiotic resources in the prairie ecosystem.
44. Is the prairie soil a biotic factor or an abiotic factor? Explain your answer.
45. Describe three factors that could limit the growth of the prairie dog population.
46. Describe two things the prairie dogs need to live that they obtain from their habitat.
47. What level of ecological organization do all of the owls in a certain area represent?

Essay

48. Explain the difference between a population and a community.
49. Explain why two different species in an ecosystem can share the same habitat but not the same niche.

APPENDIX D
STUDENT INTERVIEW

Participation is voluntary and will not affect a student's grade or class standing in any way.

Student Interview Questions

1. Do you like science?
2. What is your favorite part of science class? Explain why.
3. What is your least favorite part of science class?
4. Do you think your journal is a useful tool in your learning?
5. What would make you use/write in your journal more?
6. What other things would you include in your journal to help you learn better?
7. Are there any other thoughts you would like to share about writing in class or in your journal?

APPENDIX E
STUDENT SURVEY QUESTIONNAIRE

Participation is voluntary and will not affect a student's grade or class standing in any way.

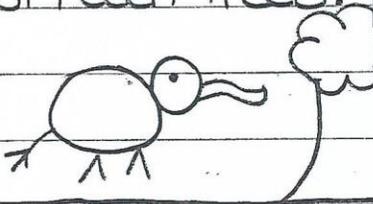
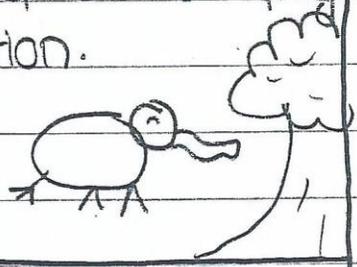
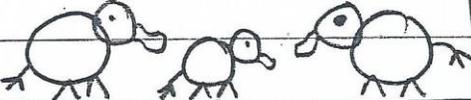
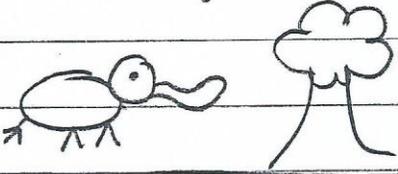
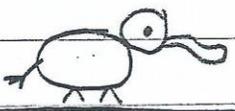
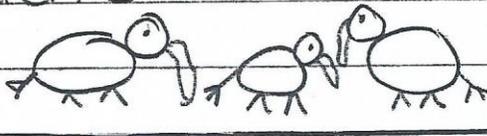
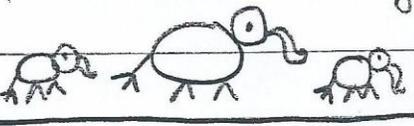
Student Survey Questionnaire

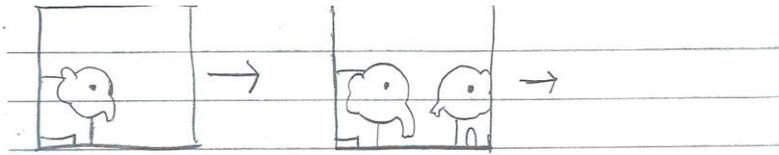
1 = Strongly Disagree 2 = Disagree 3 = Agree 4 = Strongly Agree

1. I have trouble remembering science concepts in lessons. 1 2 3 4
2. I enjoy writing. 1 2 3 4
3. I am confident in my writing abilities. 1 2 3 4
4. I have trouble taking notes on my own. 1 2 3 4
5. Pictures I see in the book help me remember concepts in lessons. 1 2 3 4
6. Pictures I draw in my journal help me remember concepts in lessons. 1 2 3 4

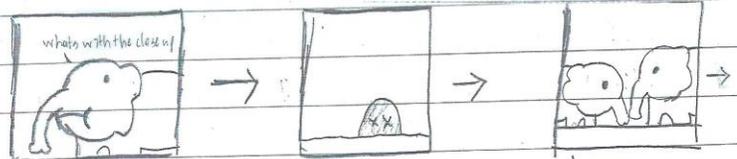
APPENDIX F
STUDENT JOURNAL SAMPLE

Student Journal Samples

<p>short trunk elephants cannot reach trees.</p> 	<p>The elephant is dying starvation.</p> 
<p>The elephant got a short trunk from her parents.</p> 	<p>The elephant could not survive or do offspring.</p> 
<p>long trunk elephant can reach high trees.</p> 	<p>The elephants doesn't need to worry about starvation.</p> 
<p>The elephant got a long trunk from his parents.</p> 	<p>The elephant survives and produce offspring.</p> 



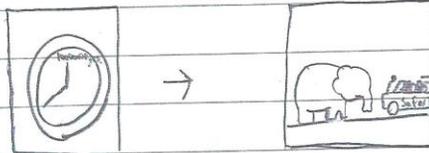
Originally, elephants had short trunks. Through variation some better adapted elephants were born.



The varied elephant are able to get more food. This means they'll survive longer.

The original elephants died off. This was due to the inability to get food, a.k.a. natural selection

Now there can only be long trunk offspring.



Over a long period of time the elephant population becomes all "long trunked."

That's how the modern day elephant came to be.