STORIES IN THE ELEMENTARY SCIENCE CLASSROOM

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

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BY

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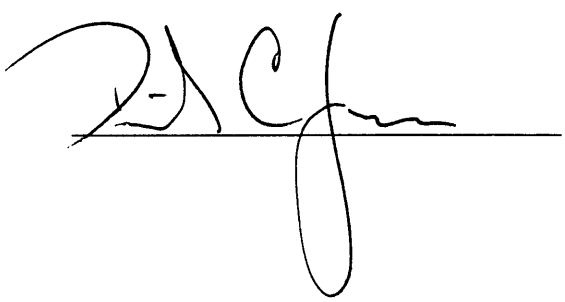
To the Associate Vice President for Research and Dean of the Graduate School:

I am submitting herewith a thesis written by Rosalee Taylor entitled "Stories in the Elementary Science Classroom." I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Science.

Carlton Wendel, Major Professor

I have read this thesis and
recommend its acceptance:



Accepted

Associate Vice President for Research
and Dean of the Graduate School

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I would like to express my love and gratitude to my mother Enid Taylor and my father Joslyn Taylor for their support and encouragement. My parents led me to believe that with hard work and determination all things are possible.

My deepest thanks to my sister Pauline Taylor McFarlane for selflessly contributing her time and talents to this endeavor, and my brother Mark Taylor for his words of wisdom.

Last, but not least, I thank God for gently steering me though life.

ABSTRACT

STORIES IN THE ELEMENTARY SCIENCE CLASSROOM

ROSALEE TAYLOR

MAY 1998

The purpose of this study was to examine the effects of stories on the learning and retention of science by students in the third grade. The subjects of this study were 35 third grade students. Each student was given a pre-test at the beginning of the lesson. The experimental class was given a lesson with a story to explain the scientific concept taught. The control class was given the same lesson without the story. Each student was administered a post-test after the lesson and a second post-test two weeks later. The findings suggest that using a story to explain scientific concepts enhances the retention of concepts. Recommendations are to continue using stories at the elementary level to encourage learning and retention of scientific concepts.

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CHAPTER I

INTRODUCTION

Throughout history mankind has used stories, myths, and legends to explain natural occurrences. Stories were told to explain shooting stars, the rain, the sun, thunder, and lightning. "The world of myth is a dramatical world--a world of actions, of forces, of conflicting powers. In every phenomenon of nature it sees the collision of these powers" (Erodoes & Ortiz, 1984, p. xi). The history of a people, their values, beliefs, and traditions were passed from generation to generation by means of stories. "Many tales and cycles embody the collective experience of a particular tribe, perhaps compacting into a single dramatic myth migrations, natural disasters, and other major events that occurred over generations and centuries, with mythical transformed references to 'historical' episodes [such as] the creation and fall from power of the Iroquois Leagues" (Erodoes & Ortiz, 1984, p. xiv).

Stories have also been used to teach. "Stories have always been an important way of transmitting values and wisdom" (Kilpatrick, 1993, p. 23). Can the use of stories affect learning and appreciation of science concepts? This idea is the focus of this study.

Rationale

Many students, particularly minorities, are not electing to study science. Nationwide, 75% to 80% of high school students take a course in biology. Only 30% of

these students continue with chemistry, and half of these go on to physics (Atwater, 1995). This lack of interest in science is more marked with minorities. "Students dislike science, regardless of their color, and few students of color pursue undergraduate degrees in science. We must begin to implement multicultural science education in classrooms around the country if all of our students are to learn science" (Atwater, 1995, p. 23).

One way to insure that student needs are being met is to insist that their learning styles are considered in the classroom. Matczinski and Joseph (1989) state that "the student population in 23 of the 25 largest school districts in the country is dominated by these groups (minorities)" (p. 43). The minority students form a large portion of the American school system. Making sure that their learning styles are addressed in the science classroom is a positive step towards encouraging students to learn and appreciate science. Kuykendall (1992) states that Black and Hispanic students are field-dependent learners. Field-dependent learners prefer student-centered, more personal environments. The field-dependent learner prefers small group activities and thrives when allowed to exchange information with peers [and] tell stories and anecdotes" (p. 38). Field-dependent students enjoy listening to and telling stories. Their interest is more likely to be gained through stories than lectures.

Abimbola and Baba (1984) state ". . . science by its special nature, has a good measure of technical terms that can be difficult for students to understand" (p. 15). This vocabulary is frequently new to many students who do not have adequate background

experiences. Thus, they do not have a framework with which they can associate the new concept vocabulary. Introducing stories that explain the new vocabulary with the science lesson may help students understand some of these technical terms.

Ethyl Pappa (1982), in her original math program, Math Town, explains number placement, multiplication, and division by means of stories set around a group of families and their relations. "Children . . . not only understand their own lives in a narrative way but were profoundly influenced in their decisions by stories. . . they had learned" (cited in Kilpatrick, 1993, p. 27). Children will remember a story and use it to make decisions in their own lives.

Stories can be used to explain a concept and to teach. Kilpatrick (1993) presents stories as a method of instruction. Kuykendall (1992) suggests that Black and Hispanic students' interest can be gained by sharing stories. Matczinski and Joseph (1989) stated that our larger school districts will be dominated by minority children. Why not use stories to teach science vocabulary and concepts? Many of the science concepts have to be associated with related words in memory in order to be remembered over time. Science is frequently taught in building blocks, as what is taught in younger grades is built upon in later grades. If a student cannot remember the concepts taught in the early years, it becomes difficult for the student to have a positive experience in science class.

Using stories to help children remember science concepts taught is a logical step in the never ending search to reach and teach all children. Students sometimes feel that

science is difficult. Making science interesting, fun, and learnable can perhaps be accomplished by incorporating stories into instruction to encourage learning and appreciation of science.

Purpose of the Study

The purpose of this study was to examine the effects of learning of science by students in the third grade class when science containing stories are integrated into instruction.

Research Question

Can the use of stories during a lesson help students learn and retain selected science concepts.

CHAPTER II

LITERATURE REVIEW

This review of literature, related to the use of stories in the elementary science classroom and their effect on students' scientific learning, will be limited to two areas of discussion. The first area will relate to the use of stories as teaching tools; the second area will concern assessment of student learning. These topics of literature were reviewed because of their pertinence to the topic of this study.

Use of Stories as Teaching Tools

Story telling is older than written history and is not bounded by one civilization, one continent, or one race. Stories differ from place to place, the purposes and conditions of storytelling change as we move from century to century; and yet, in all the different lands and periods of time, story telling has filled the same basic social and individual needs (Baker & Greene, 1977, p. 1).

A review of the use of stories as teaching tools suggests that stories have been mankind's earliest and most frequently used teaching tool. Stories were used by the Greeks to describe the creation of the world and the terrifying forces of nature (Baker & Greene, 1977). The Native Americans told stories to explain the "phenomenon of nature" (Erdoes & Ortiz, 1984, p. 1). In Africa, there was a "resident storyteller. . . [who] had

only the responsibility of keeping alive the exploits of [the] leader" (Baker & Greene, 1977, p. 1). Europe had minstrels who sang stories and traveled about the country learning new tales and passing them on (Baker & Greene, 1977). Before newspapers were invented, traveling storytellers carried news from town to town in their songs and stories.

Stories are believed to be a natural part of the human make-up. Yolen (1991) states that "Humans are the animals that tell stories" (p. 14). Humans use stories to "entertain, inform, teach, establish moral precedents, record history, remind ourselves of genealogy, and lay down laws" (p. 14-15). Stories, according to the literature reviewed, are told to children to amuse and teach them. Kilpatrick (1993) wrote about the use of stories to encourage character development in children. He writes that stories create a desire in children to do good and to teach them values. Kilpatrick (1993) suggests stories are able to teach because "we think more readily in pictures than in propositions" (p. 29). Yolen (1991) calls a story a mnemonic device. A mnemonic assists in memory and can be in the form of rhymes, pictures, or stories. "Children learn through stories; Red Riding Hood warns of the cozening of strangers; Br'er Rabbit tells us the bully can be defeated; Raven says there is a necessary chaos in the world's order" (p. 15). Ethyl Papa (1982) has used stories to teach parts of speech, to place value, for multiplication, division and phonics. She explains, "While teaching sixth grade students who were working three or more years below their grade level, I had written stories to help them understand abstract ideas, particularly stories about people and families. . . Having each part of speech labeled

either male or female is another memory aid . . ." (p. V-VI). Research suggests stories create pictures in the mind of the reader or listener. It is easier to remember pictures as opposed to whole paragraphs. Stories have been used to teach since the beginning of mankind's history. They are our earliest teaching tool and can be a valuable part of instruction.

Assessment of Students

Research on assessment strongly suggests that students should be given a variety of assessments as children learn in different ways. Sample (1992) states... "there are three major classes of knowing: Iconic, enactive, symbolic. Iconic was linked to the ways of knowing central to visual and spatial arts. Enactive-knowing framed the wisdom of movement, kinesthetic action, and dance. Symbolic-the realm of reason and reductive logic" (p. 62).

Intelligence and achievement are measured in the symbolic realm, resulting in unfair assessment of enactive and iconic children. Samples (1992) proposes that educators offer students who learn (know) using iconic or enactive modalities opportunities to express their knowledge in a way appropriate for their modality. "Learning modalities offer them a chance to demonstrate that they possess sophisticated knowledge and understanding, that go beyond their skills of reading and writing" (p. 65). Samples (1992) reports that teachers have improved test scores when they allow their students to express their knowledge in their own modalities. Nuthall and Alton-Lee (1995) report that

achievement tests may not show all the knowledge that a student possesses. Hein and Price (1994) point out that, "Children's drawing, writing, and performance are delightful activities in themselves, but they become powerful tools for assessment through methodological use" (p. xii). Research is in favor of using, not only written expression of knowledge, but other means that use a child's iconic and enactive modalities.

Assessments, according to research, have better results if given frequently, as opposed to once or twice a year or semester. "One short test cannot validly assess many important capacities, as the phrases 'habits of minds' or consistency of performance suggest" (Wiggins, 1992, p. 28). Assessments that are done frequently are a more accurate measure of students' learning.

Assessments should be meaningful to the students. Wiggins further states "assessment tasks should be, whenever possible, authentic and meaningful -- worth mastering" (p. 23). Research promotes the idea that assessments should "provoke thought" and engage the student's interest. Students should also be given enough time to complete the assessment (Wiggins, 1992).

In conclusion, research has shown that stories are a valuable tool for teaching. Stories have been used for centuries to educate on a variety of topics. Assessments should allow students to express their knowledge in all modalities. Assessments should be meaningful and frequent if students are to show their true knowledge. Assessments should be interesting to the student and thought provoking.

CHAPTER III

METHODOLOGY

Subjects

The subjects of this study were students in third grade attending an elementary school in a large urban independent school district. Two classes from each grade participated. There were approximately 20 students in each class. One class was selected by chance draw as the stories and science class; the other class from this grade was the science only class. These students attended the science classes taught by the researcher. The student population at this school is 92% Hispanic and 98% of the students were on free or reduced lunch.

A total of 35 students from two self-contained regular education third-grade classes were the subjects for this study. There were 18 students in the experimental class and 17 students in the control class. Table I presents the pertinent demographics of the subjects.

The students represented several ethnicities; in the control class, 78% were Hispanic, 11% were Afro-American, and 18% were Anglo. In both classes, 94% of the students received free or reduced lunch. Of the 35 students in the study, 31% participated in the Talented and Gifted program at the school; the control class had six and the experimental class had five of these students.

Table I.

Student Demographics

	Experimental Group	Number of Students	Control Class	Number of Students
	Experimental Group	Number of Students	Control Class	Number of Students
Total	18		17	
Hispanic	78%	14	71%	12
Afro-American	11%	2	11%	2
Anglo	11%	2	18%	3
Free or reduced lunch	94%	17	94%	16
Bilingual	70%	14	71%	12
Talented and Gifted	29%	5	33%	6
Special Education	5.8%	1	5.5%	1
Male	50%	9	65%	11
Female	50%	9	35%	6

One student in each class received Special Education services for three hours or more a day. The campus did not have a self-contained Special Education class, therefore each student was main-streamed into a self-contained regular education classroom for the hours they were not in the Special Education classroom.

In the experimental class, 78% (14 of 18) of the students were from a Mexican-American background, speaking but not writing Spanish. In the control class, 71% (12 of 17) of the students were from Mexican-American backgrounds, speaking but not writing Spanish. In total, 74% (26 of 35) of the students were bilingual.

The division between male and female students was as follows: The experimental class had nine males and nine females and the control class had 11 males and six females. At the time of this study, the two classes were almost equal in the given categories except for male and female rations. However, the study was not concentrating on the differences between the sexes but to examine the effects of stories on learning of science by students in grade three. The gender ratios were not seen as a hindrance to the study.

Procedures

The instructional period for the science lessons were one hour sessions for two weeks. After a concept was taught, students were given an assessment to measure their learning of a science concept presented in class. In addition, a similar assessment was administered two weeks following classroom instruction to measure long-term retention of selected science concepts.

Instruction

The concept taught during the instructional period was the process of heat transfer. One class participated in the story and science instruction while the other class participated in the science only instruction. In the story, Prince Eric was given the gift of

heat at birth. He used his gift to slay an evil frost dragon and rescue princess Ninke from an icy prison (refer to Appendix 4). The science lesson for both classes consisted of a pre-test, hands on activity where students recorded temperatures of water and ice water, then recorded the temperature of hot water after ice water was added to it and recorded the temperature of ice water after hot water was added to it. Students shared results with class members and together drew conclusions as to the direction heat traveled and the concept of heat transfer. Together students brainstormed for examples of heat transfer in their everyday lives and illustrated them on a chart. The experimental class also selected the character for the story that they thought would be like heat transfer.

Evaluation

Students' retention of the process of heat transfer was measured by classroom assessment administered immediately following instruction of the concept and two weeks later. The assessment for both third grade classes consisted of labeling teacher-made diagrams, drawing pictures to explain concepts and providing verbal explanation of an experiment's results.

CHAPTER IV

RESULTS AND DISCUSSION

The results will be reported in two sections, analysis of pre and post test results and the process students used to learn and recall a scientific concept taught in the lesson. Table II Presents the pertinent pre and post test results.

Table II.

Results from Assessments.

Pre-test Scores	Control	Experimental
80% and above	17%	16%
1% - 79%	11%	22%
0%	72%	62%
First Post-test		
80% and above	70%	83%
1% - 79%	30%	17%
0%	0%	0%
Second Post-test		
80% and above	58%	77%
1% - 79%	42%	23%
0%	0%	0%

The results from the pre-test revealed that the experimental and control classes came to the lesson possessing very limited knowledge of heat transfer - that heat travels

from a region of high temperature (hot) to a region of low temperature (cold). The experimental class had 16% of students scoring 80% or above on the pre-test. The control class had 17% (3) of the students scoring 80% or above on the pre-test. The experimental class had 61% (11) students receiving 0% and 22% (4) receiving scores from 1% to 79%. The control class had 70% (12) students receiving 0% and 11% (2) receiving scores from 1% to 79%.

It is important to point out that during the lesson, the experimental class was told a story that helped to explain the process of heat transfer. In the story, Prince Eric at birth was given the gift of heat. He used his gift to slay an evil frost dragon and rescue princess Ninke from an Icy prison. The control class received the identical lesson but without the story. The first post-test results showed a difference of 13% absolute between class evaluation results. Over all questions, the experimental class scored 13% higher than the control class on the first post-test.

Even though the control class did not perform as well as the experimental class, both groups showed a significant gain in knowledge on the heat transfer process since 72% of the control group and 62% of the experimental group had no prior knowledge. In the control class, 53% of the students increased their knowledge to the 80% and above level while 67% of the experimental class reached the same level on the first post-test.

On the second post-test given two weeks later, students from the experimental and control classes were asked to describe heat transfer. In the experimental class, 77% (14 of

18) of the students were able to describe heat transfer as heat going from a hot place to a cold place and 23% (4 of 18) gave no answer, were unable to recollect what heat transfer was or gave non-directional answers regarding the movement of heat. In the control class, only 58% were able to describe heat transfer as heat going from a hot place to a cold place and 42% (7 of 17) gave no answer, were unable to recollect what heat transfer was or gave non-directional answers regarding the movement of heat.

After a period of two weeks, the experimental class's students understanding of heat transfer went from 83% to 77%. This is a difference of 6% absolute or 7% relative. The control class's number of students understanding of heat transfer went from 70% to 58%. This is a difference of 12% absolute or 17% relative, more than twice that of the experimental class.

Both classes had an approximately equal understanding of what heat transfer was at the beginning of the study. At the end of each lesson, both experimental and control classes were give a similar evaluation. The experimental class wrote who Eric represented in the heat transfer process and who the dragon represented in the heat transfer process. On the first post-test, the experimental group scored 13% (absolute) higher than the control group.

After studying the pre and post test results one can conclude that not only did the use of a story help to explain heat transfer and help the students to learn the concepts, it assisted students in describing heat transfer two weeks later. The control class did not

receive the story and were not as successful in learning or remembering the process of heat transfer. The differences in the retention of knowledge of the experimental class and the control class suggest that the use of a story to assist in the explanation of a scientific process is a valuable tool by which children can learn and remember various scientific processes. The results also suggest that the use of a story in learning a science concept also helps the students to retain the concept.

In order to comprehend how the story assisted the students learning and recalling heat transfer, the students who successfully described heat transfer were asked to recall any experiences, activities or images that helped them remember heat transfer. The students were also invited to describe any mental pictures, feeling or thoughts that may have helped them remember heat transfer. The students were asked to write a sentence or two, illustrate a picture or a diagram that explained their experiences, activities, images, mental pictures, feelings or thoughts that explain how they learned and recalled heat transfer.

The students' responses to how they learned and remembered heat transfer fell into three categories. The first was classroom experiences, the second was life experiences and the third was story association.

Several students cited activities completed during the lesson in the classroom as a basis for their learning. Three examples of such citations are as follows:

"I remembered the thermometer went down with the cold water"

"Cold water went up when the hot water was added"

"Cold water got warmer"

In the control class, 60% of the students claimed to remember heat transfer due to their experience during the lesson. The experimental class had only 26% who claimed to remember heat transfer due to their experiences during the lesson.

Students from both classes referred to life experiences as a reason for learning and remembering heat transfer. Several of the students recalled the illustrations they drew on their first post-test and cited these as reasons they know what heat transfer was. A student drew a picture of a melting ice cream cone with arrows going toward the ice cream labeled "heat". A second child drew a picture of hot tea melting ice cubes in a cup. A third child drew a picture of someone cooling their face in a freezer on a hot day.

In the experimental class, 14% stated that they used personal experiences to recall heat transfer. In the control class, 40% of the students stated they used outside experiences to recall heat transfer.

Many students from the experimental class alluded to the story and the images it produced for them as helping them learn and remember heat transfer. One of the students wrote: "Eric was fire and the dragon was cold. Eric killed the dragon because heat always kills cold."

A second student wrote: "Eric was the heat and he let his warm body heat up the land."

A third student wrote: Eric made people and places warm like the sun. He melts snow."

In the experimental class, 60% of the students stated that they used portions of the story to explain how they learned or remembered heat transfer. None of the students in the control class mentioned the story because they did not receive the story as a part of their lesson. From the experimental class, 26% said they recalled heat transfer because of what they did in class, 14% used outside experiences as reason and 60% used portions of the story to explain how they learned or remembered heat transfer. In the control class, 60% of the students cited class experiences as the reason they remembered heat transfer; 40% said they recalled heat transfer due to outside experiences.

Discussion

All of the students recalled an image of what heat transfer meant to them. They remembered a picture of water warming or cooling. They remembered the thermometer going up in the cold cup when hot water was added or going down in the hot cup when cold water was added. They remembered the picture they drew of something melting, cooling down or warming up or something they had seen outside of the classroom. Students also recalled scenes from the story of Eric warming up the land, people or killing the dragon with heat. No child wrote that they remembered the written definition of heat

transfer or any words about heat transfer. It has been suggested that children naturally learned through the use of stories. Kilpatrick (1993) proposes that stories are able to teach because "we think more readily in picture than in proposition" (1993, p.29). Yolen (1991) calls a story a mnemonic device. "Children learn though stories; Red Riding Hood warns of cozening of strangers; Br'er Rabbit tells us the bully can be defeated; Raven says there is necessary chaos in the world order" (Yolen, 1991, p. 14).

Ethyl Papa explains why she uses stories to teach. "While teaching sixth grade students working three or more years below their grade level I had written stories to help them understand abstract ideas, particularly stories about people and families... Having each part of speech labeled either male or female is a memory aid..." (Papa, 1982 p. v-vi).

Research suggests that stories create pictures in the mind of the reader or listener. The students who were able to describe heat transfer used a picture of what they had done in a lesson or experienced outside of the classroom or one that had been created for them in a story in order to describe heat transfer. Pictures are easier to remember as opposed to paragraphs or sentences.

The students in the experimental class were able to consistently score higher than the students in the control class because they were able to use a story to help them visualize heat transfer. As seen in their responses to how they remembered heat transfer, 60% of the students associated scenes from the story to visualize heat transfer. They were

able to characterize the dragon and Eric. Knowing the personalities of Eric and the dragon enabled the students to remember and describe heat transfer.

Conclusion

After considering the results of the pre and post tests and the various experiences, activities and images the students used to remember heat transfer, one can conclude that not only did the use of a story to explain heat transfer help the students to learn the concept, it also assisted students in describing heat transfer two weeks later. The stories assisted the students by allowing them to create a picture representation of heat transfer. Being able to recall a picture as opposed to several sentences appears to be the preferred way students in the study learned and retained information. All the students who recalled heat transfer referred to their picture representation of heat transfer. None of the children mentioned the written definition of heat transfer as the reason they remembered heat transfer.

It has been said that a picture is worth a thousand words. The students in this study have demonstrated that given the opportunity to make a picture out of a thousand words, they can learn and remember a specific process, concept and definition.

REFERENCES

Abimbola, I & Baba, S. (1996). Misconceptions and alternative conceptions in science textbooks: The role of teachers as filters The American Biology Teacher, Vol. 58. No. 1., 14-19.

Atwater, M. (1995). The multicultural science classroom. The Science Teacher, Feb., 21.

Baker, A. & Greene, E (1977). Storytelling: Art and Technique New York: R. R. Bowker Company.

Erodoes, R; Ortiz, A. (1984). American Indian myths and legends. - . New York: Pantheon Books.

Hein, G. & Price, S. (1994). Active assessment for active science: A guide for elementary school teachers. Portsmouth, NH. Heinemann, (1994).

Kilpatrick, W. (1993). The moral power of good stories. American Educator, 47 (3), 24-30.

Kuykendall, C. (1992). From rage to hope: Strategies for reclaiming black and hispanic students Bloomington, Indiana; National Educational Service.

Matcznski, T. C. & Joseph, E. A. (1989) Minority teachers shortage: A proposal to counter the lack of activity. Action in Teacher 11(2) 42-46.

Nuthall, G. & Alton-Lee, A. (1995). Assessing classroom learning: How students use their knowledge and experience to answer classroom achievement test questions in science and social studies. American Educational Research Journal, 31 (1), 185-223.

Papa, E. (1982). A very special family parts of speech. Milford, CT: Innovative Education Publishing Program.

Samples, B. (1992). Using learning modalities to celebrate intelligence. Educational Leadership. 50 (1), 62-66.

Wiggins, G. (1992). Creating tests worth taking. Educational Leadership, 49 (8), 26-33.

Yolen, J. (1991). Best-loved stories told at the national storytelling festival. Jonesborough, TN: National Storytelling Press. 14-15.

APPENDICES

1. Rosalee Taylor (1996). Heat Transfer Lesson
2. Rosalee Taylor (1996). Sample of Assessments Pre/Post
3. Rosalee Taylor (1996). Scoring Rubic Pre and Post Test
4. Rosalee Taylor (1996). Prince Eric: Keeper of the Heat

APPENDIX 1

Heat Transfer Lesson for Third Grade

Created by

Rosalee Taylor

Objective: Students will understand that heat travels from a region of high temperature to a region of low temperature and that this process is called heat transfer.

Materials:

2 - 16 oz measuring cups
8 oz ice water
8 oz warm water
1 thermometer
Pre-assessment sheets
Directions for experiment
Heat Transfer Chart
Story 'Eric Keeper of the Heat'

Procedures:

*Passed out pre-assessment sheet

*Explained to students that researcher is interested in knowing what they think heat transfer is, which way they think heat travels and how they would illustrate heat transfer.

*Reassured students that they are making guesses like scientists and they call it making an hypothesis.

*Collected pre-assessment sheets

*Read 'Eric Keeper of the Heat' to experimental class

*Passed out directions

Experiment:

*Groups of 4 students are given 2 cups, 2 thermometers and heat transfer data chart

*1st cup 8oz of ice water was placed in cup children were instructed to take temperature and record on data chart

* 2nd cup 8oz of warm water was placed in cup, children took temperature and recorded on data chart

*4oz of warm water was added to 1st cup; temperature taken and recorded

*4oz of cold water was added to 2nd cup; temperature taken and recorded

*Children given opportunity to discuss and record results with group

* Groups shared results with class and together drew conclusion as to the direction heat traveled and what heat transfer was

*Together students thought of examples of heat transfer in their everyday lives and illustrated them on chart

*Experimental class also selected the character from the story that they thought would be like heat transfer

Heat Transfer Data Sheet

NAME: _____

COLD WATER CUP	HOT WATER CUP
TEMPERATURE:	TEMPERATURE:
HOT WATER ADDED	COLD WATER ADDED
TEMPERATURE:	TEMPERATURE:

ILLUSTRATION:

APPENDIX 2

Heat Transfer Pre-assessment

WHAT DO YOU THINK HEAT TRANSFER IS ?

WHICH WAY DO YOU THINK HEAT LIKES TO GO FROM HOT PLACES TO HOT PLACES OR FROM HOT PLACES TO COLD PLACES?

DRAW A PICTURE OF WHAT YOU THINK HEAT TRANSFER IS?

APPENDIX 3

Scoring Rubic Pre-test
5 pts
Passing scale 80%

Definition of heat transfer: the temperature of an object decreasing

Question #1

What do you think heat transfer is?

Answers:

- 3 pts - A hot object losing heat to a cooler object
- 2 pts - Temperature of an object decreasing
- 1 pt - Hot turns to cold

Question #2

Which way do you think heat likes to go: from hot places to hot places or from hot places to cold places?

Answer:

- 1 pt - Hot to cold
- 0 pt - Hot to hot

Question #3

Draw a picture of what you think heat transfer is

Answer:

- 1 pt - Picture of a hot object warming up a cold object

Scoring Rubic Post-Test #1
Passing scale 100%

Question #1 Record Results

Answers:

- 1 pt - Hot cup temperature going down when cold water added
- 1 pt - Cold cup temperature going up when hot water added

Question #2

- 1 pt - Record conclusion that heat moves from a region of high temperature to a region of lower temperature.

Question #3 Draw a picture of what you think heat transfer is.

Answer:

- 1 pt - Picture of a hot object warming up a cold object

Scoring Rubic Post-Test #2
Given 2 weeks later

Question: Describe heat transfer

Answer:

- 1 pt - hot object losing heat to a cooler object.

APPENDIX 4

Prince Eric: Keeper of the Heat

In a time long ago, there lived a brave and handsome prince called Eric, Keeper of the Heat. Prince Eric was given this name by an ancient shaman who proclaimed that Eric would possess the blessings of heat, courage and justice. All the people marveled at such gifts. The gift of heat. What could that mean? Will he shoot flames of fire at his enemies and turn them into ashes? For years, the people watched Eric, Keeper of the Heat, waiting for the heat to shoot through his fingers, but it never came. People did say that whenever they touched him, they felt a wonderful feeling of warmth and wherever he went the land was blessed with a warm tropical climate. Eric enjoyed being Keeper of the Heat. He enjoyed watching the people's faces light up when they felt his heat and seeing the land spring to life with the warmth he brought to the climate.

Eric became famous throughout his father's kingdom for bringing heat and for slaying evil giants, fierce beasts, wicked warlocks and defending the weak. In fact, Eric was so good at getting rid of foul creatures and disgusting villains that there were none left! Eric had killed them all or they were too scared to show their faces.

Then one day, a traveler passing through his father's kingdom told the woeful tale of Princess Ninke who was trapped in the Kingdom of Ice. The dreaded Frost Dragon, while flying across Prince Ninke's home, saw her and decided he wanted to marry her.

Princess Ninke was the most beautiful princess in the world. She was also the smartest. Princess Ninke knew that the Frost Dragon would not be a good husband. She refused to marry him. The Frost Dragon became filled with rage. He flapped his mighty wings, opened his mouth and blew the cold frosty breath of ice on every living thin except the Princess. The Princess was doomed to sit in her castle and cry ice tears for her people who were doomed to live frozen in ice.

Eric, upon hearing this sad tale, vowed to save the Princess Ninke from the evil Frost Dragon. He traveled many kilometers for many days until he came to a barren and icy land. A harsh, frosty wind swirled across the face of the land. Eric knew this was the home of Princess Ninke. Hastily, Prince Eric, Keeper of the Heat leapt, off his horse and began to stomp across the land. As Eric walked across the land, it began to come back to life! The grass pushed through the snow, the flowers merrily turned their faces up to the clear warm air, the trees seemed to stretch their branches to the sky and shake the last of the ice from their limbs! The birds gleefully fluttered their wings and sang "Hello" to all the animals, plants and people that were coming back to life! Eric, Keeper of the Heat lifted his head and laughed for joy. The land was getting warm. Soon he would free the princess.

He ran to the center of the kingdom. There he saw a splendid marble castle. It shone in the sunlight like a diamond. Soaring above the castle was the Dragon. He was furious! Someone had dared to warm the land he had frozen! It was melting and things

were coming back to life. Someone was going to pay for this! The Frost Dragon's cold gray scales glistened in the sun. His pale blue eyes flashed darts of ice at Eric.

Eric knew the Frost Dragon would not die easily. Eric, Keeper of the Heat braced himself for the full force of the Dragon's icy breath. The dragon flapped his awesome wings and blew a blood chilling gust of air. Eric released all the heat he could summon from deep within him. He could feel the heat leaving his body and mixing with the dragon's cold, cold breath. Eric, Keeper of the Heat closed his eyes and raised his hands up to the sky. Heat shot through his fingers and into the Dragon's heart. The Dreaded Frost Dragon burst into flames. The battle was over.

The princess, having felt the warmth return to her land and seeing the mighty battle, ran to open the castle gates. When Eric heard the castle gates open he turned and saw the most beautiful princess he had ever seen. Princess Ninke walked slowly toward Eric, thanking him for sharing his heat with her people and land. To Eric, Keeper of the Heat, her voice was like sweet, sweet music and she moved with the grace of a gazelle. When Princess Ninke asked Prince Eric how could she reward him for saving her home he simple said, "Marry me."

And she did.