Inquiring Minds Want to Know

Research Project

By

Karen Harlow

for

MURMSI Project

Chapter 1 Introduction and Focus

The purpose of this study is to study the motivation, productivity, and achievement levels of fourth grade students by implementing a more involved inquiry approach to my science instruction. After taking graduate classes in science and math, along with teaching science to 4th graders for a year, I have come to the conclusion that I need to fine tune my method of delivery with more emphasis on science inquiry. I am concerned about students who lack motivation and produce very little work. Many of my students are low performing, who are not engaged in active learning and do not seem interested in science.

Research Question: Does student achievement increase with students actively engaged in inquiry-based science learning versus traditional textbook and lecture instruction?

Chapter 2 Literature Review

The National Association for the Education of Young Children (NAEYC) reports the contributions of science experiences to the intellectual development of children has been emphasized for a long time, and increasingly so in recent years. The process of science – investigating, discovering, experimenting, observing, defining, comparing, relating, inferring are what the growth of the mind is all about. Gardner in The Unschooled Mind also agrees that elementary classrooms need to involve students in science experiences and not postpone science inquiry until middle or high school.

The National Science Education Standards state "Inquiry into authentic questions generated from student experience is the central strategy for teaching science." (NSES, 1992, p.31) A study by Dunkhase (2003) goes on to say that inquiry is pervasive throughout the standards as the driving force for effective teaching and learning in science…inquiry is central to the mission of acquiring scientific literacy for all learners. The National Research Council has published an additional volume entitled *Inquiry and the National Science Education Standards* which is dedicated specifically to elaborating on the inquiry standards (National Research Council, 2000).

Dennis Littky's *The Big Picture* strongly advocates students "doing", engaging students in active learning where everyone talks and listens and works to solve real life problems. Problems and investigations that make sense to students and that serve a purpose provide high interest and motivation.

The National Science Education Standards, developed by the National Research Council (1996), elaborate major components of learning and teaching science through inquiry. "Students at all grade levels and in every domain of science," it states, " should have the opportunity to use scientific inquiry and develop the ability to think and act in ways associated with inquiry, including asking questions, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments" (National Science Foundation, Foundations. Vol. 2).

In summary, the science research literature strongly supports and highly recommends the inquiry method of teaching science. When students have the opportunity to explore, inquire, construct meaning and come to conclusions, they retain of the concept. At the same time implementing a discovery/inquiry-based classroom is not a simple feat, which requires much planning initially, and restructuring the physical environment. Teachers need to have training and much support from administration at the school and district levels. Overall the inquiry approach to teaching science is the most thorough method to use.

Chapter 3 Variables

This project involved 4 groups of 4th graders who were randomly chosen as the classes were grouped according to the ability levels supplied by baseline data from standardized testing.

Strategies:

2 groups were taught using traditional/lecture methods which involved the use of textbook, science journals, teacher assessments, and textbook investigations.

2 groups were taught using discovery/inquiry methods which involved an exploration segment, an explanation segment, an evaluation segment, concept maps, cooperative learning groups, science log/journals, teacher assessments,

Groups were switched after 2 or 3 weeks following the assessment of the concept.

Chapter 4 Methods

Prior to beginning my research project, I surveyed my 4th grade students to gain understanding of their personal preference, interests, and motivations regarding science. Appendix E & F.

The inquiry-based class students recorded their observations, questions, inferences and reflections in science journals to provide feedback on pre and post learning. The discovery/inquiry students were grouped into cooperative learning centers for investigations, and individual or whole group concept mapping strategies were used at the end of the learning cycle to evaluate student understanding. The traditional/lecture class students utilized science journals for note-taking, organization of homework assignments, class work, define vocabulary, and textbook investigations.

For this action research project the students were randomly chosen as the classes were grouped according to the ability levels supplied by baseline data from standardized testing. Sound and electricity-magnetism were the two science content areas that the students studied for this project. The students were expected to produce evidence that demonstrates understanding of how is produced by vibrating objects. The students were expected to produce evidence that demonstrates understanding of the flow of energy in a system. One group was taught with the discovery inquiry method for two weeks while the other group was taught in traditional/lecture methodology. At the end of the two weeks, following assessments, I reversed the methods. The students were expected to produce evidence that demonstrates understanding of how sound is produced by vibrating objects. The students were expected to produce evidence that demonstrates understanding of the flow of energy in a system.

In order to provide my students with a discovery/inquiry environment for learning: classroom materials and resources included rubrics, classroom leveled library, word wall, multimedia, science tools, and science journals. I also employed CRISS strategies. Students were actively engaged in decision-making, asking questions and reflecting through out investigations.

For my traditional/lecture whole group instruction, classroom materials and resources included pencil and paper, Harcourt Brace publishing company student textbook, worksheets and assessments. Students listened to teacher lectures and read independently and answered questions in textbook. Students outlined chapters and answered questions on worksheets and were assessed by published tests and quizzes.

Chapter 5 Permissions

Before beginning this action research project, permission was asked of the principal. I discussed the action research with the other three 4th grade teachers so they would have an understanding of the plan. My students were also informed with a limited version of the project. I did not inform the parents because all students were being taught the same subject matter, just with different methods.

Chapter 6 Timeline

Timeline:

Summer 2004-Research & Action Plan

August-September 2004 - Planning for implementation

October 2004 - Implementation of Action Plan

November 2004- January 2005 - Gathering data

February - March 2005 - Compiling results of data

April 2005 - Presenting final results

Chapter 7 Data Collection Plan.

Collect FCAT scores on students from previous year to determine where they are in reading

Give interest/attitude survey and analyze results (Appendix E & F)

Collect science journals bi-weekly for teacher feedback with individual feedback intermittently on as needed basis checking for understanding of subject matter and completeness of assignments.

Assess concept maps at the end of each learning cycle for understanding

Use teacher observations during the "exploring" segment of the lesson to determine student progress of the discovery/inquiry procedure

Chapter 8 Data Analysis & Interpretation

The student surveys showed that most of the students liked science. The majority of the students identified making project, doing activities, learning new things, and working with others as factors they liked about science. Survey 1 also revealed that the students did not like textbook reading, studying for tests, and writing as major components of the science instruction. (Appendix E)

Students were also provided a Likert Attitude Survey in order to provide them with the opportunity to express their opinion regarding science instruction. The Likert attitude survey revealed high student interest in active hands-on science. (Appendix F)

Students maintained science journals with responses to investigations and explorations. Teacher and students conferenced together regarding individual performance.

As students worked on group and individual projects, teacher observations concluded that the discovery/inquiry based students spent more time on task, generated an increase in student discussions and questions.

All classes were given the same teacher made assessment after each unit of study.

The results showed that the students in the discovery/inquiry classroom environment demonstrated significant student achievement versus the student's achievement in the traditional environment.

Appendixes A, B, C, D.

Chapter 9 What I've Learned and Going Forward

The emergent Action Plan is to refine my methods of teaching. I have discovered through this Action Research Project, along with other professional development, that depending on the textbook for my main source to teach will change. I want to create units that integrate other subject's content and employ the discovery/inquiry approach to learning.

I believe that this will be an ongoing endeavor for sometime. I realize that much planning will take place in the beginning but it will last over time. Every year that I teach the same content, I'm sure new materials and methods will be added.

In the 2005-2006 school year I will be team teaching instead of teaching four classes. This situation will allow me more freedom to integrate subject areas. One possibility for research would be to compare the other fourth grade students who will not be involved with my methodology. There may be too many variables, depending on the background data and how the students are grouped. If both teams are equitably divided according to data then I may keep track of their progress.

Chapter 10 MURMSI

The MURMSI project has afforded an excellent opportunity for teacher researchers to share their findings, receive help, ask questions, and have a support group when needed. The NEFSTEM website has provided the researchers a venue so they can receive input from many, many other teacher researchers around the world.

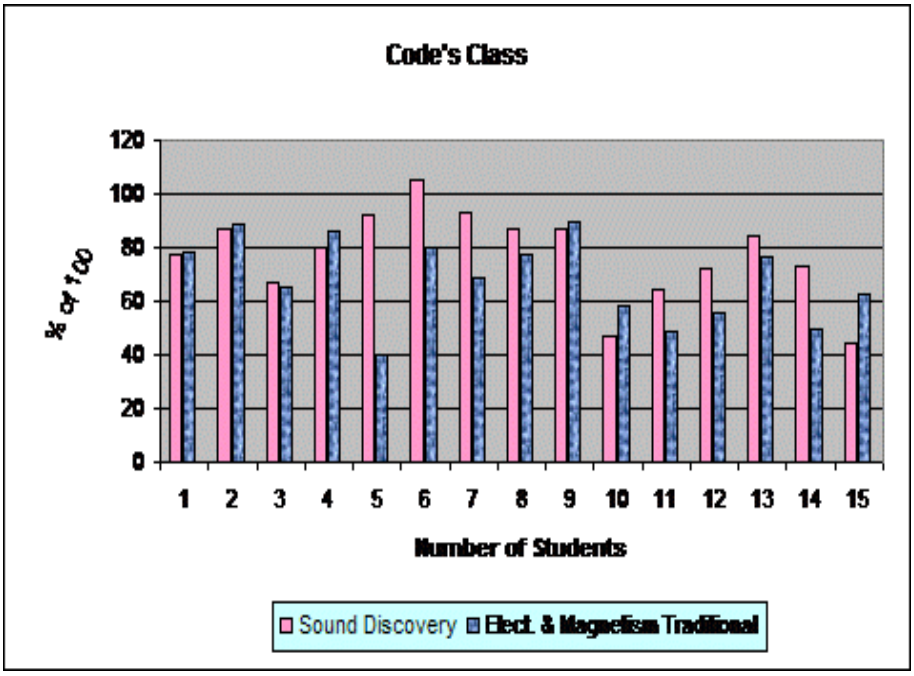
First reaction--what do I do? It took me awhile to warm up to the website. I really appreciate being able to meet and network with others.

Chapter 11 Graphs, Surveys, Data

Appendix A

Class C COMPARISON SCORES for TRADITIONAL/DISCOVERY

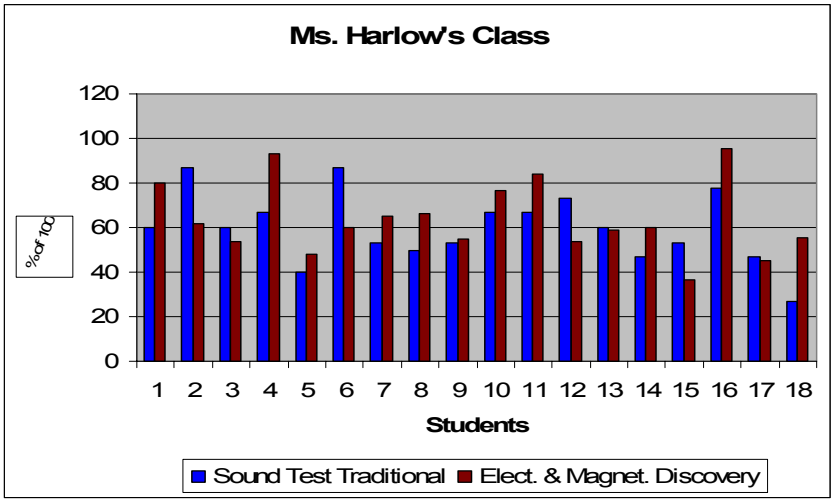
Class C	Sound Discovery	Elect. & Magnetism Traditional
Rico	77	78
Rodney	87	89
Carlos	67	65
Damien	80	86.5
Antonia	92	40
Charmesia	105	80
Devonte	93	69
Canisha	87	77.5
Dale	87	90
Quashas	47	58
James	64	49
Tedric	72	55.5
Lafavette	84	76.5
Shalakey	73	49.5
Roy	44	62.5
Averages	**77**	**68**



Appendix B

Class H COMPARISON SCORES for TRADITIONAL/DISCOVERY

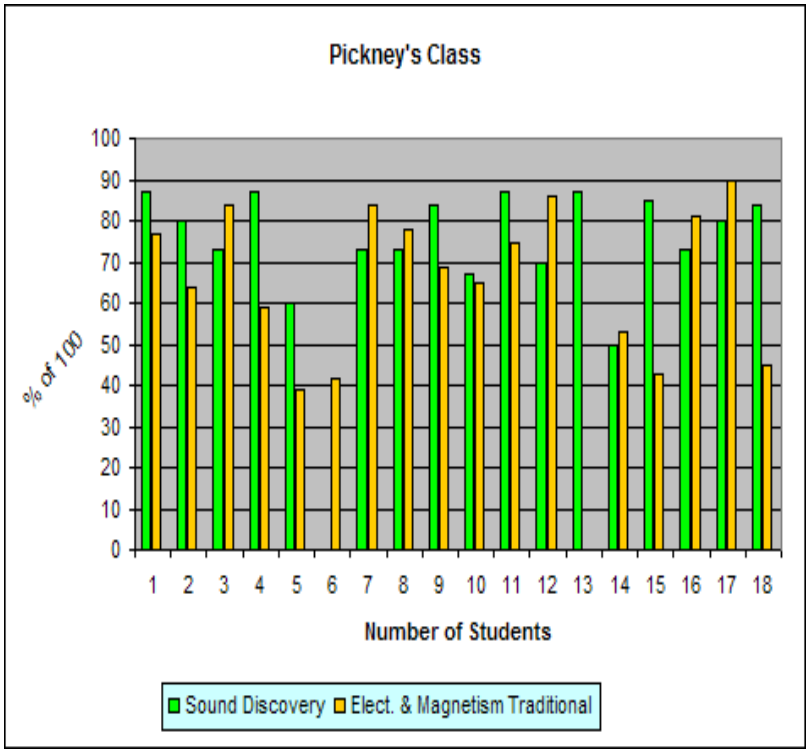
Class H	Sound Test Traditional	Elect. & Magnet. Discovery
Deshawn	60	80
Miracle	87	61.5
Earnest	60	53.5
Carlos	67	93
Antwan	40	48
Shantay	87	60
Patrick	53	65
Ronnisha	50	66.5
Rickia	53	55
Deondre	67	76.5
Juaneshia	67	84
Henry	73	54
Brandon	60	59
LaQuanna	47	60
Terry	53	36.5
Octavia	78	95.5
Tyron	47	45
Keanna	27	55.5
Averages	60	64



Appendix C

Class P COMPARISON SCORES for TRADITIONAL/DISCOVERY

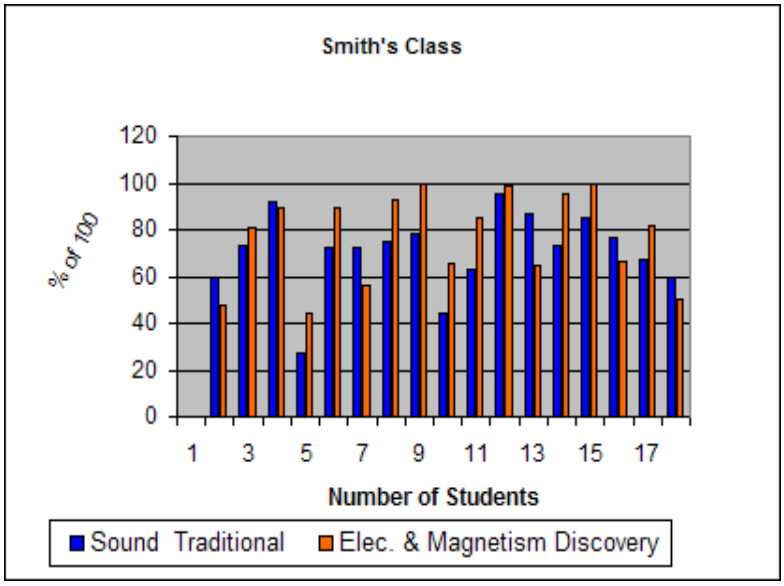
Class P	Sound Discovery	Elect. & Magnetism Traditional
Aaron	87	76.5
Marquize	80	64
Tevyn	73	84
Earnest	87	59
Ronald	60	39
Shawaenica		41.5
Kenyotta	73	84
Craig	73	78
Eric	84	68.5
Chanel	67	65
Tavaris	87	74.5
Tajuanna	70	86
Kevin	87	
Evelyn	50	53
Bryonna	85	42.5
Ko'mari	73	81
Matthew	80	90
Ernest	84	45
Averages	**76**	**67**



Appendix D

CLASS S COMPARISON SCORES for TRADITIONAL/DISCOVERY

Class S	Sound Traditional	Elec. & Magnetism Discovery
Aubrie	60	48
Demetrius	73	80.5
Marvelous	92	89
Janasha	27	44
Te'kendra	72	89
Destiny	72	56.5
Benjamin	75	93
Tairrah	78	100
Anquenette	44	65.5
Guy	63	85.5
Jamarius	95	99
D'odray	87	65
Candice	73	95
Blair	85	99.5
Ervin	77	66.5
Donnisha	67	81.5
Joshua	60	50
Averages	**71**	**77**



Appendix E

SCIENCE INTEREST SURVEY

Science Interest Survey

Name _____ _____

1.Do you like science?	yes	No	sometimes			
2. Circle the things you like about science.	learning new things	reading the book	doing activities	making projects	working with someone	studying for tests
3. Circle the things you don't like about science.	reading the book	Doing activities	writing	studying for tests	working with someone	Making projects

4. In the spaces below give me suggestions about things to do in science.
(Remember you do have to get a grade on your report card, so also give me suggestions on things to grade.)

a.
b.
c.
d.
e.
f.

Appendix F

SCIENCE SURVEY 2

Science Survey 2

	Strongly Agree	Agree	Agree Sometimes	Disagree	Strongly Disagree
I like science	**5**	**4**	**3**	**2**	**1**
I like reading the textbook.	**5**	**4**	**3**	**2**	**1**
I like doing investigations/experiments	**5**	**4**	**3**	**2**	**1**
I like discovering new information	**5**	**4**	**3**	**2**	**1**
I like to write/draw about what I have discovered	**5**	**4**	**3**	**2**	**1**