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**ROSES ARE RED, VIOLETS ARE BLUE
HOW POETRY IN SCIENCE
CAN HELP STUDENTS LEARN SOMETHING NEW**

by

KIMBERLY A. CASSELMAN
M.S. University of Central Florida, 2009

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science
in the Department of Teaching and Learning Principles
in the College of Education
at the University of Central Florida
Orlando, Florida

Spring Term
2009

ABSTRACT

This study was an attempt to examine how poetry integrated with science could assist eighth graders in the memorization of key science vocabulary words. Furthermore, it would investigate if student attitude, interest, and motivation would improve with the use of the poetry. Instruction was adjusted to implement poetry into astronomy lessons. Memorization activities such as poems, chanting, and repetition were used to help students remember the vocabulary and the definitions. Pre/post tests were used to interpret if the poetry did assist in the memorization of the astronomy vocabulary. Science interest surveys and science attitude surveys were used to interpret if the use of the poetry helped to increase student interests in and attitudes toward science. This study was intended to be a first step toward proving how poetry could benefit students in the areas of memorization, attitude, and interest of science; and if successful, perhaps could be used to assist in other subjects as well.

This study is dedicated to all of the special people in my life. My family who has supported me through good times and bad; my friends who have stood beside me when the going got rough; and to my students, whom without, I would have never learned to appreciate the gift we all have...the gift to learn.

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CHAPTER 1: INTRODUCTION

Rationale

As a middle school teacher, it becomes very intimidating to follow a set schedule of curricula and still feel that I have the ability to meet the needs of each student. As students progress through school, the curriculum for science seems to grow in difficulty due to extensive vocabulary and mature reading passages. The first step is to make sure that students understand the vocabulary that builds the science material. Due to the fact that students have a hard time understanding science material, their lack of interest in science begins to become apparent. Student progress can be disrupted under these conditions. A great deal of emphasis is put on science under the middle school in this instance due to a state assessment being given in the spring. Students have not seen a test of this magnitude in science for three years. I have witnessed students exhibit feelings of apprehension regarding the science assessment due to the pressure they feel to succeed and a fear that they will not remember the important facts. The goal of this action research project is to explore a method that will improve the memorization of science vocabulary. I want to motivate students to learn, help students improve academically in their vocabulary assessments, and helping them gain a more positive attitude toward the science curriculum.

Background

For many years, science has been portrayed as nothing more than a configuration of facts, proven or unproven, that needs to be implanted into the minds of students. “Science teaching has suffered because science has been so frequently presented just as so much ready-made

knowledge, so much subject matter of fact and law, rather than as an effective method of inquiry into any subject matter” (Dewey 1910, p. 126). This interpretation of science can stem from many causes including instructors unwilling to present the material and students misunderstanding of the concepts being taught causing frustration. At times, these can collide and create a very negative learning atmosphere in the classroom.

As time with science incorporated into classroom learning has passed, there have been some positive attitudes promoted by integrating hands-on inquiry into regular lessons (Dewey, 1910). This is a bonus for science in that it gives students real-world experience of the science facts and helps by incorporating memorization of key items. One negative from hands on inquiry is when test time approaches in the form of a summary which shows only sentences and words; not any of the activities that the students remember. Students are then struggling to remember the terminology in textbook form instead of real-world experiments.

The goal of this study is to integrate poetry with the science curriculum to determine if it can improve the memorization of vocabulary terms while studying astronomy. “Writing poetry allows you to examine a topic from a different perspective for alternative views, tap the creative ideas of students for original ideas, provide an interesting way to present the topic of motivation, and create a thing of beauty for an aesthetic experience” (Kirman 2007, p. 208). The hope is that by using this method of study it will demonstrate growth in student memorization, help raise test scores, improve student motivation for learning and increase student interest in science.

Research Topic

For the past two years in my teaching career, I have begun to pay more attention to the students’ intake of science. From testing results I have witnessed a sizeable amount of incorrect

answers involving definitions of words. By integrating poetry with science in the area of astronomy, this study will demonstrate how this can improve the student memorization of key vocabulary and meaning.

Purpose of the Study

The purpose of this study was to see improvement in student memorization, bettering student performance on tests, and motivate students to develop a greater interest in science. The following questions were examined:

Research Questions

1. How can the integration of poetry into the science curriculum in the area of astronomy assist eighth grade students in memorization of science vocabulary?
2. How can this study improve the motivation of student learning and increase student interest and attitude in science?
3. How can this activity assist student performance on science assessments?

Definitions

Alliteration: to write or speak with a consecutive group of words that begin with the same letter.

Figurative meaning: expressed by a means of metaphor or other figures of speech; i.e., similes, onomatopoeia, alliteration, etc.

Imagery: communicating in a fashion in which what is said is described in such detail that it can be pictured in the mind of the listener.

Inquiry: a systematic investigation of matter to determine the answer to a posing question.

Integration: to combine two learning concepts together to promote learning.

Literal meaning: true in the usual sense of the words.

Memorization: to commit to memory with various methods of repetitive practice.

Mnemonics: the process or technique of improving or developing the memory with activities such as rhymes, recitals, songs, writing, etc.

Onomatopoeia: word-formation by imitation of the sound made by the word represented; i.e., frog- “ribbet”, dog- “woof”, cat- “meow”.

Poetry: a literary work in metrical form; verse; the art of rhythmical composition, written or spoken, for exciting pleasure by beautiful, imaginative, or elevated thoughts.

Science Process Skills: the skills used by scientists when they do research; examples of this would be: observing, classifying, estimating, measuring, inferencing, predicting, making and using models, making operational definitions, collecting data, interpreting data, investigating and experimenting, identifying and controlling variables, and communicating.

Significance of the Study

Poetry has not been used often as a tool to help motivate students in the area of science. In the past, children have easily remembered nursery rhymes and chants. Young females can memorize cheers and dance moves; young men can memorize the positions they are to play in an upcoming football or basketball game. It has been about the love of the game. The same concept can be accomplished with science material if completed in a way that can grasp the attention and interest of the students.

According to the 2005 National Assessment of Educational Progress, eighth grade student proficiency in regards to science has not improved or fallen, but remained unchanged

(Grigg, Lauko, & Brockway, 2006). This measure showed that 32% of eighth graders in the U.S. were proficient in science. This percentage result is identical to the measurement taken in 1996. This implies that students are not showing improvement in the area of science.

In the state of Florida, the Department of Education shows that only 40% of the eighth graders were performing at or above the state achievement level in science on the Florida Comprehensive Assessment Test. This percentage has risen 12% since 2003, when the science achievement measurement began (FLDOE, 2009). There are many things that can contribute to the enhancement of student comprehension in science.

On the district level, the county in which the study was conducted had 38% of their eighth graders performing at or above the state achievement level in science on the Florida Comprehensive Assessment Test. This percentage had risen 14% since 2003.

The Central Florida School in which the study took place was a new facility that began in the 2006-2007 school year. The eighth graders from this school were at a 49% average for scores at or above the state achievement level.

The class chosen to participate in this study has been showing some excitement towards science class since having poetry introduced with science at the beginning of the school year. The goal of this research is to help improve memorization of scientific vocabulary. This could prove to be of great benefit to both teachers and students.

Summary

Personal experience has shown that achieving positive results in the area of science is difficult. Being boring and difficult to understand has always been the usual attitude for science class. A lack of comprehension causes a problem for remembering vocabulary terms and definitions. Teaching has brought a realization that these problems are the same for a large portion of the student population at various age and grade levels. There are times when students would like to see the “fun” of a particular subject area. The goal of this research is to help children see that there is a fun way to learn science and remember it. In turn, they can use their creativity, perhaps gain a higher respect for the subject, and improve performance on their tests.

CHAPTER 2: LITERATURE REVIEW

Introduction

In the words of John Dewey, “One who, like myself, claims no expertness in any branch of natural science can undertake to discuss the teaching of science only at some risk of presumption” (Dewey, 1910, p.127). There are many ways that science can be interpreted and taught. It is the goal of the science education supporters for teachers of science to show that being willing to try something new will spark the interests of the students. From an instructor’s point of view, every experiment or activity attempted, can have a different outcome, but each activity provides an opportunity for new experiences.

Increasing Student Interest in Science

The beginning step to success in something is to connect to the interest of the students. If interests are non-existent, an instructor needs to find something from the student point of view to spark their interests. This can be done by hands on experiments, real-life scenarios, clearly presented topics, and open problems for investigation. These ideas were provided from a survey given from the Research Conference (2006). If students can share their interests and have them related to the science class, there may be a gain in student learning.

The Science Olympiad can help fuel the interests of the students. This is a national non-profit organization that promotes experimentation among students. Students can form a team with the grade level from their school. The team can choose an experiment that will show a question, hypothesis, model, observation, outcome, and conclusion. This helps build teamwork,

self-esteem, and promotes experimentation. Students can learn from fellow peers and use the information to improve their projects. There is also a sense of competition. Groups have the opportunity to win money that will benefit their school's science program. This can provide students with the sense of accomplishment that helps them gain an interest in learning more.

Another organization that is determined to help foster student interest and future careers for students is the Florida Foundation for Future Scientists. The goal of this organization is to promote student interest in science, engineering, and research. The belief of the organization is that students who are provided the opportunity to receive awards will pursue excellence. FFFS will provide awards in the form of scholarships to universities for students who compete in their state science fair and place. FFFS also promotes youth programs that promote science and engineering leadership. Students not only win a prize, but they are also learning how to grow both academically and professionally for their futures. (FFFS, 2008).

Florida Association for Science Teachers is non-profit organization that intends to improve science education at elementary, secondary, and university levels. The members of the FAST organization are science teachers, science supervisors, scientists, administrators, representatives of business and industry, and individuals that have an interest in science. FAST aims to create science education that helps students understand the technology of today and can make meaningful decisions in regards to science. Workshops involving approaches to teaching science are offered statewide throughout the year. Speakers are the scientists, teachers, or members of FAST that have more information to offer about an aspect of science. An annual conference is held for educators every October to offer teaching techniques, research findings, material and equipment, and make and take workshops. This is an organization that motivates the teachers to make science meaningful to students by providing an unlimited amount of

information and offering monetary awards for teaching excellence in the area of science. (FAST, 2009).

How Poetry Can Assist in the Classroom

In this particular study, poetry is the “new experience” to help intrigue the interests of students. “Adding a little poetry to classroom routines helped struggling readers attend to the reading process, understand concepts presented in the poems, and learn to read fluently so that listeners could also make meaning of the poems” (Sekeres & Gregg, p. 466). There is a deep meaning inside each piece of poetry that can be discussed and analyzed to help promote stronger comprehension. Students are able to learn about rhythm, rhyme, alliteration, onomatopoeia, imagery, literal meaning, figurative meaning, and the use of poetic language. Rhythm, rhyme, and alliteration provide the means for quick memory. Onomatopoeia helps students relate sounds to what is being studied. Imagery teaches students how to describe in poetic phrases. Literal meaning assists students in understanding how to define words, whereas figurative meaning helps them to personalize words. The poetic language assists in the actual writing. It is not always necessary to write a rhyme. Limericks, haiku, and free verse can help students to write ideas on paper, but require no rhyme. “Poetry can help shape the way students think by giving them words and concepts to frame their ideas and arguments. Poetry can feed their imagination, bring comfort to them, or fuel their passions” (Sekeres et al., p. 474).

How Poetry Can Translate

Poetry can be integrated into any subject to help look at a skill from a different point of view. According to Kinman (2007), this proves to work well with geography. This article was just a suggestion into teaching geography in a creative way that may assist students in appreciating it more. The main focus for this was to reiterate that by integrating language arts and geography together using poetry, geography is able to receive more needed attention. It is often left on the back burner in classrooms to be taught if time allows. There is time to reflect on various subject matter, it can be used for evaluation purposes, and it can help struggling learners comprehend more effectively in terms that they can understand. Poetry allows students to see geography esthetically and may help them appreciate it more.

“Against Gravity” by Rabas (2007) depicted how a writer of a dissertation linked poetry to plays. It associated how the play “Sidewalk Drum” and the poem “Last Road Trip” dealt with similar issues and themes such as: student/teacher relationships, the unifying and divisive role of music in society, protest, imagery, and regional setting. The author was able to integrate his life experiences and beliefs in a play that other people could understand. It also exhibited many of the emotions that anyone can face on any given day. Interestingly enough, a very informational piece was the work and creativity that was spent editing and revising. Proving that no matter how creative something may be, it still requires care and comprehension that will create a deeper understanding from the point of view of the writer.

It becomes very intriguing when something casual and light-hearted can be linked with something factual and serious. Robert Frost mastered this with his poetry when he began to write poems that reflected his interest in the science of quantum physics. Like many poets often do,

Frost wrote poems about items that interested him and science was one of those items. Below is a clip from Frost's poem entitled "Version":

Once there was an Archer,
And there was a minute
When he shot a shaft
On a New Departure
Then he must have laughed
Comedy was in it
For the game he hunted
Was the non-existence
Of the Phoenix pullet
And the shaft got blunted
On her non-resistance
Like a little bullet
Did in fact get splattered
Like a ripe tomato
That's how matter mattered.

It can be interpreted that "shaft" from line three represents the beam of alpha particles, "New Departure" is the new model, and "non-resistance" refers to the damage done when an object is hit by excessive force. This poem reflects on a physicist named Ernest Rutherford and his work with the "non-existent Thomson atom" (Colleta & Tamres, 362). Frost has many other poems that analyze quantum physics, atoms, momentum, cosmology, characteristics of water and light, and biology. Perhaps the use of this type of technique can help students realize that science can

be unique and interesting, in addition to helping them to see that there is more to the subject of science than just a textbook. This can give students a different view of the science curriculum, help expand their thoughts creatively and hopefully assist them in understanding the true definition of the terminology.

Science and Poetry Working Together

According to Cabrera (2006), using cinquain poetry with English language learners can help them gain a better understanding of the science they were learning and assisted in the process of having students become more engaged in the curriculum they were learning. The students had to write a poem about a particular area of science, illustrate the poem, and share with their classmates. A cinquain poem is a five line poem that describes a person, place, or thing. Line one names the person, place, or thing. Line two contains two words that describe the person, place, or thing. Line three consists of three words that express action. Line four has four words that express feeling. The last line has one word that is the synonym of the word from line one. This study helped to determine that the ELL students became more involved in science class and the discussion of the science topics. Students also shared their thoughts about the poetry. They felt that the poetry writing, illustrating, and sharing were able to assist them in learning new vocabulary. They also expressed that the repetition of the same type of poetry became boring.

Depending on what is being addressed and how it is being presented, science and poetry can have much in common. Science has certain language arts skills involved in creating definitions or naming new finds and defining them. Poetry has a science aspect to it when an author writes it or a reader comprehends it. "...the language must be viewed successively as a

structured collection of particles, as a hierarchal sequence of waves, and as a field network of relationships” (Pike, 283). Poetry has its stanzas to help it flow and hold together just as science has its experiments and definitions to help it grow, justify, and expand its knowledge. If each can create such a strong assembly for themselves, imagine what could come of a partnership between the two. Material that integrates science and poetry should help the non-scientists of the audience relate to the topic, may woo those who are suspicious of science or scientists, and demonstrate that science is part of our cultural heritage (Crawford, 2006).

Who and what we are is continually related to science. It can include our thoughts on how we view nature, pollution, space technology, physical activity, and how we live our lives. Poetry, on the other hand, can express all of these things in a creative language that exudes emotion and captures the eyes of interested readers. Peter Atkins, a distinguished chemist, gave the argument, “...science is omniscient, that is, able to supply all of our intellectual needs” (Midgley, p. 21). Poetry and creativity can supply the science facts in a language that sparks imagination and creates a dramatic first impression of the important information being learned.

The following poem entitled “Radiation Pressure” by Robert Morgan is an example of how science and creativity can go hand in hand to probe interest:

Though in our slow world of friction
And gravity we hardly feel it,
Light presses on the things it hits,
Pouring on a stream of photons
Against each surface, raining down
Forever on each face and facet,
Propelling bodies deep in space,

Beyond significant gravity,
Away from the white source

If light is comprehended through this poem, it is clear that light is a part of darkness that pushes everything away from a larger light source. The science in this is our light and the explanation for why we see it. The poetry is the romantic flow in which the job of light is described with great detail.

Science has been a subject that philosophers label as “morally neutral” (Holub, p. 14). On the contrary, science has much emotion involved. When a scientist creates an experiment to prove or disprove a hypothesis, there can be much anticipation felt while awaiting an outcome. When the conclusion is reached, depending on the original hypothesis, a scientist can feel a sense of relief, slight sadness, or perhaps, complete elation at a remarkable breakthrough. It can seem that a person who is not passionate about science sees an experiment as facts being joined together to get an answer. A scientist can envision a new path to an unknown region or a possible pot of gold at the end of their experimental rainbow.

To provide more evidence of the history of poetry in science is a poem found that was written in 1905. It appeared in “The Niagra Rainbow” in 1906 and described how the teacher of a class wrote this poem to help educate her girls in chemistry. “The hall was brilliantly lighted by the Phosphorescent Sun. Miss Hydrogen came with her pale blue flame of most becoming tint; the guests all beamed in radiant light of Oxygen’s glowing splint” (Lei, p. 1). The teacher treated the properties of chemicals as individuals and brought them to life to help her students grasp the concept being taught. No proof is provided to imply that this helped students retain information, but it did help to intrigue their thought processes and open them up to the science facts.

Poetry may not only spark the interest of students, but it may also be capable of aiding in memorization of facts. Some of the earliest memories are of the nursery rhymes in which children could hear the rhythm and repetition repeatedly and eventually they could recite for themselves. The comprehension may not always take place as quickly, but with time and practice the memorization can help. Rhyme heightens attention to the action of a poem or story (Denman, 1988). It also functions as a mnemonic aid, and it contains repeated patterns that create predictability that helps children understand that there is a structure in a story and that children learn to define those elements of the structure (Goldman, p. 347). This enhances a child's comprehension of what they are reciting.

Memorization Techniques

Memorization, also known as mnemonics, has many techniques that enhance the brain functions to assist in remembering items studied or learned. This can be easier for visual learners when the mnemonics are in the form of pictures. There are benefits for auditory learners when the material is spoken, such as a lecture or tapes. Auditory learners can also gain more memory if the student teaches what they have learned to someone else. Ways for students to gain memorization of information would be taking notes, organizing them, creating flashcards, reciting, acronyms and poetry. It is imperative that students use what they understand to create their own memorization techniques that work for them. Students need to take the time to relate what they are learning to their personal lives. This will assist in students working to build the bigger picture that puts all of the little ideas into a sequence.

Popular music can assist with memorization. The fact that the songs on the radio play over and over again demonstrates how it helps memory. The repetition is a major assistant to memorization. Songs usually tell a story and hearing it repeated will help students understand the point to the story. This can also help when introducing poetry or continuing the learning of poetry. “Lyricists use many of the same conventions poets have used for centuries” (Luebke, p. 7). Music can add emotion to the subject of the lyrics.

A study completed in 1989 by Everett observed the effects of using music motivational instruction on a seventh grade life science class. He compared two classes in this study; one class had music motivational instruction and the other class had traditional classroom instruction. From this study, there was a significance found in the attitudes of the students regarding life science. By creating a relaxed and informal environment, the students were able to develop a more positive attitude about learning science with music motivational instruction (Everett, 1989).

Motivation

Improving Student Motivation

In order for students to gain valuable information, it is helpful if they have an interest or motivation to learn it. One step to take is to give a student interest survey to record current data about interests that students have. “Such information is helpful for making subject matter more relevant as well as giving new insights to the many ways there are to relate to students” (Wlodkowski & James, p. 127). Once this data is collected, an instructor can use its results to prepare material that will be seen as meaningful to the students. “In order to maximize motivation, it is seen as important that students have a sense of personal competence and control,

and perceive learning activities as meaningful and relevant” (Elliot, Hufton, Willis, & Illushin, 2005, p. 27).

According to a study done in 2005 on motivation, engagement, and educational performance by Elliot, Hufton, Willis, and Illushin, there were four factors that would have a significant impact on student engagement and achievement:

1. Student perception of and satisfaction with their current performance in school.
2. The importance ascribed to effort.
3. The value placed on educational achievement and the desire to reach future goals.
4. Peer influences; the acceptability of other peers can influence how much students engage and strive.

Why Motivation is Important

The ability to gain a better understanding of a particular subject area can, perhaps, assist in motivating students to learn more in other areas (Hunt, 2008). It is not often that students name their favorite subject or class as one that they are not doing well in. (Scheidecker & Freeman). There are some ways that students can be motivated without even realizing that a teacher is trying so hard. For example, a seemingly ordinary classroom teaching technique is for a teacher to simply prepare the students for a test. It is better that the students know what will be on the test that they are taking. Surprises that are not included in the lesson can hurt student abilities on an assessment (Scheidecker, et al., 1999). Another approach would be to provide an ungraded pretest in which students can be introduced to the material that will be taught. This

helps students to feel comfortable with the information and also prepares them for the key facts that they need to know. It is important to remember to work as a team, not just as a teacher telling students what to do. It is not often that individuals witness teachers sharing the responsibility student progress or the lack of progress (Scheidecker et al., 1999).

Motivational Techniques

An additional concept that can assist with student motivation is to give them more challenges (Benson, 2000). Often teachers take the wealth of material and subject matter and manipulate it because they feel students do not have the abilities to learn the material from the textbook point of view. “When a teacher has low expectations for the class, there is a sense of lower self worth among the students (Elliot et al., p. 27)”.

There is also a need to teach “outside” the textbook. The importance of taking real world information that surrounds students currently does exist. “First, teach them something related to their interests; then, give them some skill in the area...along with feelings of competence” (Mager, p.115).

Motivation and Attitude

Another piece of motivation is attitude. If teachers want students to have a positive attitude for the subject, teachers must also exhibit a positive attitude. Attitude is often looked upon as a negative word. This depends on how it is used. “All statements about attitude are based on circumstantial evidence; on the evidence of what people say and do” (Mager, p.12). Some examples of promoting positive attitude towards a particular subject area could be: speak

favorably about the subject, encourage others to become interested in the subject, and spending more time nurturing the subject.

As students become motivated, they can gain a sense of appreciation of a subject (Benson, 2000), and this could help them have a better performance on a test. Key motivation for a student or an adult is to have happiness in school and work, and that this happiness will have an impact on their community. (Wlodkowski et al., p. 3). Motivation can help students succeed. The responsibility lies with the teacher to portray the motivation for their students. Motivation begins with the instructor and needs to be inherited by the students (Scheidecker et al., p.132).

Conclusion

There are multiple ways to connect various topics or categories of interest. The goal of this study is to show the already well developed relationship of science and poetry and help eighth graders use poetry to assist in the memorization of the scientific vocabulary they are learning. It is hoped that as students practice reciting the poetry, the memorization will increase due to the repetition and rhyme of the vocabulary and definitions.

Poetry has been able to assist with memorization for many years. There are a variety of adages which include rhymes that have been used in the past to assist in the importance of remembering key facts. “Red touch yellow, Jack’s a dead fellow,” (FWC, 2007) is an example of how it can work regarding a warning of the poisonous coral snake. “An apple a day keeps the doctor away,” that dates from 19th century Wales (Green, 2006) was used to imply to individuals that eating healthy could prevent health issues later. “Early to bed, early to rise; makes a man healthy, wealthy, and wise,” from “Poor Richard’s Almanack” (Franklin, 1732), gives a reminder of how important it is to get a good night’s sleep in order for a person to perform at

their best. When something of this magnitude can make something easier to remember, it stands to help individuals benefit in a multitude of ways when used appropriately.

This study will try to portray how poetry integrated with astronomy science curricula can assist in student memorization of key scientific vocabulary and definitions. It will furthermore attempt to show how this poetry technique will assist in student performance on vocabulary assessments. A positive achievement from this accomplishment would be to also promote student motivation and interest toward the subject of science.

CHAPTER 3: METHODOLOGY

Introduction

This chapter describes the methodology used in this action research study and has been arranged in the following sections: statement of the question, study population and sample, instrumentation, instrument reliability and validity, data analysis, and possible limitations for this study.

Statement of the Questions

The purpose of this study was to see improvement in student memorization, bettering student performance on tests, and motivate students to develop a greater interest in science using astronomy. The following questions were examined:

Research Questions

1. How can the integration of poetry into the science curriculum in the area of astronomy assist eighth grade students in memorization of science vocabulary?
2. How can this study improve the motivation of student learning and increase student interest and attitude in science?
3. How can this activity assist student performance on science assessments?

Research Design

This action research was a mixed design utilizing both qualitative and quantitative methods. The use of both research methods strengthened and expanded the scope and breadth of the data collected. Rossman and Wilson (1991) suggested combining qualitative and quantitative methods to corroborate, to provide greater details in reporting and to initiate new ways of thinking about the ideas that emerge from such a study. The qualitative method for this study was purposive sampling, which is a non-random, causal comparative study. This type of sampling allows the researcher to select from a specific grade level for the intended purpose to study student performance in science in which poetry was integrated into lesson plans. This performance was measured using surveys on science interest, science attitude surveys, and assessments. The reason was to determine if students were able to benefit from having poetry skills integrated with their science curriculum. This method used a total of fourteen students from one class using poetry in which there was a diverse mix of learning levels and styles that would hopefully give a fair examination of the effectiveness of poetry integrated with science; and thirteen students from another class not using poetry to determine if there was significance in the results from the poetry class.

Setting

The Central Florida suburban middle school in which this study was conducted consisted of a total student population of 1,424 with 480 sixth grade students, 463 seventh grade students, and 481 eighth grade students. The 92 faculty members taught academic and exploratory courses related to the middle school curriculum. Four academic teachers worked together as a team.

These faculty members taught approximately 114 students during the day. Student classes were located in two hallways designated as eighth grade hallways.

The science classroom in which the study took place was relatively smaller compared to the standard science classrooms throughout the school. This made practicing experiments and other scientific activities crowded. There were no sinks or countertops. There was a storage closet in the back of the room to hold the science materials. There were four working computers on the left-hand side of the classroom with cabinets above the computers for additional storage. The walls were decorated with student work, classroom procedures, science concepts, and a white board. Tables that seated two students were positioned together to fit groups of four. This needed to be done to make team work on experiments feasible in the classroom. The population for this study included eighth grade students in a public middle school. Eighth grade students were chosen because it was believed to be more beneficial for results due to the fact that so much emphasis was placed on science for the eighth grade level. The eighth graders would take an annual state science examination in the spring of the school year to test their knowledge of science content. One of the important curriculum aspects to be achieved by the students was the state assessment vocabulary that emphasized words from sixth grade through eighth grade.

The target population consisted of two eighth grade classes that had similar demographics. The reason two classes were used was to compare their differences: one class taught using poetry and one class taught without (Table 1).

Table 1: Demographics of Poetry Class vs. Non Poetry Class

Gender	Poetry Class	Non Poetry Class
Girls	3	7
Boys	11	6
Ethnicities	Poetry Class	Non Poetry Class
Hispanic	10	7
Asian	1	0
African American	0	3
Caucasian	3	3

These were the ethnic categories of the classes as defined by the county standards where the school was located.

Data Collection Instruments

The following instruments were used to collect data:

1. A pre-survey and post-survey regarding science interests of students.
2. A pre-survey and post-survey regarding science attitudes of students.
3. A pre-assessment and post-assessment for Astronomy Unit part one.
4. A pre-assessment and post-assessment for Astronomy Unit part two.
5. Observations/field notes.
6. Student feedback.

Data Collection Methods

Prior to the beginning of the school year, the science teacher met with the language arts teammate to discuss the levels of poetry that eighth graders would be taught and find out when poetry would be taught. The science teacher wanted to be fully prepared and knowledgeable in the area of poetry. It was later revealed that the language arts teacher was not scheduled to teach poetry until after the annual writing assessment in the spring. The science teacher decided that because this was a first time study, she would write the poetry that included vocabulary and share it with the children. If time allowed, the teacher would try to fit in a few lessons on poetry and let the students attempt to write their own for the science class.

Science Interest Pre/Post Survey

The school year began with a science interest survey. With one month until the astronomy unit was due to start, the teacher wrote individual letters to students and parents

letting them know that during the astronomy unit, there would be pretests and posttests administered to the students. They were also notified that these grades would not be counted for or against the students. These would only be used as a measurement device to compare data.

Once the letters were returned with permission, the science interest survey was administered with each of the classes. The purpose of this was to notify the science teacher of the learning interests of the students regarding science. The teacher could also ascertain whether the student population was coming into the classroom with positive or negative attitudes toward science. This information is a benefit to the teacher for the purpose of planning the types of activities needed to enhance the interest in science and keep the attention on the subject matter.

Science Attitude Pre/Post Survey

Students were also given a science attitude survey. The purpose of this survey was to find out how students felt about how science had been taught to them. Some of the target statements for this study included:

- I think being a scientist would be exciting.
- Science is fun.
- I usually try my best in science.

These statements were measured using the following words or phrases: strongly agree, agree, disagree, and strongly disagree. The number of student responses would be tallied to determine their attitude towards science. This could assist the instructor by showing how students could be motivated to learn science.

A post-survey would be given at the end of the study to determine if the attitude of the students had become more positive, negative, or remained the same. This could be the determining factor on if the study was successful in motivating student attitude towards science.

Classroom Instruction

During the first nine weeks, importance was placed on establishing a guide of expectations and a behavior system that students could adapt to and follow. This time period was also used to revisit and learn the “basics” of science. The basic skills of the scientific process, experimentation, recording data and the nature of science would be needed throughout the study of science.

The teacher introduced the students to earth science with her rhyming book about some of the key concepts that would be taught in earth science. The teacher desired to help the students interpret science in a light-hearted way that would increase their interest and motivate them to want to learn more about earth science. The teacher provided a poem for each lesson covered in class that included key vocabulary and definitions. Copies of these poems were distributed to the class with poetry integration to use as a study guide for their vocabulary. It was attempted to help students learn to appreciate science by using the poetry as a grabber to begin lessons.

The astronomy unit took between 5-7 weeks to complete. It was important to note this study had to be done in consecutive weeks, but because of a two week break coming up before the unit was over; the astronomy unit was broken into two sections to show better clarity of the study.

Astronomy Unit 1 included lessons on:

- The history and scale of the solar system
 - distances in space
 - nebular theory
 - birth of the planets
- The earth and moon system
 - the formation of the earth and moon
 - tides
- Orbits and their effects
 - eccentricity
 - axial tilt
 - precession
 - inclination
- Impact events and the earth's system
 - Asteroids
 - Comets
 - meteors, meteorites, and meteoroids

Astronomy Unit 2 consisted of lessons on:

- the sun and its effects on the community
 - structure of the sun
 - earth's energy budget
 - harmful solar radiation
 - sunspots

- solar flares
- electromagnetic spectrum
 - the nature of electromagnetic radiation
 - how astronomy relates to electromagnetic radiation
 - using electromagnetic radiation to understand celestial objects
- our community's place among the stars
 - classifying stars
 - the lives of stars

Assessments

Assessments were created to measure the retention of the students in regards to the science vocabulary words. Due to the fact that there would be a two week break for the students that would interrupt the study, the Astronomy unit was divided into two sections. Pre-assessments were given to the students prior to the units being taught. A pre-assessment was a unit of measurement to understand how much knowledge students had on astronomy. Once the units were completed, students were given a post-assessment to measure how much information they had learned. The post-assessments were identical to the pre-assessments. The reason for this was to compare the data to investigate if students had learned a significant amount of information from the units taught using poetry.

Student Feedback

When the study was completed, students were encouraged to offer suggestions on how this could be taught better in the future. The purpose of this was for the instructor to understand the strengths and weaknesses of the lessons taught as seen by the students. From this information collected, the instructor could modify the lesson for future use.

Field Notes

During this study, the teacher kept a journal to record the highs and lows of the study. This gave the instructor time to review and reflect on instruction in the class and how to improve upon it for the next class. This technique could also help the teacher collect the daily data on successes and failures within the unit.

Methods of Data Analysis

The following paragraphs discuss the methods used to analyze the data collected during the study on how poetry integrated with science can help students gain memorization of key science vocabulary terms, motivate student interests in science, and promote students to have a positive attitude towards science. The tools used are referred to as coding and descriptive statistics.

Descriptive Statistics

Descriptive statistics are used to describe the basic features of the data gathered from an experimental study in a variety of ways. They provide simple summaries about the sample and the measures. The graphs chosen to reflect the data found from this study were bar graphs and paired t-test tables.

The science interest surveys and the science attitude surveys contained the responses strongly agree, agree, disagree, and strongly disagree. A bar graph was used to describe the percentage of students who agreed or disagreed on the topics presented. These graphs were used for both the pre and post surveys to help portray a difference in the attitudes and interests of the students after the study was completed.

The assessment scores were placed into a paired T-test to demonstrate significance from the pre-assessment to the post-assessment. A finding is characterized as statistically significant, when it can be demonstrated that the probability of receiving such a difference by chance only, is relatively low. It is conventional to describe one's finding as statistically significant, when the obtained result is among those that would occur no more than 5 out of every 100 times when the only factors involved are the chance variations that occur whenever random samples are drawn (Hoffman, 2003). After analyzing the results, specific scores were studied to determine if students had shown improvement from pre-test to post-test.

Several strategies were used to ensure internal validity including triangulation of data. Multiple forms of data were collected that included pre/post surveys, pre/post tests, field notes, and pre/post assessments.

Assumptions

The students would enjoy listening to the poetry. Some students seem to get enthusiastic when listening to music and rap. The connection to an already established interest should assist in the application of this concept.

The process would help students become more involved in the science class. If students became excited about the process of learning during science class, they would become more involved in other academic activities that were offered to them.

Students would provide truthful feedback on the survey forms. It was assumed that enough time was given for students to rate the statements to the best of their ability. The students were free to express their thoughts and feelings in the presence of the instructor.

CHAPTER 4: DATA ANALYSIS

Introduction

The purpose of data analysis was to depict the process of gathering, modeling, and transforming data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. The techniques of action research required looking for emerging themes and patterns from all the data collected. Three themes surfaced from the surveys, assessments, and field notes. These themes were memorization of key vocabulary, student attitudes towards science, and student interest in science. Determinations were reached in regards to how the practice of science poetry affected the attitudes and interests of the students involving science and how this practice affected the vocabulary test performance of the students.

Observations/Field Notes

The first step was to organize the unit. There was a large amount of information for the students to learn during this unit. An important factor was opening with a poetry activity that would help the students notice the words associated with astronomy (Nodelman, 1992).

Students were given the Astronomy 1 pre-test to begin the unit. After the test was completed, there would be time to discuss prior knowledge of students regarding astronomy. The teacher wrote the word “astronomy” on the board. It was written vertically to portray a model of an acrostic poem. Students were then asked to think of words that they felt were related to astronomy and started with the letters on the board. It did not take long to realize that our words

were limited due to the lack of letter variety in the word astronomy. It was then decided that students could name any words that were related to astronomy. The most fascinating part of this activity was realizing how many words students would associate with astronomy. This was just the beginning.

On the first day of each lesson, the poetry class was provided with an introductory poem that included the key vocabulary words and definitions to be memorized. After the students were given the opportunity to read the poem, the science lesson would continue. A typical lesson included a lab activity, discussion of the outcome, reading text, and a review exercise. At the end of the lessons, the teacher would review the key terms in the poem by reading it aloud. The instructor would read an entire poetic stanza, leaving the last term out. This was an opportunity for the teacher to analyze if the students could remember and apply the terms to the definition they heard in the poem.

Students began to show interest in the poetry. They would create rhythmic beats on the table tops and let each other “rap” the poem for the unit. They would also become competitive to see who could remember the vocabulary first. It was fun to see students become so involved. “Hey...that was my word!” Some students were doing their best to remember on their own. Others were looking at their poems to try and match words with phrases. Their attitudes had become completely motivated towards the science material.

The moment of inspiration occurred four weeks after the unit began. The teacher was having a difficult time coming up with the poem on the layers of the sun. It became a struggle at times to find the correct rhythm for the words and their meanings to rhyme and flow. The poem created by the instructor was:

Our sun has layers
Just like our Earth
Each layer has properties
To describe its worth
The photosphere is Sun's surface
That we can see with our eyes
Although we should not look directly
Or we stand the chance to be blind
The chromosphere is a layer in the
Sun's atmosphere near its photosphere
The corona extends for millions of miles
Around the sun and make up its outermost atmosphere

As shown above, it was very difficult for the instructor to make a poem that was able to catch the sense of the layers of the sun and make it easier to understand for the students. The instructor was struggling and stressed, not quite sure how to finish the poem so that it would be ready to share. As the poetry class began to trickle in, the teacher was working on typing the poem so that it could be displayed on the projector. Then, she was approached by one of the students. A young girl wanted the teacher to listen to something that she, the student, had written over the weekend about the layers of the sun. As the student read the words aloud to the teacher, the teacher was overjoyed! What she heard was the perfect poem for the layers of the sun. What was even more remarkable was that a student had written the poem. After the student finished reading her poem, she looked at the teacher with a nervous yet excited smile on her face. It was here when the teacher realized that if nothing else was gained from this study, she would feel accomplished by

the fact that a student had been able to use the poetry to gain a better sense of what she was learning in science class. Just one student could make a difference.

Reading the poetic stanzas and leaving out a key word worked well with the poetry class. Students were very receptive to this form of memorization. The students were always looking forward to the time when the poem would be recited in the hopes that they would be able to fill in the blanks.

For the non poetry class, the science lessons were taught without the use of poetry. These students would get the vocabulary and definitions from the textbook, take part in a lab activity, discuss the outcome, and complete science comprehension exercises. There were some very interesting discussions about the topics being studied. The class was somewhat receptive to the information provided, but they were not always giving one hundred percent of their attention. They would converse with classmates, make jokes, and stare at anything other than the book. They were easily off task and non responsive to questions.

Data Results

The data collected indicates that the poetry helped boost the interests of the students regarding science. The four main topics regarding science interests of the students were investigated. These included encouragement, teachers make science interesting, topics taught in class are boring, and teachers were enthusiastic about science.

It was great to see that students that began the year with a very off task attitude seemed to be more interested in the science class at the conclusion of the data collection. The teacher and students worked as a team to learn the important facts about astronomy. There was also a very

light hearted attitude throughout the class. Students showed a respect for the teacher. They were raising their hands, more involved in lab activities, and they were also paying better attention when reading from the textbook.

The fourteen students that participated in this study completed seven astronomy units over the course of six weeks. Using the philosophy of action research, there was an attempt to find emerging themes and patterns within all of the data collected. There were a few themes that emerged from the science interest survey: feelings of encouragement by science teachers, feelings of science being made interesting by science teachers, if topics taught in class were boring, and if students felt that science teachers were enthusiastic about science. The science attitude survey recorded the following themes: students think being a scientist would be exciting, students think science is fun, and students try their best in science class. The pre and post assessments were used to correlate how poetry in science assisted with memorization of key vocabulary words.

Science Interest Surveys

There were four themes that emerged from the science interest survey. Feelings of encouragement, science teachers make science interesting, science topics in class are boring, and teachers were enthusiastic about science. (Figure 1)

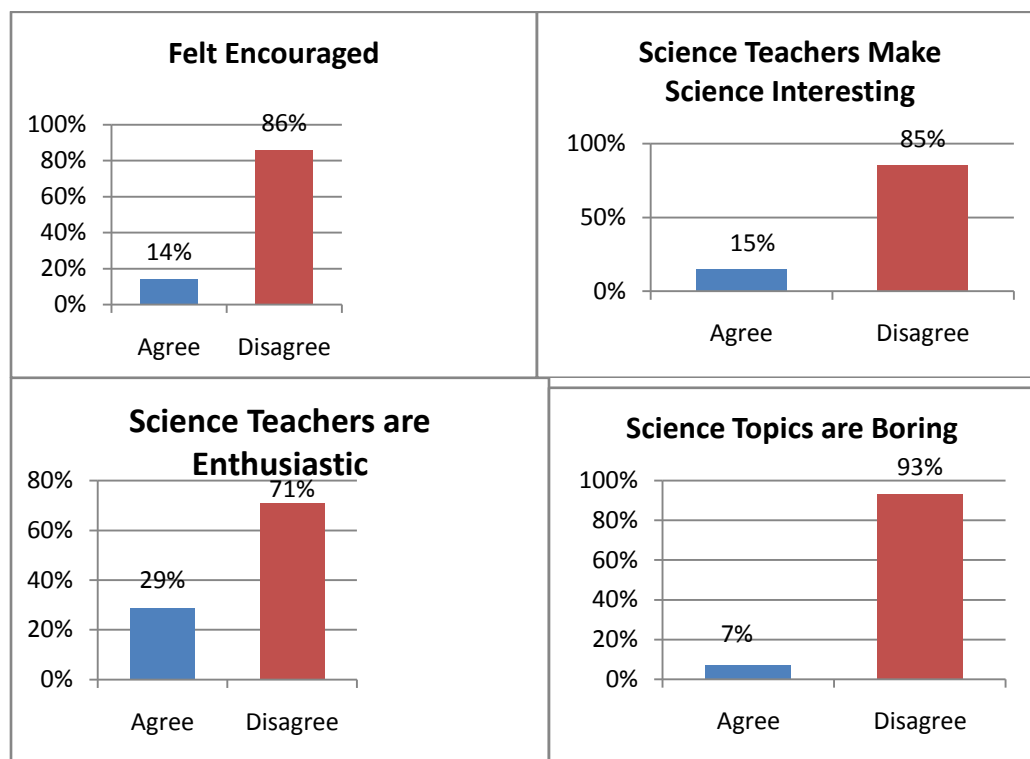


Figure 1: Poetry Class Science Interest Pre-Survey

According to the pre-survey, students felt that encouragement from previous science teachers was not very strong. As shown in Figure 1, only 14% of the students felt encouraged by their teachers. Additionally, 14% of the students felt that their teachers made science interesting and 29% of the students felt that their teachers were enthusiastic about science. What was encouraging being a science teacher was that only 7% of the students involved felt that science topics taught in class were boring. It was encouraging to the instructor that the use of the poetry in science could help these numbers change for the better.

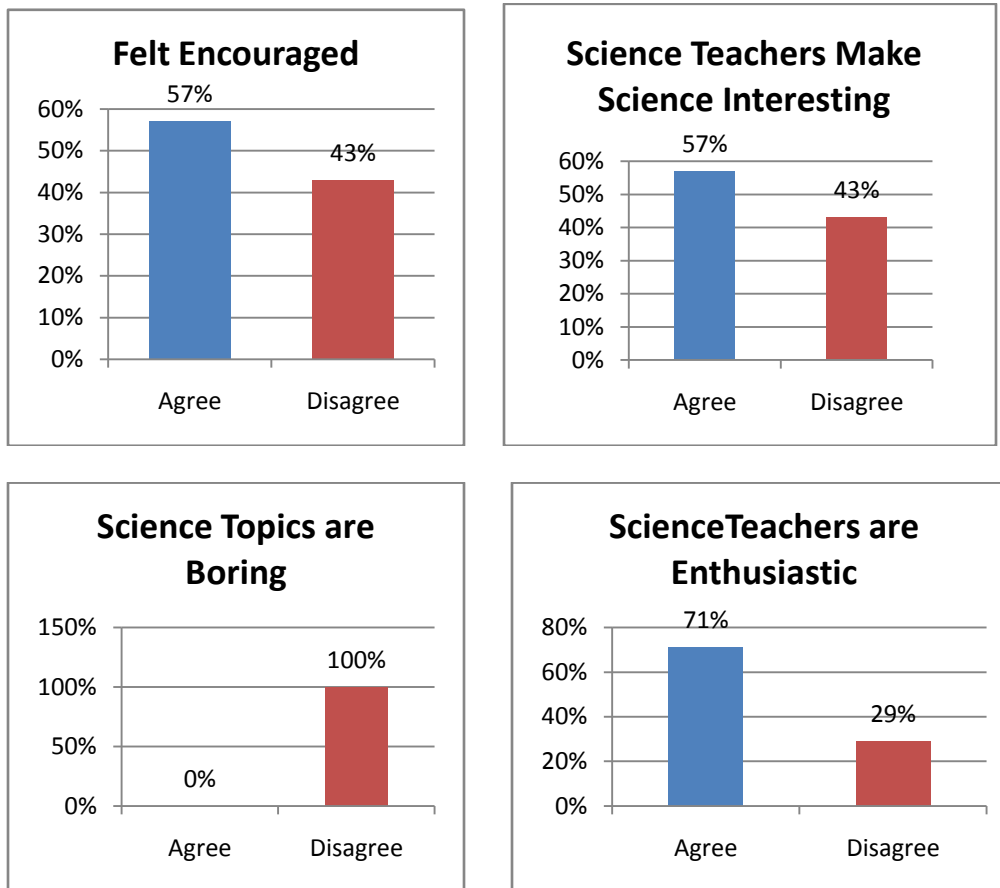


Figure 2: Poetry Class Science Interest Post-Survey

Once the study was concluded, students were given a post-survey to measure their science interests. In Figure 2, the number of students that felt encouraged by their science teacher and that science teachers made science interesting soared to 57% for each. Student thoughts about the enthusiasm of the science teacher rose 42%, from 29% to 71%. It was extremely encouraging to the teacher that no student felt that science topics were boring.

Science Attitude Surveys

Three themes were exposed from the attitude surveys that were found to be of importance to this study: students think being a scientist would be exciting, students think science is fun, and students usually try their best in science class.

From the poetry class pre-survey, shown in Figure 3, 21% of the students surveyed felt that being a scientist would be exciting, 36 % thought science was fun, and 43% said that they usually try their best in science class.

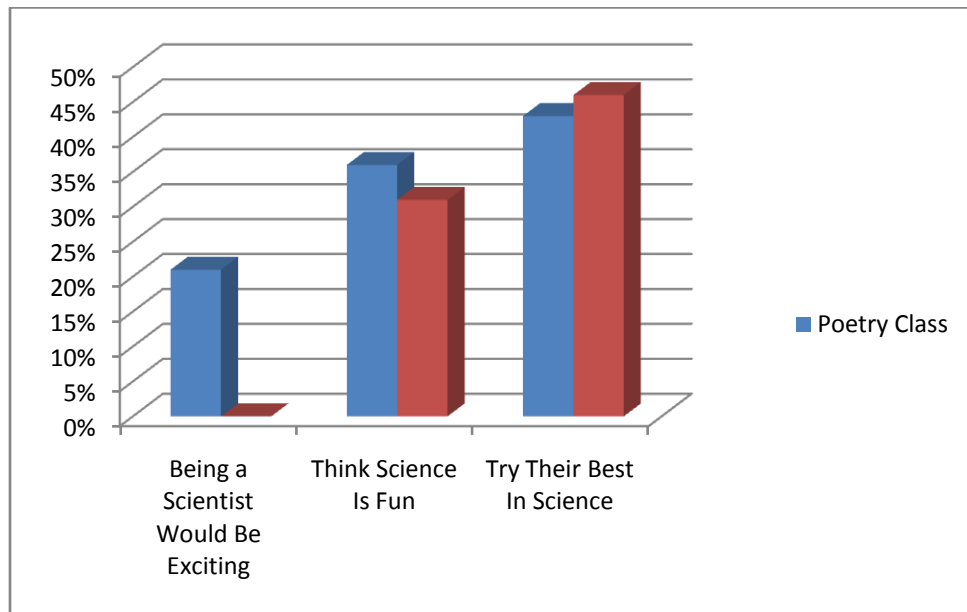


Figure 3: Poetry Class and Non-Poetry Class Science Attitude Pre-Survey

In comparison, the non-poetry class survey resulted in 0% thinking being a scientist would be exciting, 29% thought science was fun, and 44% believed that they tried their best in science. The fact that the survey implied students wanted to succeed was very reassuring.

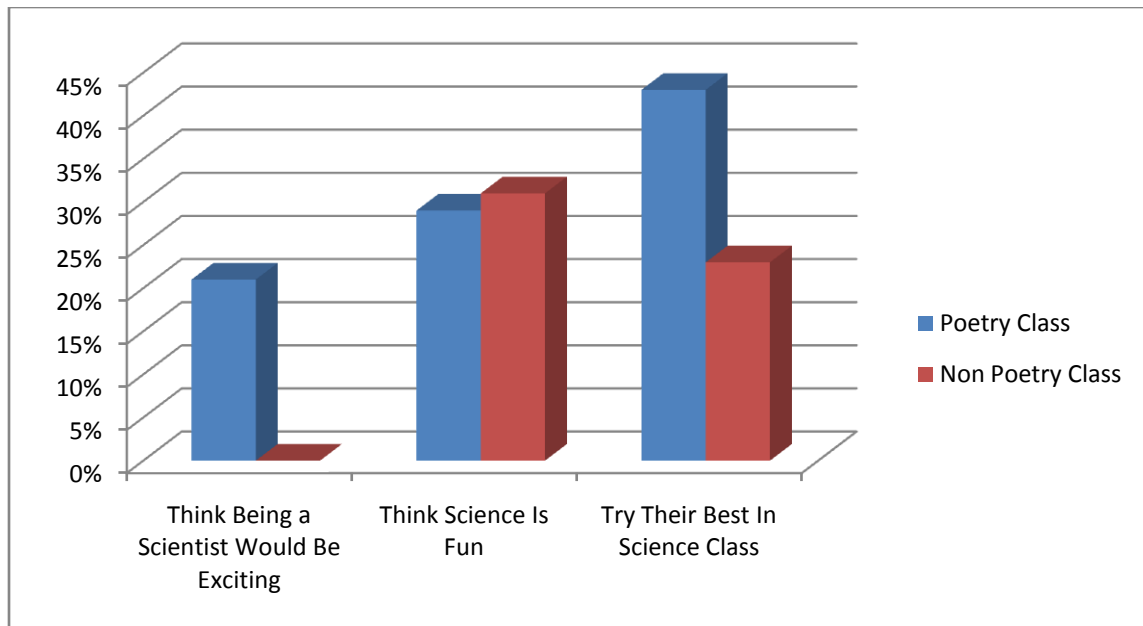


Figure 4: Poetry Class and Non-Poetry Class Science Attitude Post-Survey

After the study was completed, the poetry class post-survey (Figure 4) revealed that 21% of the students thought being a scientist would be exciting, 29% of the students thought science is fun, and 43% of the students said that they usually try their best in science.

The disappointing outcome was to notice was that the non-poetry class fell in this survey. They were not as willing to try their best in science class. This is discouraging but informative. It had been evident to the instructor from past evidence that if students were not trying their best, they were not learning to their fullest potential.

Assessments

Table 2: Poetry Astronomy 1 Test Results

	Paired Differences					Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Pretest	71.4286	14.62216	3.90794	62.6876	80.1695	.000
Posttest	90.9286	6.96656	1.86189	86.9062	94.9509	.000

Table 3: Non-Poetry Astronomy 1 Test Results

	Paired Differences					Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Pretest	55.8462	16.65833	4.62019	49.5669	62.1524	.000
Posttest	84.8462	13.61278	3.77550	76.6200	93.0723	.000

The quantitative measure was to show improvement of memorization regarding science vocabulary words were the pre/post assessments of the astronomy unit for both the poetry class and non poetry class. It was clear from these measurements that the poetry class had better retention of the vocabulary words that were tested on the Astronomy 1 Posttest. The results from the T-Test in Table 2 showed a significant difference ($p=.000$) in the pretest scores of the poetry class. Their class average was approximately 90%. In comparison, the non poetry class, shown in Table 3, showed a significant difference as well. Their class average was approximately 85%.

One observation to note was that although the poetry class had a higher average on the Astronomy Posttest 1, their class average only rose 19%. The non-poetry class average rose 29%.

Table 4: Poetry Class Astronomy 2 Test Results

	Paired Differences					Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Pretest	56.8571	16.23793	4.33977	47.5159	66.3412	.000
Posttest	74.8571	10.26263	2.74334	68.9305	80.7838	.000

Table 5: Non-Poetry Class Astronomy 2 Test Results

	Paired Differences					Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Pretest	60.0000	12.96791	3.59665	52.1636	67.8364	.000
Posttest	70.1538	9.52931	2.64295	64.3953	75.9123	.000

During the second part of the astronomy unit, students in the poetry class were able to show a much larger gain between the pretest and the posttest than the non-poetry class. According to Tables 4 and 5 the poetry class was able to improve their class average mean 18%. The non-poetry class increased by 10% which suggests that the poetry was of some benefit to the poetry class in regards to science vocabulary words.

Student Feedback

Once this study was completed, it was important to find out how the students in the poetry class felt about the poetry used. There was a class discussion about the progress made and what students thought helped or hurt them. During this discussion the following key questions were approached and answered by the students:

- How did the poetry help you?
 - “Poetry gave me a different perspective of the words.”
 - “Poetry was more detailed. The text was confusing and the poetry made it easier.”
- What was good about it?
 - “It helped me remember stuff on my test.”
 - “It helped me understand what was being asked of me.”
 - “The rhyming helped me remember the definitions better.”
- What was bad about it?
 - “The words need to rhyme more.”
 - “Highlight the vocabulary words.”
 - “Try to make the phrases simple. The poetry was still a little difficult to understand.”
- What can we do differently?
 - “If we could make the poetry on our own, may we would be able to understand it more.”

- Would projects be a good idea?
 - “Yes.”
 - “If we could work in groups, it might be fun.”
 - “I don’t know if I could write poetry.”
 - “I am not good at rhyming. Can we write other types of poems?”
 - “Some words are hard to understand. I don’t know if I could do a good project.”
- What do you feel you would want to know about writing poetry before getting a project?
 - “Show us other kinds of poetry.”
 - “Let us practice in class first. Like do it for bell work.”

Their responses were very resourceful to this study and to possible studies in the future. It was enjoyable to see that they had a better sense of understanding the concept and they were able to create ideas for doing a study like this again. Students do not always realize how much help they provide. It is fortunate to have students take part in what can be a study that should continue for years to come.

Summary of Results

How does the integration of poetry assist in the memorization of science vocabulary words? Can the use of poetry assist growth of student interest in science? Can poetry motivate students’ attitudes toward science? By the use of both qualitative and quantitative methods, analyzed data portrayed that poetry did improve student memory regarding science vocabulary. The science interest of students in the poetry class also showed improvement. The science attitude remained unaffected by the use of poetry in the science classroom.

CHAPTER 5: CONCLUSION

Introduction

As the astronomy unit drew to a close, I began to reflect on how my class was affected by rhythm and flow. I remember all of my trials and feelings of being incomplete, until I started to remember how the learning by students was such a treat. Their response to the poetry was actually quite grand and I know that what I found could give other teachers a hand.

Research Questions

1. How can the integration of poetry into the science curriculum in the area of astronomy assist eighth grade students in memorization of science vocabulary?
2. How can this study improve the motivation of student learning and increase student interest and attitude in science?
3. How can this activity assist student performance on science assessments?

This action project answered these questions and also brought up new questions that may expand the study in the future.

Literature Review Connection

As Albright showed in his study, “Quantum Poetics”, scientific ideas can be related to the metaphors of poetry (Crawford, 2006). This study revealed how poetry integrated with the scientific lessons of astronomy assisted students in scoring higher on their science vocabulary assessments. Students were able to take the rhymes and patterns from the poetry provided to them and use them to recall key phrases of the definitions of their science vocabulary.

Everett (1989) found a significant difference between students receiving musical motivational instruction than students receiving traditional instruction. In a comparative view of the data in this study, poetry was able to boost the motivation of poetry students’ attitudes in science compared to the non-poetry students’ attitudes. It was interesting to see how the poetry class was reacting to the poetry provided to them regarding astronomy. Their eyes were lighting up, chanting became a habit, and they were looking forward to seeing the material.

It became evident that splitting the unit words by themes and creating poems students could relate to assisted in the memorization of definitions. These conditions created an atmosphere that made learning and remembering the concepts much easier.

I began to understand how Cabrera (2007) felt when she conducted her poetry study with her ELL class. The repetition of simple rhyming poetry did begin to falter the response of the students in the last two lessons of the Astronomy unit. Students were not as involved as they had been at the beginning.

When the pretest was given, there were many complaints about having to take a test. There was a lot of apprehension and stress. Students felt an inevitable sense of failure because they had not seen the words and definitions before. As the time came to take the post test, after

utilizing the poetry, the students had a much higher sense of confidence. They were also exhibiting better memory of the words. They were actually excited for the test to arrive.

Based on the data collected from the pre/post tests of the Astronomy Unit for the poetry class, there was a significant gain in student scores.

Research Questions

1. Can poetry assist students in the memorization of key science vocabulary words? The data was able to show that the students who were taught poetry in science did perform better on the vocabulary assessments given.
2. Will this learning exercise help motivate student attitudes regarding science? From the information obtained in the science attitude survey, the class that was involved in poetry did not show significant improvement of their attitudes regarding science.
3. Will this learning exercise assist in the growth of student interest in science? The survey data revealed that student interest in science regarding how they learn and how teachers present it did improve.

Discussion

The reason for this study was to find a more intriguing way of stimulating the learning of the students so that they could better retain the vocabulary they were learning. There is a level of importance towards their future education in remembering key vocabulary words. In the spring, there will be a state assessment in which the students will be tested in their knowledge of comprehension and how it pertains to science. On this assessment, there are approximately 86

words for the students to remember. If poetry can be proven to work with one unit, it would be interesting to see how it could work throughout an entire school year. The poetry did assist students in creating a light-hearted approach to science. The hook of poetry was used to intrigue the students about science by introducing them to something they had never heard before. They were able to comprehend the terms and the definitions, retain that information, and apply it to their lab assignments and reading. To give students a sense of community in which they have more responsibility, they will gain interest (Benson, 2000). By building this type of environment, students were more interested in taking part in class conversations, volunteering answers, and even writing poetry. It also helped students remember those important scientific terms. When their performance showed improvement, their assessments showed improvement.

I think that the poetry could be of great use in the future. It reflects back on the times of nursery rhymes to help students remember their multiplication tables or the capitals of all 50 states. I would like to write more poetry about scientific concepts to help ESOL students understand the terms and associate them with descriptions. I would like to begin each lesson with a poem as an introduction to the terms. It would be remarkable to see more student involvement in the actual writing of poetry in their words. It would require teaming with the language arts teacher to assist in teaching students the basics of poetry. I believe this would be beneficial to the students because they could learn their terminology, learn to write successfully, and perhaps it would motivate them to try the concept in other classes where struggling to remember is a problem.

Another helpful concept would be to create a book of the poems that were written at the end of the year to help students feel as though they have achieved a significant accomplishment

of being published. This would boost the morale of students and hopefully encourage them to take it with them to use in any style they choose.

Anyone can write a poem. It does not have to rhyme and it does not have to mean anything to anyone except the author. It is a personal connection to an activity or event. Concepts and terms can linger in the mind of the students in the form of a poem or riddle that they remember from long ago. Although it may become aggravating to not be able to get it out of their mind, they will find it useful later. In regards to science, it is recommended that poetry should complement other effective teaching strategies such as class discussions, lab experiments, and higher order thinking.

Although the evidence shown does not have enough significance in the numbers, I was able to observe that the poetry helped to stimulate the interests of students in the science class. After a poem was read, students became more involved in class discussions and competitive in vocabulary recall.

Implications of the Study

The results of this study could prove to be very beneficial for the purpose of integrating other subjects into the science curriculum. This could become especially true for students who have difficulty comprehending science curriculum. Therefore, the implications of this study could provide valuable assistance for students to gain better memorization skills regarding science vocabulary words. This could be a first step to the improvement of science reading comprehension. The following are the major suggestions arrived at from this study:

- Model poetry for the science class- Have a couple of poems to introduce to the science class as units are beginning. This can assist in learning if students are open to using poetry in learning their science concepts.
- Take surveys from the class regarding science interest and science attitude- When these surveys are given, an instructor can use them to try and reach students from a point of view that is relevant to students. It would also be a good measure in knowing if the poetry in science class truly can motivate students.
- Let the students try to write poetry themselves- Students may show more appreciation if they can actually have a work that they feel is personal. Pride helps to build a positive attitude toward learning science.
- Help motivate students to do their best and take part in challenges- This is related to the previous suggestion. Motivation is a huge indicator of student performance. If they are not challenged, performing to their fullest potential is unlikely.
- Assign poetry projects- Let the students provide feedback by writing poems on their own and sharing with the class. This project idea could be just a recital of poetry written, or it could be a group assignment in which students create a play or write a “rap” song to perform. Give suggestions to the students and let them decide.

Limitations of the Study

Time management was a large factor in this study. It was not just the class time, but the fact that there were district science assessments that interrupted the study. There can be difficulty showing the validity of a study when there is interference in carrying out activities.

The students would not be able to connect personally with the poetry due to the fact that they were not writing it. When the study began, it was intended to have the students create a poem of their own about astronomy.

A lack of interest in poetry can be a drawback. It may be interesting to a few students, but not all will be receptive. Loss of interest can challenge student performance. Interference with the validity of the study can result.

Testing was a concern. The tests were created by the teacher and were looked over by the curriculum resource teacher for validity and reliability. They were approved by her for the purpose of measuring the vocabulary retention of the students.

The same test was given as a pretest and again as a post test. This could affect the validity due to the fact that students had already seen it once and the risk would exist that they would remember previous testing trials.

Recommendations

One key factor missing from this study was having students write poetry about the science vocabulary they were learning. In order to do this, a teacher must also make the time to teach a few lessons on how to write poetry or meet with a language arts teacher and work with them to integrate lessons of poetry into the language arts class. If the students write genuine poetry about the lessons they are learning, perhaps they will have a greater appreciation for the poetry due to a personal connection.

Among the surveys given to students, there should be a poetry survey to measure the types of poetry, knowledge of poetry and student opinions regarding poetry. With this data, an

instructor could plan the types of poetry to write as an introduction to a unit or to teach a mini-lesson for students to become aware of their choices.

Better involvement can be achieved by having students write a poem using a particular science subject. Incorporating music with the poetry and allowing the students to perform a song for the class can encourage better interest. Selecting and working in groups can promote a positive learning opportunity for the class.

The possibilities are endless when integrating poetry into a science class. There are many avenues that can be utilized. Students should become more involved in helping to make the decisions and producing the guidelines for what they feel will assist them in having a positive learning experience.

Final Thought

I can remember the day that I wrote my first poem and how exhilarating it felt to realize that I had created something special. I could associate anything with a poem. When I first began to write poetry, it was just for fun; to relax and not think about anything else. Now, it is amazing to see how far it has come. If someone had asked me if I would ever write a poem about science or any other academic subject, I would have laughed at them. It never occurred to me until I began this study. Now that I have found this hidden talent, I would like to show it to others. Whether it is teachers or students, it needs to be taught that everyone has a hidden talent, and when it is used to the fullest capacity, it can be the beginning of something beautiful that can be shared with others.

APPENDIX A: IRB APPROVAL FORM



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Expedited Review and Approval of Requested Addendum/Modification Changes

From: **UCF Institutional Review Board**
FWA00000351, Exp. 10/8/11, IRB00001138

To: **Kimberly Casselman**

Date: **December 16, 2008**

IRB Number: **SBE-08-05760**

Study Title: **Roses are Red, Violets are Blue How Poetry in Science can Help Eighth Graders Learn Something New**

Dear Researcher:

Your requested addendum/modification changes to your study noted above which were submitted to the IRB on 12/04/2008 were approved by **expedited** review on 12/6/2008.

Per federal regulations, 45 CFR 46.110, the expeditable modifications were determined to be minor changes in previously approved research during the period for which approval was authorized.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Subjects or their representatives must receive a copy of the consent form(s).

This addendum approval does NOT extend the IRB approval period or replace the Continuing Review form for renewal of the study.

On behalf of Tracy Dietz, Ph.D., IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 12/16/2008 11:02:18 AM EST

A handwritten signature in cursive script that reads 'Joanne Muratori'.

IRB Coordinator

Internal IRB Submission Reference Number: 004555

APPENDIX B: RESEARCH REQUEST FORM

Submit this form and a copy of your proposal to: Accountability, Research, and Assessment P.O. Box 271 Orlando, FL 32802-0271	Orange County Public Schools RESEARCH REQUEST FORM	Your research proposal should include: Project Title; Purpose and Research Problem; Instruments; Procedures and Proposed Data Analysis	
Requester's Name <u>Kimberly A. Casselman</u> Date <u>7/10/08</u>			
Address: Home <u>1073 Bee Lane Geneva, FL 32732</u> Phone <u>407-718-0536</u> Business <u>13914 Mailer Blvd. Orlando, FL 32828</u> Phone _____			
Project Director or Advisor <u>Dr. Robert Everett, ED 1228</u> Phone _____ Address <u>University of Central Florida Orlando, FL 32816-1250</u>			
Degree Sought: (check one) <input type="checkbox"/> Associate <input type="checkbox"/> Bachelor's <input checked="" type="checkbox"/> Master's <input type="checkbox"/> Specialist <input type="checkbox"/> Doctorate <input type="checkbox"/> None			
Project Title <u>Roses are Red, Violets are Blue. How poetry in science can help students learn something new!</u>			
ESTIMATED INVOLVEMENT			
PERSONNEL/CENTERS	NUMBER	AMOUNT OF TIME (DAYS, HOURS, ETC.)	SPECIFY/DESCRIBE GRADES, SCHOOLS, SPECIAL NEEDS, ETC.
Students	20-25	90 days	8 th grade earth science
Teachers			
Administrators			
Schools/Centers			
Others (specify)			
Specify possible benefits to students/school system: <u>Identifying an activity that promotes student retention of important ^{science} information; this could be integrated into multiple subject areas.</u>			
ASSURANCE			
Using the proposed procedures and instrument, I hereby agree to conduct research in accordance with the policies of the Orange County Public Schools. Deviations from the approved procedures shall be cleared through the Senior Director of Accountability, Research, and Assessment. Reports and materials shall be supplied as specified.			
Requester's Signature <u>Kimberly A. Casselman</u>			
Approval Granted: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		RECEIVED AUG 08 2008 Date: <u>8-18-08</u>	
Signature of the Senior Director for Accountability, Research, and Assessment <u>Lee Balseri</u>			

NOTE TO REQUESTER: When seeking approval at the school level, a copy of this form, signed by the Senior Director, Accountability, Research, and Assessment, should be shown to the school principal.

Reference School Board Policy GCS, p. 249

APPENDIX C: ADMINISTRATIVE SUPPORT LETTER



AVALON MIDDLE SCHOOL

13914 Mailer Blvd.

Orlando, Florida 32828

407-207-7839

To UCF IRB Committee:

Kimberly Casselman has my full support to complete her study of integrating poetry with science to help students gain improvement in memorization of science vocabulary.

Please contact me with any additional questions or concerns you may have.

Sincerely,

A handwritten signature in black ink that reads "Judith E. Frank". The signature is written in a cursive style with a large, flowing "J" and "F".

Judith E. Frank

APPENDIX D: PARENT CONSENT LETTER

Dear Parents,

December 1, 2008

My name is Kimberly Casselman and I will be instructing your child in our 8th Grade Earth Science class. I am currently working as a Lockheed Martin Scholar to earn a Master's Degree in K-8 Math and Science Education at the University of Central Florida. I have the hopes of conducting a study in our science class that will help your child improve their science comprehension and vocabulary memorization skills. I am writing to request consent for your child to participate in this unique study that I am conducting in our Earth Science classroom this year.

The purpose of this study is to determine if integrating poetry with science will help students retain science information learned in the classroom and in turn perform better on assessments. This research will start near the beginning of September and continue through the end of November. The unit that will be used for this study is astronomy. Students will conduct our usual curriculum of hands on experiments and textbook reading. The poetry will serve as an added activity to help in the memory of scientific concepts and vocabulary word meanings.

Students will be given a science interest survey at the beginning of the year to determine the strength of their interest in science. Students will also be given a science learning style survey at the beginning of the study to help me understand the accommodations I need to make to meet the academic needs of your child. Our unit will be Astronomy. This unit will begin with a pre-test to measure the knowledge of your child before the unit begins. This test is designed to be used only as a measuring device, not as a grade. As we learn more about astronomy, students will receive poetry that helps them remember their scientific facts and vocabulary. After lesson 4 is completed, there will be a post-test to measure the possible growth of their knowledge in the area of astronomy. There will be a pretest before Lesson 5 for the vocabulary that will be presented in the last three lessons. This will follow the same format as the first half of the chapter. Then, students will receive a post test that will measure their knowledge of lessons 5, 6, and 7. The two post tests will be part of their required grade for the class.

There is a slight risk of a breach of confidentiality regarding the videotapes and audiotapes. The identity of your child will be held in the strictest of confidence. I will be using pseudonyms in place of their names during the writing of this study and discussions with my UCF peers and advisor. During this study, your child may be audio or videotaped. These videotapes and audiotapes will only be seen or listened to by myself and my supervisor. These tapes will be kept in a locked, safe place until the research is complete. Upon completion, the tapes will be erased or destroyed. If you do not want your child audio or video taped in the study, they will still be able to participate without being audio or video taped.

There will be no compensation for this study, but I will be happy to share my results with you and your child at the conclusion.

Participation is not mandatory. Your child's grade will not be affected by not participating. Your child will have the opportunity to earn extra credit by writing a report on earthquakes and plate tectonics to take the place of the poetry. You and your child can choose to withdraw consent at any time during this study. If you have any questions or concerns, please do not hesitate to contact me at 407-207- 7839. You may also email me at Kimberly.Casselman@ocps.net. If you feel it necessary, you can contact my faculty supervisor at University of Central Florida, Dr. Robert Everett at 407-823- 5788. Questions or concerns regarding research participants' rights may be directed to:

12201 Research Parkway, Suite 501
Orlando, FL 32826-3246
Telephone 407-823-2901 or 407-882-2012

Their hours of operation are 8:00am-5:00pm Monday through Friday except on University of Central Florida holidays.

I appreciate the time you have taken to read this. Please check the statements on the next page that pertain to you and your child. I look forward to working with your child to help boost their understanding of and interest in science!

Sincerely,

Kimberly Casselman

_____ I have read the above statement.

_____ I give consent for my child, _____, to take part in the research study.

_____ I am at least 18 years of age.

_____ I am an emancipated minor per Florida state law.

_____ I agree to have my child videotaped.

_____ I agree to have my child audiotaped.

_____ I do not agree to have my child audio or videotaped.

_____ I would like to receive a copy of the procedure description.

_____ I would not like to receive a copy of the procedure description.

Signature of Parent

Printed name of Parent

Date

Signature of Parent

Printed name of Parent

Date

Printed name of Child

Principal Investigator

Date

APPENDIX E: STUDENT ASSENT LETTER

Dear Students,

My name is Kimberly Casselman. I am doing a research project on how poetry in science can help you learn the science information better. I am interested to find out how you learn more effectively. This research is part of my studies at the University of Central Florida.

As a way to study this, I would like to observe the class, take notes, and video tape/audio tape some of our class meetings. I will be conducting a survey at the beginning of the year to find out what your interests are in science. At the end of the activity, I will give you a survey to find out if those interests have changed.

This study will be done over the next 9-12 weeks. At the beginning of the year, I will give you a science interest survey to find out how you are / are not motivated by science. I will also give a learning inventory survey to find out how you best take in information learned.

We will be doing this study during our Astronomy Unit. First, you will be given a pretest to determine how much information you already possess on astronomy. This will help me understand what areas you need the most assistance in.

Each class, I will give you a science "poem of the day" to help you understand the lesson we are working on that day. My goal is to give you important words and meanings in a poetic style that will better assist your memory of the words and definitions.

At the end of each lesson, we will take the astronomy posttest. These will be your test grades for the unit.

Due to the fact that there will be 7 lessons within this unit, you will be given a pretest before Lesson 1 and then before lesson 5. Your posttests will be given after Lesson 4 and after Lesson 7. There is a tremendous amount of vocabulary to learn and I do not want to overwhelm you, so we will be breaking it into smaller section.

As we are practicing our use of poetry with science, I may need to videotape some of our classes. If you think that this may be a problem for you, please let me know. The only people looking at the videotape will be my professor from UCF helping me with this study and myself. When the study is complete, the videotapes will be destroyed. All names will be changed so that nobody will know it was you in my study. It will not affect your grade if you decide you don't want to do this. You can stop participating at any time. If you don't want to be video taped, you cannot be in the study and your teacher will assign another activity for you. You will not be paid for doing this. Would you like to take part in this research project?

I would greatly appreciate your assistance in this study. It is important to me that I help you learn how to better remember science facts for your future education journeys. There are many science facts still left to be learned in high school and I would like to help you find what makes you feel more comfortable learning. You will never know if you do not try. It is my hope that this project will assist you with success in science!

Please check the appropriate blanks on the following page that pertain to you in this study.

Thank you,

Ms. Casselman

_____ I would like to take part in Ms. Casselman's study.

_____ I would not like to take part in Ms. Casselman's study.

Student Signature

Date

Student's Printed Name

APPENDIX F: STUDENT SCIENCE INTEREST SURVEY

Science Interest Survey

Race/Ethnicity: Caucasian _____; Hispanic _____; African American _____;
Asian American _____; Indian _____;
Pacific Islander _____; Other _____

Scale Score: Mark 1 for Strongly Agree, 2 Somewhat Agree; 3 Somewhat Disagree; 4 Strongly Disagree

- | | | | | |
|--|---|---|---|---|
| 1. My family has encouraged me to study science. | 1 | 2 | 3 | 4 |
| 2. My friends do not like science. | 1 | 2 | 3 | 4 |
| 3. My science teachers encourage me to do my best. | 1 | 2 | 3 | 4 |
| 4. I do not enjoy visiting science museums or science centers. | 1 | 2 | 3 | 4 |
| 5. The topics taught in my science class are important in the real world. | 1 | 2 | 3 | 4 |
| 6. Visiting science museums and science centers makes me consider a career in science. | 1 | 2 | 3 | 4 |
| 7. People in my family are not interested in science. | 1 | 2 | 3 | 4 |
| 8. My science teachers have encouraged me to learn about science. | 1 | 2 | 3 | 4 |
| 9. My friends view science as nerdy. | 1 | 2 | 3 | 4 |
| 10. My family is enthusiastic about a science career for me. | 1 | 2 | 3 | 4 |
| 11. Visiting science museums and science centers makes me want to learn more by a science topic. | 1 | 2 | 3 | 4 |
| 12. My friends do not like to watch science topics on T.V. | 1 | 2 | 3 | 4 |
| 13. My family is interested in the science courses I take. | 1 | 2 | 3 | 4 |
| 14. I prefer attending science class than going to science museums and centers. | 1 | 2 | 3 | 4 |

- | | | | | |
|---|---|---|---|---|
| 15. My science teachers make science interesting. | 1 | 2 | 3 | 4 |
| 16. The topics taught in my science class are boring. | 1 | 2 | 3 | 4 |
| 17. My science class has interesting equipment. | 1 | 2 | 3 | 4 |
| 18. My friends perform science experiments outside of school. | 1 | 2 | 3 | 4 |
| 19. We do not use most of the science equipment in our classroom. | 1 | 2 | 3 | 4 |
| 20. My science teachers are enthusiastic about science. | 1 | 2 | 3 | 4 |

Please circle the word or phrase below that describes your interest in science:

Strongly dislike Not interested Kind of interested Very interested

APPENDIX G: SCIENCE ATTITUDE SURVEY

Science Attitude Survey

Gender: male female

Primary language spoken at home: English Spanish other:

What words come to mind when you think of a scientist?

Please place an X under the phrase that best describes what you think about each statement.

	Strongly agree	agree	disagree	Strongly disagree
1. I think being a scientist would be exciting.				
2. I would rather listen to someone talk about science than read a science book.				
3. I like to watch TV shows about science.				
4. I think science is important only at school.				
5. I would rather use computers to learn about science than read a science book.				
6. Science tests are easier than other tests.				
7. I learn more from doing experiments than from listening to the teacher's explanations.				
8. Science is fun.				
9. I like to use science equipment to study science better than reading science books.				
10. I usually try my best in science class.				
11. If I don't understand a science topic I read more about it.				
12. I like to figure out something without the teacher telling me how to do it.				
13. Reading books is my favorite way to learn about science.				
14. I would probably do well in science if I took it next year in school.				
15. We learn about important things in science class.				
16. Science class activities are exciting.				
17. I am interested in many scientific ideas that are not taught at school.				
18. I know where to find answers about science questions.				
19. I feel comfortable asking questions about science.				
20. I know how to set up a scientific investigation.				

APPENDIX H: GLOSSARY OF ASTRONOMY TERMS

Absorption spectrum: a continuous spectrum produced when light is passed through a cool gas under low pressure; the gas absorbs selected wavelengths of light, and the spectrum looks like it has dark lines superimposed.

Accretion: process that occurs when crustal fragments collide with and stay connected to a continental plate.

Albedo: the fraction of total radiation that is reflected back by a surface.

Asteroid: a small, rocky body, which can range in size from a few hundred kilometers to less than a kilometer.

Astronomical Unit: average distance from Earth to the sun; 1.5×10^8 , or 150 million kilometers.

Aurora: a bright display of ever-changing light caused by solar radiation interacting with the upper atmosphere in the region of the poles.

Chromosphere: the first layer of the sun's atmosphere found directly above the photosphere.

Coma: the fuzzy, gaseous component of a comet's head.

Comet: a small body made of rocky and metallic pieces held together by frozen gases; generally revolve about the sun at an elongated orbit.

Constellation: an apparent group of stars originally named for mythical characters.

Corona: the outer weak layer of the sun's atmosphere.

Cosmologist: an astronomer who studies the evolution and space-time relations of the universe.

Eccentricity: A measure of the deviation of an elliptical path, especially an orbit, from a perfect circle. It is equal to the ratio of the distance between the foci of the ellipse to the length of the major axis of the ellipse; Eccentricity ranges from zero (for a perfect circle) to values approaching 1 (highly elongated ellipses).

Electromagnetic spectrum: the arrangement of electromagnetic radiation according to wavelength.

Emission spectrum: a series of bright lines of particular wavelengths produced by a hot gas under low pressure.

Gas giant planets: the outer solar system planets: Jupiter, Saturn, Uranus, and Neptune, composed mostly of hydrogen, helium, and methane, and having a density of less than 2 grams per square centimeter.

Inclination: the degree of slope from a horizontal or vertical plane

Infrared: Of or relating to the range of invisible radiation wavelengths from about 750 nanometers, just longer than red in the visible spectrum, to 1 millimeter, on the border of the microwave region.

Ion: an atom or molecule that possesses electrical charge.

Ionosphere: A region of the earth's atmosphere where ionization caused by incoming solar radiation affects the transmission of radio waves. It extends from a height of 70 kilometers (43 miles) to 400 kilometers (250 miles) above the surface.

Light-year: the distance light travels in a year, about 9.5 trillion kilometers.

Luminosity: emitting or reflecting light

Meteor: the luminous phenomenon observed when a meteoroid enters Earth's atmosphere and burns up; a.k.a. shooting star.

Meteorite: any portion of a meteoroid that reaches Earth's surface.

Meteoroid: a small, solid particle that travels through space.

Molecular cloud: A molecular cloud is a type of [interstellar cloud](#) whose density and size permits the formation of molecules.

Neap tide: lowest tidal range, occurring near the times of the first-quarter and third-quarter phases of the moon.

Nebula: a cloud of gas and/or dust in space.

Neutron star: a star of extremely high density composed entirely of neutrons.

Nuclear fusion: the way in which the sun produces energy; occurs when less massive nuclei combine into more massive nuclei, releasing tremendous amounts of energy.

Orbital plane: a plane formed by the path of the Earth around the Sun.

Parsec: a unit used in astronomy to describe large distances. One parsec equals 3.26 light years.

Peak wavelength: the wavelength of electromagnetic radiation with the most electromagnetic energy emitted by any object.

Photosphere: the region of the sun that radiates energy into space; visible surface of the sun.

Planetesimal: small, irregularly shaped body formed by colliding matter.

Plasma: a state of matter wherein all atoms are ionized; a mixture of free electrons and free atomic nuclei.

Precession: a slow motion of Earth's axis that traces out a cone over a period of 26,000 years.

Protoplanetary body: a clump of material, formed in the early stages of solar system formation, which was the forerunner of the planets we see today.

Radio telescope: a telescope designed to make observations in radio wavelengths.

Solar wind: streams of protons and electrons ejected at high speed from the solar corona.

Spectroscope: an optical device for producing and observing a spectrum of light or radiation from any source, consisting essentially of a slit through which the radiation passes, and diffraction grating to split the colors of light.

Spectroscopy: the study of the properties of light that depend on wavelength.

Spring tide: highest tidal range that occurs due to the alignment of the Earth, the moon, and the sun.

Stellar black hole: a black hole formed by the gravitational collapse of a bright star at the end of its lifetime.

Supernova: an exploding star that increases in brightness many thousands of times.

Ultraviolet: electromagnetic radiation at wavelengths shorter than the violet end of visible light; with wavelengths ranging from 5 to 400 nanometers.

Visible spectrum: the portion of the electromagnetic spectrum that is visible to the human eye.

X -ray telescope: an instrument used to detect stellar and interstellar x-ray emission. Because the Earth's atmosphere absorbs x-rays, x-ray telescopes are placed high above the Earth's surface.

APPENDIX I: ASTRONOMY PRE-TEST/POST-TEST 1

Astronomy Pre-Test/Post Test 1

Name: _____

Date: _____

Block: _____

True/False

Directions: Read each statement carefully. Write a T in the blank if the statement is True. Write an F in the blank if the statement is False.

____ 1. A light-year represents how far light travels in one year.

____ 2. A small planetary body in orbit around the Sun larger than a meteoroid but smaller than a planet is called a comet.

____ 3. Terrestrial planets are of similar size, composition, and density as the Earth.

____ 4. Tides of increased range occurring semimonthly near the times of full Moon and new Moon are called spring tides.

____ 5. Due to gravitational tugs by the Sun, moon, and other planets, a recession occurs.

____ 6. Meteoroids are small rocks in space.

Matching

Directions: Read each word and definition carefully. Match the correct definition letter with the correct word.

____ 1. astronomical unit (AU)

____ 4. protoplanetary body

____ 2. nuclear fusion

____ 5. neap tide

____ 3. constellation

____ 6. solar wind

- a. A flow of hot charged particles leaving the Sun.
- b. A nuclear process that releases energy when lightweight nuclei combine to form heavier nuclei.
- c. A clump of material, formed in the early stages of solar system formation, which was the forerunner of the planets we see today.
- d. A unit of measurement equal to the average distance between the Sun and Earth.
- e. A grouping of stars in the night sky into a recognizable pattern.
- f. The tides of decreased range occurring semimonthly near the times of the first and last quarter of the moon.

Multiple Choice

Directions: Read each question carefully. Choose the best answer to fill in the blank.

1. Which is the furthest unit of measurement?
 - a. 1 AU- astronomical unit
 - b. 1 light-year
 - c. 1 parsec

2. Which planets are larger in size?
 - a. protoplanets
 - b. gas giants
 - c. planetesimals
 - d. terrestrial planets

3. Which planet would show the greatest variation in distance from the sun (eccentricity) during its year?
 - a. Venus
 - b. Earth
 - c. Mercury
 - d. Pluto

4. A plane formed by the path of the Earth around the sun is called a _____.
 - a. obliquity cycle
 - b. axial precession
 - c. orbital plane
 - d. orbital precession

5. The process in which dust and gas accumulate into larger bodies like stars and planets is called
 - a. orbit
 - b. obliquity
 - c. inclination
 - d. accretion

6. A small planetary body in orbit around the sun that is larger than a meteoroid but smaller than a planet is called a _____.
 - a. asteroid
 - b. meteorite

Fill in the Blank

Directions: Read each statement carefully and choose the correct word from the word bank to complete each statement.

nebula

coma

planetesimal

inclination

cosmologist

meteor

1. A _____ is a scientist that studies the origin and dynamics of the universe.
2. The angle between the orbital plane of the solar system and the actual orbit of an object around the Sun is called an _____.
3. If you are looking at a comet, the _____ is a spherical cloud of material surrounding the head of the comet.
4. Otherwise known as a shooting star, a _____ is what is seen when a meteoroid enters the atmosphere.
5. _____ is one of the small bodies that formed the solar nebula and eventually grew into a protoplanet.
6. A cloud of interstellar gas and dust is known as a _____.

APPENDIX J: ASTRONOMY PRE-TEST/POST-TEST 2

Astronomy Pre-Test/Post-Test 2

Name: _____

Date: _____

Block: _____

True/False

Directions: Read each statement carefully. Write a T in the blank if the statement is True. Write an F in the blank if the statement is False.

- ____ 1. Spectroscopy is the science that studies the way light interacts with matter.
- ____ 2. A molecular cloud is a cloud that is the size of a molecule.
- ____ 3. Electromagnetic radiation at wavelengths shorter than the violet end of visible light are called ultraviolet rays.
- ____ 4. Plasma is a state of matter in which not all atoms are ionized.
- ____ 5. The visible surface of the sun that is below the chromospheres is called the photosphere.
- ____ 6. The wavelength of electromagnetic radiation with the least electromagnetic energy emitted by any object is called a peak wavelength.

Matching

Directions: Read each word and definition carefully. Match the correct definition letter with the correct word.

- | | |
|----------------------|---------------------------|
| ____ 1. chromosphere | ____ 4. infrared |
| ____ 2. spectroscope | ____ 5. ionosphere |
| ____ 3. supernova | ____ 6. emission spectrum |

- g. A spectrum containing bright lines or a set of discrete wavelengths produced by an element.
- h. Electromagnetic radiation at wavelengths shorter than the violet end of visible light.
- i. A layer in the Sun's atmosphere, the transition between the outermost layer of the Sun's atmosphere, or corona.
- j. The part of the earth's atmosphere above about 50 km where the atoms are significantly ionized and affect the propagation of radio waves.
- k. An instrument consisting of a slit and grating which produces a spectrum for visual observation.
- l. The death explosion of a massive star whose core has completely burned out.

Multiple Choice

Directions: Read each question carefully. Choose the best answer to fill in the blank.

7. The outermost layer of the Sun- not visible unless the Sun is eclipsed.
 - d. corona
 - e. photosphere
 - f. chromosphere

8. Which spectrum is detectable by the human eye?
 - e. electromagnetic spectrum
 - f. emission spectrum
 - g. visible spectrum
 - h. absorption spectrum

9. Which is a continuous spectrum interrupted by absorption lines?
 - a. electromagnetic spectrum
 - b. emission spectrum
 - c. visible spectrum
 - d. absorption spectrum

10. The imploded core of a massive star produced by a supernova explosion is called a _____.
 - e. stellar black hole
 - f. supernova
 - g. neutron star

11. An atom with one or more electrons removed, giving it a positive charge...
 - e. proton
 - f. neutron
 - g. electron
 - h. ion
 - i.

12. A telescope that is used to observe longer wavelengths of radiation, with large dishes to collect and concentrate the radiation onto antennae.
 - c. x-ray telescope
 - d. radio telescope

Fill in the Blank

Directions: Read each statement carefully and choose the correct word from the word bank to complete each statement.

albedo

aurora

electromagnetic radiation

x-ray telescope

luminosity

stellar black hole

7. An _____ is the bright emission of atoms and molecules near the Earth's poles caused by charged particles entering the upper atmosphere.
8. The total amount of energy radiated by an object every second is _____.
9. _____ is the reflective property of a non-luminous object.
10. The energy propagated through space by oscillating electric and magnetic fields is _____.
11. An _____ is an instrument used to detect stellar and interstellar x-ray emissions.
12. The leftover core of a massive single star after a supernova is called a _____.

APPENDIX K: ASTRONOMY POEMS WRITTEN BY TEACHER

Distances in Space

Distance is measured differently
When studying galaxies in space
By using the time it takes light
To hit a particular place

An astronomical unit is the average
Distance between the Sun and the Earth
Whereas how far light travels per 12 months
Gives a light year its worth

The larger distance is known as a parsec,
Which is equal to 3.26 light years
These can be compared to how Earth measures time
Using things such as hours, days, months, and years.

Actions of Stars

Stars seem to make
Displays during our nights
Like constellations which are certain
Patterns with stars shining like lights.

It seems that there are
Clouds in space in very small batches
These can be defined as nebula,
Interstellar gas and dust making foggy patches.

Nebulas can be formed slowly
Much like our earth
Beginning with planetesimals,
Small bodies forming solar nebulas
Which will begin the birth.

Becoming a protoplanetary body
Is the next step to this galaxy tree
Where a clump of material formed in space
Is the first step in the formation of the planets we see.

In order for our stars and solar system to be
Created and help us reach our conclusion
There must be the process in which light nuclei
Form heavier nuclei which is known as nuclear fusion

Meteors vs. Meteorites vs. Meteoroids

Meteoroids are know
As small rocks in space
Which turns into a shooting star
Or meteor when it enters our place

Any of that meteoroid that
Survives our atmosphere
Is known as a meteorite when
It ends up landing here

Eccentricity

There are many things that determine
How our Earth moves around the sun
Whether a degree in tilt, or Earth
And its ellipse moving as one.

Eccentricity is a measure of the distance
In an orbit from one end to the other
The more flat an ellipse is
The more eccentric it will be compared to another

A precession describes a wobble
That can cause the earth's tilt to change
Although it may take about 26, 000 years
Or somewhere along that range.

An axial tilt is what makes our
Earth's multiple seasons occur
This provides evidence of past
Ice Ages...ooohhh...what a brrrrr!

Our orbital path is our path
Formed around our sun
The farther out a planet is
The larger its path will become

Inclination describes how some
Planets may have a much higher path
For example, Pluto is higher than Earth by
About 17 degrees...which is big when dealing with math.

Scientific Rainbow?

Spectroscopy is the science that studies
How light interacts with matter.
Isaac Newton used this to discover
How light has a certain color pattern.

Red is the coolest of the colors
Known in our scientific rainbow
Violet is the warmest and is hard to detect
For it has a very dim glow.

The rays of colors we cannot see
Can do unto us the most harm
Like the UV rays from the sun
That may burn the skin of our arm.

Infrared radiation will be
Detected as heat
Like the x-ray machines
That can see the bones in our feet.

Most of the colors in space
Are difficult for us to see.
Which is why scientists
Created tools to give us that ability.

Radio telescopes can produce
Images of bodies of stars
By recording radiation
They emit from afar.

X-ray telescopes can sense
Stellar and interstellar x-ray emission
Like explosions of the supernova
That cannot be seen with our vision.

Our primary colors have much importance
In how we see things on earth and more
And they help machines gather data
So that we can continue to explore.

Plasma

Plasma is a state of matter
In which all atoms are ionized;
Or a mixture of free electrons
And free atomic nuclei

The plasma leaves the Sun
In the form of a solar wind
Which can create "space weather"
That can make our radio signals end.

Plasma can also help radio waves
As they come our way
For when it hits our ionosphere
Ions become ionized and help radio waves play.

**APPENDIX L: ASTRONOMY VOCABULARY POEM WRITTEN BY
STUDENT**

Structure of the Sun

Way up in the sky, miles away
Lies the sun shining bright
And excited today

Its light is amazing,
Surely bright enough for me
How excited I am
For it's the photosphere I see

Its visible surface so attracting and bright
Deeper within its surface, to travel I might.

"Sun's next layer!", I yelled to the pilot,
To enjoy the production of Sun's ultraviolet.

"Move out of the way and let me steer,
Might be a bumpy ride into the Sun's chromosphere."

Our stay in the transition between the outermost layer
Was one I'll revisit, only by dare.

Now our trip must come to a stop,
We'll end on the corona,
The Sun's very top.

Don't dress to impress or
Underestimate the weather
Corona's superheated surface
Is no place for leather!

Now that our tour of
The Sun's structure is done
We hope you enjoyed and
Had many "degrees" of fun!

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