6-18-2009

Differentiated interdisciplinary science instruction in a fourth grade inclusion classroom

Laura Oliver
Rowan University

DIFFERENTIATED INTERDISCIPLINARY SCIENCE INSTRUCTION IN A FOURTH GRADE INCLUSION CLASSROOM

by
Laura Oliver

A Thesis

Submitted in partial fulfillment of the requirements of the
Master of Science in Teaching Degree
of
The Graduate School
at
Rowan University
June 18, 2009

Approved by
Dr. Robin Haskell McBee, Advisor

Date Approved June 18, 2009

ABSTRACT

Laura Oliver
DIFFERENTIATION INTERDISICIPLINARY SCIENCE INSTRUCTION IN A FOURTH GRADE INCLUSION CLASSROOM
2008/09
Dr. Robin Haskell McBee
Master of Science in Teaching Program

This action research project explored what would happen if interdisciplinary, differentiated instruction was used during a science unit on recycling in a fourth grade inclusion classroom of 20 students. The project also focused in particular on the progress of two throughout the project's implementation. Four differentiated techniques were used throughout the unit. These included a tiered writing assignment, student choice based on interests, centers, and a RAFT, which was a summative assessment that allowed for student creativity based on their own interests and readiness. Using field notes, journal entries, student grades, and student surveys the data revealed a notable difference between previous science test grades and the project grades, with the science project grades being higher than the test grades. Students also revealed a greater interest in writing assignments when the writing assignment is based around science concepts. Student writing greatly improved, with students being more engaged in writing and writing more when the writing assigned was based on science concepts taught in class.

ACKNOWLEDGEMENTS

I would first like to thank my wonderful husband for all of his support throughout this action research endeavor. His patience and understanding helped guide me through the entire process. Secondly, I would like thank Dr. Tanya Santangelo for taking the time to provide her feedback on my differentiated lesson plans. She proved to be an invaluable resource for my unit plan. I would also like to acknowledge Dr. Beth Wassell for all her encouragement and support in helping me to find a research project about which I could truly be passionate. Finally, I would like to say many thanks to Dr. Robin McBee for her hours of editing and advice that helped shape this final report on my action research project.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

Introduction

One of the most important things for a teacher to remember is that each classroom contains a diverse set of learners with varying degrees of interest, readiness, and learning profiles. The push to include students who receive special education services in regular education classrooms has presented a stepping stone for teachers to design instruction that will fit all learners' needs in the classroom. The tool for providing such instruction is using differentiation strategies that are tailored to fit individual students' interests, readiness, and learning profiles (Tomlinson, 2005). In this study, I used four explicit differentiation strategies, along with science curriculum, to explore the effects my strategies had on student learning in the classroom.

The students' love for science in this classroom became evident within the first two weeks of my student teaching. Because of this, I was curious to see if when I used differentiation while incorporating science into other content areas, work habits and enthusiasm would improve. I was also curious to see if my differentiation strategies made students more eager to do the work.

Statement of the Problem

The students in my class come from many diverse, challenging situations. One student has never met her mom or dad and is being raised by her grandmother. Many of the students have parents who were never married or are divorced. Most students live in small apartment buildings, and at least two students in the classroom had to be

evacuated because of cockroach infestations in their apartments. These students come to school everyday with the weight of the world on their shoulders, but for the most part, are well-behaved and eager to learn. A couple of them have the attitude school is not important and does not matter. They feel learning is a sign of weakness, and showing you are smart is not "tough."

Because this is the fourth grade inclusion class and two teachers work in the room, many of the students who are at a lower readiness level have been placed purposely in this classroom. This means most of the students in this room struggle with fundamental skills they have yet to master. On the other hand, there are a handful of students who excel in all subjects. These students often find themselves bored with curriculum that is not challenging enough for them.

The special education teacher has noticed learned helplessness has become increasingly evident in the classroom with many of her students. Some of these students expect modifications. They expect tests to be read; they are aware they have modified spelling lists, reading tests, and other assignments. When an assignment is given with no modifications, they immediately raise their hand and ask for help or say they do not understand. They do not even try to do the work on their own; they always need a crutch. This usually results in the eight students, who receive modifications, getting pulled out of the classroom for small group instruction, thus conflicting with the intent of having an inclusion classroom. Differentiation is supposed to take place at many different levels within the classroom during whole group instruction.

Given my concern about low academic performance and about the ways in which academic content was modified rather than making other types of accommodations, the research question that guided my action research study was:

What happens in my fourth grade inclusion classroom when the RAFT strategy, along with other differentiation techniques, are used during a unit on recycling?

A second question was:

Will the integration of the science curriculum into other content areas increase student motivation to learn?

Story Behind the Research The first week in this classroom involved intense observation of the students. I observed that many of them love music as they tapped beats out on their desks or bobbed their heads up and down to a song. I realized the students in this classroom are extremely artistic, athletic, and creative. Despite these many talents, most of them have a very poor self image. Many of them think they cannot succeed in school because they do poorly on tests.

Another observation I made is that the students in this classroom tend to succeed when given hands-on challenges, experiments, or real life scenarios. They seem to retain this type of learning much more easily than a workbook page or textbook reading. Because of this, I quickly learned the favorite subject for the majority of students was science. They expressed great interest in science due to the fact that experiments were usually involved. Once I discovered the students' love of science, I decided to conduct an action research experiment using science curriculum as the foundation for it. I planned to teach the students a unit on recycling and to use differentiation techniques to help teach the content. I wanted to see if using these strategies would help students be more

motivated to learn. One other very important feature of my plan was to instruct all students within my classroom and not to allow students receiving accommodations and modifications to be pulled from the class for separate small group instruction. I planned to have them stay in the classroom throughout all lessons, and differentiation techniques would be used to provide accommodations to meet their IEPs as well as to meet the learning needs of the rest of the students.

The best teachers I had were those who realized learning is not the same for everyone. Before I began my unit, I explained to my students that no one learns in the same way, and people can show what they have learned in different ways. The differentiated assignments I gave the students reflected the different readiness abilities in my students. My hope was that by using these differentiated tasks, students would be motivated to learn.

Significance of the Study

This study is significant because it attempts to evaluate the impact that differentiation and interdisciplinary instruction have on student learning. Both differentiation and interdisciplinary instruction are two techniques that I, myself, have been taught that, if used correctly, can be successful in increasing student grades and motivation in the classroom. Through this action research project I chose to implement selected differentiation and interdisciplinary instruction strategies to see if they would prove to be successful in my classroom with my students.

Purpose of the Study

In my action research project I gave students four differentiated assignments based on a recycling unit I designed. One of these assignments was a summative unit

assessment which allowed students to choose between a certain Role, Audience, Format, and Topic (RAFT).

Besides the RAFT project, students participated in three differentiated assignments throughout the unit. The first was a tiered writing assignment based on the book, *A Diary of a Worm* by Doreen Cronin (2003). In the second assignment students chose between writing a jingle, making a commercial, or creating an advertisement to promote recycling. Finally, I used differentiation in the construction of recycling centers. Students spent time at learning centers assigned to them, based on their readiness, interests, and learning profiles.

In addition to these assignments, as a part of the writing curriculum, students were given two writing prompts directly related to science content. One prompt was directly related to a discussion the class had on ways to help save the earth. The other writing assignment was a writing prompt, based on the story, *The Lorax* (Seuss, 1971). In the past when writing prompts were assigned to the class, students with IEPs were given extra modifications for those assignments outside the realm of what was called for in their IEPs. For example, they would be told to only write two or three sentences per paragraph, even though these types of parameters were not set forth in their IEPs. The modifications I provided included extra time to complete assignments and variations in the length of the entire assignment. For instance, students were required to write a five paragraph essay on three ways they can save the earth. Depending on what their IEP stated, some students were only required to write 3 or 4 paragraphs. They were also told if they wanted to write more they would have extra time to do so.

Assumptions and Limitations

Part of the reason I chose to do this action research was because I received my undergraduate degree in biology. I love science, and I love teaching it. When I realized my students also shared my love and interest for this subject, I naturally decided to take my research in that direction. My enthusiasm for this subject has been evident since the first day I taught it in the classroom. Some of the students actually asked my cooperating teacher if I was hired to teach them science. This enthusiasm for science may have helped increase my students' interest in the subject matter. If I allowed this enthusiasm to spill over into other subject areas (especially when based on science content), it might also have influenced the students' performance. Another teacher not as passionate about the subject might not receive the same results as I did when implementing this action research plan.

I was a student teacher at the time this action research project took place, and my cooperating teacher was a great help to me during this study. While I met with small groups to discuss the RAFT project, my cooperating teacher would make sure students who were working at their seats were on task. If it had been my own classroom, I would have had to be the eyes and ears of the whole classroom and might not have been able to give as much attention to the students with whom I was working in small groups. It eased my mind to know that I could focus solely on the individual students I had in front of me and not worry if there were distractions. This was also true when I set up the recycling centers. Having my cooperating teacher there made a big difference. She was able to assist me by floating around and helping students at the same time as I did.

Another limitation of this is study is that I completed part of this unit during a week of holistic testing where students were being tested in the mornings on reading concepts that had been taught in the prior few weeks. This allowed for extra time in the schedule for me to teach my unit and really spend a decent amount of time on it. Usually science is only taught for a half hour, but holistic testing week allowed much more flexibility and time for teaching the unit content. The regular classroom schedule does not allow for this extra time, but it was definitely useful while implementing this project.

Definitions

Action research is done by teachers for their own individual purposes. It is a four step process that includes identifying an area of focus, collecting data, analyzing and interpreting data, and, finally, developing an action plan (Mills, 2007). Action research is not purely scientific research in which variables and hypotheses are involved. In classrooms, all the factors involved in an action research project cannot be predicted or controlled. This, therefore, makes action research unique in that it embraces bumps in the road or unpredictable circumstances surrounding the research question. Action research is used to make effective educational changes in a particular context, based on the findings from a systematic study (Mills, 2007).

Differentiated instruction is instruction that "creates a user-friendly environment, one in which [teachers] flexibly adapt pacing, approaches to learning, and channels for expressing learning in response to the students' differing needs" (Tomlinson, 2005, p. viii). Differentiated instruction is guided by student interests, readiness, and particular learning profiles. Using this information, teachers can then design instruction to best suit the needs of all learners in their classrooms.

According to Ginsberg (2005), motivating students is defined by a set of criteria that includes procedures and routines, an environment where both students and teachers respect each other, performance assessments that relate lessons to real-life, and using students' prior knowledge to expand and challenge them further. I chose this definition of motivation because I feel these were all components I used in my classroom and lessons.

In addition to using differentiation techniques, I was also teaching lessons in the units that were interdisciplinary in nature. Interdisciplinary instruction is that which incorporates multiple subjects into lesson plans (Jacobs, 1989). For example, some of my lessons included science and writing or math combined with science. Using interdisciplinary methods in the classroom helps students to make better connections to the content they are learning.

CHAPTER II

Review of Relevant Literature

Differentiated Instruction

One of the most obvious components of any classroom is the diversity among its learners. No student can be expected to learn in the exact same capacity as another student. With this being the case, it is important to explore differentiated strategies to reach all learners in a classroom environment. According to Tomlinson (2005),

> Acknowledging that students learn at different speeds and that they differ widely in their ability to think abstractly or understand complex ideas is like acknowledging that students at any given age aren't all the same height: It is not a statement of worth, but of reality. (p. viii)

The basis of differentiated instruction is content, process, and product of learning based on individual student interest, readiness, and learning profile (Tomlinson, 2005). This means all students are required to come to the same basic understandings of a particular topic. The way in which students engage themselves in these understandings, however, can be adapted to fit their own interests, readiness, and learning profiles. Tomlinson (2003) stated that,

> Good curriculum comes first. The teacher's first job is always to ensure a coherent, important, inviting, and thoughtful curriculum. All tasks should respect each learner. Every student deserves work that is focused on the essential knowledge, understanding, and skills targeted for the lesson. Every student should

be required to think at a high level and should find his or her work interesting and powerful." (p. 6)

This means, no matter what level their readiness, students receiving differentiated instruction all have to meet the same curriculum goals.

One of the most powerful components of differentiated instruction is that it has been proven successful to reach all types of learners. One of these success stories comes from an elementary school with an ethnically diverse set of students and a failing curriculum (Beecher & Sweeny, 2008). In order to improve achievement in a failing school with students of low socioeconomic status, differentiated curriculum and teacher training were implemented. The impact of this enrichment approach "resulted in improved student achievement and the reduction of the achievement gap between rich and poor and among different ethnic groups" (p. 503). This is just one documented success story of differentiated instruction.

Despite its documented success, there are conundrums with differentiated instruction. During her research, Tobin (2008) discovered problems with differentiating literacy in elementary classrooms. Throughout her study, Tobin worked with elementary teachers from grades 2-4 and claims that differentiation instruction is harder than it seems based on her extensive observations and interviews with teachers and students during her field work. She found differentiating based on interests, readiness, and learning profile is easier said than done in most classrooms. She discovered through her research that many students do not feel empowered in the classroom. Her research suggests that before differentiated instruction can be successful, "teachers need to engage students in public conversations about their literacy learning in ways that validate their worth and position

them favorably within the power relationships of the classroom" (p.166). Talking to students in this way will help shape how students currently perceive themselves, and it may also inspire them, in the future, to become more responsive in the classroom. Students may also find themselves taking more control of their own learning in a positive way. This may help them become more responsive to differentiated instruction.

Products of differentiated instruction are designed "so the broadest range of students [have] the maximum opportunity to think about, apply, and demonstrate what they have learned" (Tomlinson, 2005, p. 85). This means students are not just tapping into their interests for their own enjoyment at the end of a unit of study. All students are required to thoughtfully engage the same knowledge and understandings in a manner appropriate to fit an individual's learning needs. According to Tomlinson (2005),

> The ways to design, support, and assess challenging product assignments are endless. Just remember to provide written guidelines, which may be lengthy at times, so students have adequate structure, challenge, and clarity of purpose and expectations. (p. 92)

The specific methods to differentiation are limitless and flexible depending upon the individual students in a given classroom. Differentiation is based on the belief that "classrooms in which students are active learners, decision makers, and problem-solvers are more natural and effective than those in which students are served a one-size-fits-all curriculum and treated as passive recipients of information" (White, 2006, p. 61).

Differentiation can be used across all content areas, but this study focuses on differentiation in a specific content area - science.

Differentiation in Science Curriculum

There seems to be much debate about how science concepts should be taught in the classroom. Most research shows a correlation between engagement and hands-on activities, but some other research considers students who prefer direct instruction from a teacher. Sondergeld and Schultz (2001) worked in a third grade inclusion classroom to differentiate science curriculum for "gifted" and "special needs" students. Their research provides a comparison to Tomlinson's. They indicate,

> Planning and preparation are essential ingredients in the recipe for quality differentiation that meets state standards, but more important are student needs. Also, knowing what strengths, interests, and learning preferences your students have is essential before setting out to alter the classroom environment. (p. 39)

In another inclusive classroom, fourth grade students were given hands-on experiences during a science unit on ecosystems (Scruggs & Mastropieri, 2007). Other students were restricted to textbook connections and questions. The study found,

> Not only did the students in the hands-on experiences outperform textbook condition students, the 7 students with a variety of disabilities in the hands-on condition performed better than normally achieving students in the textbook condition. (p. 63)

The argument whether or not a hands-on science curriculum is more successful than textbook lessons has been relevant in the literature. What best fits differentiated lessons is also an argument occurring in the literature. According to Shepardson and Britsch (2006), there are five key elements to effective differentiation of science instruction. These key elements include, "talk, materials, participant knowledge,

engagement and power" (p. 460). Their study showed that when a teacher is willing to provide students with a conceptual base, it will lead students to a greater understanding. These five key elements contrast with the idea of using student interest, readiness, and learning profile to develop differentiated science instruction. Instead, this study used teacher directed instruction to guide students to deeper understandings in science content. Instead of basing assignments on students' interests, readiness, and learning profiles, the teacher talked to the students about the content being taught and provided the students with the necessary materials to learn about the content. This usually took the form of a lecture. Students used their own prior knowledge to add to the lecture which then helped them feel engaged in the lesson and empowered in their own learning process.

White (2006) used a different approach when trying to differentiate science content in his classroom. In order to complete a unit on the cardiovascular system, he had students work in groups and pairs. He wanted his students to see science as a student-centered subject unregulated by the teacher, based upon group work and group understandings. All the activities for his unit on the cardiovascular system were based upon inquiry questions the students needed to explore. The inquiry questions were big ideas about the cardiovascular system such as how does the heart work? Or, what foods help to keep your heart healthy? The results showed that "using inquiry in this way allows students to learn important concepts, and by working closer to their comfort zone, students also stay better connected to the unit's essential questions" (p. 63). This approach differed greatly from Shepardson and Britsch's (2006) teacher directed approach, but both studies showed evidence of successful differentiated instruction.

Having students collaborate on differentiated projects in science has also proven successful in other areas of research. Mastropieri et al (2006), discovered that peer mediated learning in an 8th grade science inclusion classroom was a successful way to help students learn content through differentiation. During their twelve week investigation, thirteen classes of 213 students (44 of these students were classified) were divided among two teaching strategies. Some students received hands-on differentiated learning that also included peer mediation. The other class received teacher directed instruction with no hands-on learning strategies. Their findings concluded that,

> An ongoing challenge for inclusive classroom teachers is meeting the instructional needs of all learners, especially when content is challenging and when student needs are diverse. Differentiated curriculum enhancements with peer tutoring may provide one approach to helping to meet that challenge. (p. 136)

Despite the argument that some students excel in science with hands-on experiences and others with textbook connections, the fact of the matter is students all differ in their approaches to learning any subject content, including science. This is why it is important to keep the following idea in mind.

> As in all diverse classrooms, no one method of teaching will meet the needs of every student. This is as it should be, respecting and honoring the varied needs and diversity of interests children have in an educational environment. (Sondergeld & Schultz, 2001, p. 39)

Interdisciplinary Instruction

Interdisciplinary instruction "motivates and challenge[s] students while preparing them for the complexities that they will encounter in their education and in the real world of work" (Jenkins, 2005, p. 42). Jenkins received a grant from the Cuyahoga Special Education Service Center (CDESC) that allowed her to collaborate with other fifth grade teachers and create an interdisciplinary unit on colonial life to be used in an inclusion classroom. She used social studies, language arts, math, and science standards to guide her unit plan. Her feedback from both parents and students from this unit were all positive, and she plans on collaborating with the teachers again to create more interdisciplinary units.

Jenkins is not the only person who believes interdisciplinary instruction is key to a productive classroom learning environment. Lewis (2003) designed interdisciplinary instruction by using three classroom approaches in English, mathematics, and science. Specifically in the subject of science, she designed three different ways to teach physics principles of technology. She taught one class just physics first. She taught another class principles of technology first, and the third class was taught an integration of the two subjects. Even though her pretest scores for all classes showed no differences, the class that was taught with the integrated physics and principles of technology curriculum had significantly higher test scores than those who just had each subject taught to them one at a time (p.541).

Galles (2005) was asked in an interview what she thought about incorporating writing into her science curriculum. She replied that she thought it was important, but admittedly did not have the knowledge about how exactly she would do this in her

classroom. She made it her goal to incorporate interdisciplinary instruction in all her teaching practices by collaborating with colleagues and using student feedback about their work. She has successfully incorporated writing into her science curriculum and is now pushing to add reading comprehension to her lesson plans. Her main findings have been that interdisciplinary lessons do not have to stem from hours of planning instruction, but that most of her ideas come from the connections the students themselves make about the content.

Student Motivation

Ginsberg (2005) states, "There is substantial evidence that motivation is consistently and positively linked to educational achievement." This means when teachers work to motivate students, their learning can be a much more meaningful and enjoyable process. Part of motivating students can be done by "designing lessons that help elicit students' stories, opinions, values, and interests as a catalyst for learning" (Ginsberg, 2005, p. 220). In addition to this Ginsberg claims there are four main components necessary in a classroom to motivate students. There must be set procedures and routines along with an environment where teachers and students respect each other. Like Tomlinson's model, Ginsberg also states that lessons must be taught based upon students' interests. The last two criteria for motivating students are performance assessments that relate to the real world and teachers using what students know to go beyond and really challenge their knowledge (p. 222).

Student choice can be highly motivating for a student. When students are not specifically told the final product of a task, but instead are given options for completing an assignment, they are more likely to be motivated to see the task to completion

(Tomlinson, 2003, p. 73). Carrie Kondor (2007) completed an action research study on differentiation and motivation with third grade mathematically gifted students. Her finding revealed, "educators need to plan curriculum that allows student choice and utilizes authentic tasks in order to engage and motivate students" (p. 3). Using student choice, her students were able to go above and beyond the expectations she set for them. Giving them a choice really motivated them to complete assignments and take pride in their work.

In conclusion, differentiation strategies based on individual student interests, readiness, and learning profiles have proven to be successful tools used to reach all learners in the classroom. In conjunction with this, providing students with lessons that are interdisciplinary in nature can help make content more memorable and has been noted to improve student test scores. Finally, using student choice is not only a differentiation technique, but it can also help to motivate and engage students in their learning.

CHAPTER III

Methodology

An action research project is a plan that is set in place in order to better inform classroom instruction. I wanted to put a plan in place to see if using interdisciplinary science content and differentiation techniques would improve student motivation, grades, and work habits. I decided to design my action research project based on three differentiated science lessons, two science-related literacy tasks, and a differentiated summative performance assessment. The implementation of this project took place over the course of a two week span.

The first assignment that I designed was based on the book, *The Diary of a Worm* by Doreen Cronin (2003). I read this book to the students and then lead a discussion about earthworms and the role they play in the food chain. Through reading this book, students were able to identify that earthworms can turn compost into nutrient rich soil. The students further learned that without earthworms, our soil would be lacking many of the necessary components for grass, vegetables, and fruits to grow. The next day students worked with me to conduct a hands-on science activity in which they, as a class, constructed their own worm bin. Each student was then given one of three writing assignments, based on their readiness level. Each student was responsible for explaining the role the earthworm played in the food chain. One group drew a picture of the

earthworm's role and explained their picture in a few sentences. Another group had to list five reasons why earthworms were important in the food chain and then pick what they thought was the most important reason and explain why in a paragraph. The third group had to write about what would happen to humans if the earthworm went extinct. I chose these three assignments based on the readiness levels of my students. By readiness level, I mean the level to which students are able to write. Some of them were below a fourth grade writing level; others were on level, and some were above the fourth grade writing level. Those who were at a below grade level readiness received the first assignment. Those who were on a fourth grade level received the second assignment, and those who were above a fourth grade readiness level received the third assignment.

The second differentiated lesson took into account student choice and interests. Since I noticed most students enjoy art, music, and acting, I allowed students to choose between creating a commercial, advertisement, or jingle about recycling in their county. Students wrote down on a piece of paper whether they wanted to do a commercial, advertisement, or jingle. From their choices, I then chose the groups. When choosing the groups I tried to put students who I knew were friends together in groups. I did this because I wanted students to feel comfortable with the students with whom they were working so that they would try their best on this activity. This lesson reflects differentiation strategies in that it allows for student choice by drawing from their interests. I also used the idea of choice to see if students had an increased enthusiasm for this assignment. I felt that if students could choose which form of the assignment they completed, they would be more motivated to complete the assignment to the best of their ability.

In the third set of differentiated lessons I set up recycling centers for students. Over the course of two days, students completed these centers in small groups. One center was an interactive computer program all about the earthworm. Students had to answer questions based on information from the website. The second center involved sorting objects into two piles: renewable and non-renewable resources. Since the class had spent a good deal of time talking about both renewable and non-renewable resources and how to ensure we can conserve both types of resources, I decided to have students then write about why it is important to conserve resources in the environment. The third center was a math center. On the desks were cards with recycling facts. From those facts, I made math problems the students had to complete. Many of these were multiplication and division word problems, with which I knew most students needed extra practice. Students were allowed to work in a small group to complete the math problems. The fourth center I had was conferences with me about the summative assessment I assigned the students at the beginning of this unit.

At the beginning of the recycling unit, I assigned students a differentiated summative assessment called a RAFT. RAFT stands for Role, Audience, Format and Topic. Each student was able to choose from five different roles, audiences, and formats, but all students were required to complete the project on the same topic. Each student was given a detailed handout of the requirements of the project that was sent home to be signed by a parent or guardian. In addition to this, students were given a rubric on the project, itself, as well as a presentation rubric. Each student was required to present his or her project to the class. The table on the next page shows the choices the students had in order to complete the RAFT.

Table 1

RAFT Tasks

ROLE	**AUDIENCE**	**FORMAT**	**TOPIC**
Superhero	People of Cumberland County	Storyboard, comic strip, or diagram with captions	How you saved the world with recycling
Author	Classmates	Children's book	Recycling: How Can We Save The World?
Journalist	Fourth Graders	News article	Today's top story: "How Recycling Saved the World"
Fourth Grader	First Grader	Picture Collage	How you can save the world by recycling
Famous Music Artist	Your Fans	Song Lyrics	How Your Fans Can Save the World Through Recycling

The roles and formats were determined based on students' interests, readiness, and learning profiles. Each student had one day to decide which role he or she would choose and was required to tell me his or her choice the next day. I used center time to discuss the progress of the students' projects as well as answer any questions the students might have about it.

There were two additional writing assignments that students were assigned throughout this unit. One writing task was based on a discussion that the class had about ways they could individually help save the earth. The class sat in a circle and passed the objects (a piece of paper, a fluorescent light bulb, a tin can, a reusable bag, and a plastic bag) around. Each object was discussed along with whether it was good for the environment or could be recycled. Students were then given the task of completing a five paragraph essay on three ways they could help save the earth.

The second writing task was directly related to Dr. Seuss's book, *The Lorax* (1971). As I read the students the book, the class discussed that the greedy Lorax had cut down all the truffula trees for his own gain. By the end of the book, the students were able to learn a valuable lesson about renewable resources: only take what one needs, and if something can be replaced, replace it. Based on this book, students were given the following writing prompt, "The Once-ler throws the truffula seed out the window and into your hand. It is the last truffula seed on earth. You catch the seed in your hand and then you…"

So, to summarize, the design of this project was multi-pronged. Students took part in three hands-on, differentiated, and interdisciplinary science lessons. They also engaged in two additional writing tasks related to their study of the environment. Finally, they worked on a differentiated interdisciplinary culminating assessment task for the environmental study.

Context of the Study

School and community. The school in which this action research project was conducted serves 830 students from pre-kindergarten through grade five. The school was

opened recently in December, 2007 in an effort to revitalize the downtown area of an urban neighborhood. The construction of this school was "designed to serve as a catalyst for private investment to revitalize urban communities with new housing and retail opportunities" (McElroy, 2007).

The school, itself, consists of 126,000 square feet and has 46 classrooms. The school also houses community health and social community features such as computer labs, a cafeteria with a kitchen, an auditorium, a gym, a pool, playgrounds, and athletic areas, all of which are available to the public during non-school hours. In addition to these services, the school has a wellness center that provides preventative and dental health care for students from a non-profit organization (McElroy, 2007).

The community surrounding the school is composed of families from mostly Hispanic origin. Three students in the classroom have parents who do not speak English. Due to this, letters sent home to these parents are translated into Spanish. In my classroom, my cooperating teacher works closely with a bilingual third grade teacher that helps to translate communication with the parents of students who do not speak English.

Classroom. This is a fourth grade inclusion classroom in which seven students have Individualized Education Plans (IEP), and one student has a 504 plan. The class is composed of 10 boys and 10 girls and two students who are English Language Learners. The classroom has many routines and procedures set in place. Students understand what is expected of them and what happens if they do not meet those expectations. This structured environment has created a positive learning environment where all students are responsible for meeting the same expectations and standards for behavior.

Despite this, the teaching of content in this classroom was not one that was conducive to meeting the needs of all learners within it. Math was taught with an overhead and worksheets; students were not given any manipulatives or broken up by readiness levels. Science was taught out of a textbook, and the students were required to take notes. Social studies was also taught this way. Reading consisted of an anthology textbook from which students received vocabulary words each week that they were required to memorize. Given the diverse set of learners in this classroom, I set out to change the way these subjects, and science in particular, would be taught to the children in this classroom.

Participants In implementing this action research project I chose to look at the class as a whole, but also to focus on two students in particular. Antonio and Jose (names have been changed to protect the identity of these students) were chosen as the focus of my study because they struggle to complete assignments and projects on time. They also seem to have the attitude that school is not important, and if you try hard in school it means you "are not tough." Both boys live with their mothers. Antonio has some contact with his father on weekends, but Jose has never known his father.

Jose was forced out of his apartment the second week I started teaching because his apartment had become infested with cockroaches. Until the landlord fixed the problem, he was forced to live with his aunt and her family in their tiny apartment. Jose consistently did not complete projects and homework assignments. Many times he claimed he did not have the supplies at home to do the work (such as a pencil, ruler, or paper). Other times he claimed it was too hard to complete, and no one at home could help him. He told me on many occasions that school is "not worth it" and "does not

matter." Jose receives special education services, and this has created somewhat of a learned helplessness in him. He seems to have an "I can't" attitude; instead of trying to complete his work, he gives up before he even attempts it. He feels as if he is going to fail before he tries to complete the assignment. He is, however, a wonderful artist and a math wiz. He tested at a fifth grade reading level and a sixth grade math level. The special education teacher who works with him regularly is convinced his "I can't" attitude is the only thing holding him back in his education. Jose's favorite subject is science.

Antonio also receives special education services. He is constantly drumming a beat to music or singing under his breath. He, like Jose, has a hard time completing assignments and turning them in on time. On a few occasions he has actually been caught cheating. His sister did his homework for him a few times. When his mother was called and made aware of the situation, she told us that she had his sister do it because Antonio did not have time to complete it, and even if he did, it was just "too hard" for him. Antonio has a poor work ethic and is usually off task in class. He constantly has his head down on his desk and does not follow along with lessons. Antonio struggles with reading comprehension and does not like to write. He is strong in math, and science is one of his favorite subjects. Three days a week he takes part in an after school science program where he gets to complete science experiments and get homework help.

Instrumentation

The instruments used to collect data for this action research project were student work samples, journal entries, field notes, grades, and student surveys. I used journal entries, field notes, and informal interviews gathered from students before I started

teaching my unit and as they were completing the differentiated assignments. For these field notes and journal entries I coded for patterns and themes throughout.

I also used student assessment work samples and grades as a source of data. The RAFT project grades were compared to previous project grades in social studies, which was the subject in which similar projects were conducted, in order to see if any improvement was shown with project performance. In addition to this, I compared the RAFT project grades to previous science test grades to see if the summative assessment showed an improvement in scores compared to previous science test scores.

Finally, in addition to the journal, field notes, and RAFT project, I gave students a survey at the end of the unit to gain feedback from them. The survey was distributed to 18 students in the class. I went through and tallied students' answers for each of the questions asked in order to gain some insight as to whether or not science helped to make other subjects (in particular, writing) more interesting for students. This survey can be seen in its entirety in Appendix B. The results of this survey can be found in the next section.

CHAPTER IV

Findings

Findings

From my journal, observations, and field notes I coded for on and off-task behavior with both science lessons and lessons that incorporated science with other subjects. I did this by reading through these three pieces of data and comparing the themes and patterns I noticed in each. There were a few primary patterns that seemed to emerge when comparing student behavior, motivation, and performance prior to, during, and as I completed my project. The emergent patterns and themes from these data sources were as follows: on task in science, off task in science, and on task during interdisciplinary lessons. It is important to note that because interdisciplinary instruction was not present in the classroom prior to my arrival, it was only observed during my action research project.

Using these themes and patterns, I tallied them for the entire class and also for Antonio and Jose, individually, prior to my project and during my project. Prior to implementing my project the class was observed to be on task in science only once. Individually, Antonio was never observed on task during a science lesson, while Jose was observed on task during a science lesson twice.

In comparison to this, during the lessons I taught while implementing my project, the entire class was observed to be on task in science thirteen times. Antonio himself was observed twelve times on task during my project and Jose seven times. In addition to this, the entire class was only off task once in science during the project, as was the case for Antonio and Jose individually.

Since I used interdisciplinary tasks throughout my project, I also found instances where students were completing tasks that were interdisciplinary in nature. From these instances, I noted when students were on-task or off-task when science was combined with other content areas such as writing. I did this to eventually compare the level of student engagement between tasks that just involved science content and those tasks that combined science with other subjects. From this I found the class was on task during interdisciplinary science lessons six times. Jose and Antonio were noted to be engaged in these types of tasks once individually.

In addition to coding for emergent themes and patterns, I also compared the grades students received on previous projects to the grades they received on the RAFT project I assigned them. The table on page 29 shows these results. It is important to note some students moved throughout the course of this project and two students were absent for some of my lessons. This is why some of the numbers in the charts vary.

This chart shows eleven students' grades remained the same when comparing the RAFT project to previous projects the students had completed. Six students' grades increased and three students' grades decreased. Two students handed previous projects in late and failed to hand in one project entirely. Every student in the class handed their RAFT project in on time.

Table 2

Comparison of Previous Project Grades to RAFT Assignment

Student	Grade Increase	Grade Decrease	Grade Same	Previous Project Late	Previous Project Not Completed	RAFT Project Late	RAFT Not Completed
1*			X				
2*	X						
3	X						
4			X				
5*	X			X	X		
6			X				
7*	X			X	X		
8		X					
9			X				
10		X					
11			X				
13*		X					
14	X						
15*			X				
16	X						
17*			X	X			
18			X				
19*			X				
20			X				
21			X				

*Indicates student with IEP or 504

In order to compare science grades to science grades, I then compared previous science test grades to the RAFT project grades. The following table shows these results:

Table 3

Comparison Prior Test Scores with RAFT Scores

Student	1st/2nd Marking Period Mean Test Scores	RAFT Project Score	Grade Increase with RAFT Project	Grade Same with RAFT Project	Grade Decrease with RAFT Project
1*	76	95	X		
2*	71	98	X		
3	72	95	X		
4	70	98	X		
5*	93	95		X	
6	70	93	X		
7*	90	90		X	
8	64	93	X		
9	95	99	X		
10	70	92	X		
11	98	95		X	
13*	55	88	X		
14	49	97	X		
15*	79	97	X		
16	79	99	X		
17*	79	87	X		
18	70	95	X		
19*	44	96	X		
20	83	100	X		
21	80	96	X		

*Indicates student with IEP or 504

The chart shows that seventeen out of twenty students had higher grades on the RAFT project when it was compared to their science test average. Three students remained within three points of their average test grade on the RAFT project, and thus their grades remained about the same. Not one student's grade was lower on the RAFT project than the test average.

Students also received grades for the assignment in which they chose to create an advertisement, commercial, or jingle in groups. Students worked cooperatively and efficiently on this task. When they presented their final products to the class, I was impressed with the level of thought that all groups had put into it. Because of this, they all received an A for a class work grade.

In addition to this data, I also used a student survey to receive feedback about the lessons I designed and how they impacted individual student learning. The table on the following page shows that all of the students liked having choice, thirteen of the eighteen students who completed the survey, enjoyed writing with science, and fourteen of the eighteen felt science makes other subjects more interesting.

Students were given a choice for their RAFT projects as well as for their assignment incorporating a commercial, advertisement, or jingle. The above chart shows every student, except Antonio, liked having a choice for both of these assignments. Antonio did not like having a choice for one of the assignments. Thirteen out of eighteen students thought writing about science made writing more enjoyable. Five students thought that writing assignments that were science related did not make writing more enjoyable. Fourteen out of eighteen students thought that science makes other subjects

more interesting, while four students did not think science made other subjects more interesting.

Table 4

Choice and Influence of Science on Other Subjects

Student	Liked Choice	Enjoy writing w/science	Science makes other subjects more interesting
1*	XX	X	X
2*	XX		
3	XX	X	X
4	XX		
5*	XX	X	X
6	XX	X	X
7*	XX	X	X
8	XX	X	X
9	XX	X	X
10	XX		
11	XX	X	X
14	XX	X	X
16	XX	X	X
17*	X		X
18	XX	X	X
19*	XX	X	
20	XX	X	X
21	XX		X

*Indicates student with IEP or 504

Students' writing samples were found to be valuable data in this action research process. During the worm writing assignment, one student showed signs of frustration, and his task was then altered to lessen his frustration. Most students did a good job on the

worm assignment, but I do not feel it reflected any significant findings. There were, however, the two other writing assignments that students did throughout the unit that were science based. One was a writing prompt guided by Dr. Seuss's *The Lorax* (1971). Students who usually received accommodations for writing assignments that shortened the length of the assignment were writing anywhere from 3-5 paragraphs when given a prompt about this story. Usually, these students only wrote 2-3 paragraphs. Students also wrote an essay on three ways they could save the earth. This writing assignment was given after we sat in a circle and passed around some objects and talked about what they had to do with recycling. Students did exceptionally well on this essay as well. Students were writing no less than three paragraphs. At least five students wrote a five paragraph essay. This is something most students in this class had never done up until this point in the school year.

Analysis

Prior to my project the entire class was only observed on task during science instruction once. During my project, students were observed on task in science twelve more times than prior to my project. In addition to this the class was seen on task during interdisciplinary lessons six times throughout my action research project. Student feedback revealed that providing them with a choice for assignments and incorporating science with other subjects are two things about which the majority of them felt positively.

Since all students said they enjoyed having a choice for assignments, it is interesting to note that for both of these assignments where choice was involved, students performed well. For the assignment in which students had a choice between a

commercial, jingle, or advertisement all students received a classwork grade of an A because they all did such an excellent job working together and presenting their projects in groups. The RAFT project grades, shown in the table above, were all an 87 or higher. When compared to science test scores, the RAFT project scores show a significant increase for many students. This may be linked to the fact students liked having the choice of which format their summative assessment took.

In addition to this, it is important to note that, as reflected in Table 1, all students completed the RAFT project on time. This helped all of their scores because no points were taken off any of them for lateness.

Although I cannot say there was a significant increase in project grades for the whole class, it is interesting to note that Jose's science test scores were pretty close to his RAFT project grade. His first marking period science test was an 86, while his test from the second marking period science test was a 100. This gave him an average test score of 93 percent. His RAFT project score was a 95. With only two points difference, I felt it safe to say that his grades did not increase between science tests and projects. The project grades, when compared between projects done before mine and mine, were very different. One project he handed in late prior to mine. On this project he received a 75. The second project he was given prior to mine he failed to complete and received a zero for a score. The grade difference in projects may have been attributed to Jose's love of science and his lack of interest in social studies.

Antonio, when compared to Jose, had different results when test scores were compared to the RAFT project grade. His score on his first marking period science test was an 87. During the second marking period, he received a 70 on his science test. This

gave him a science test average of 79. This test average can then be compared to his RAFT project grade of an 87. His RAFT project grade was eight points higher than his test average. His project scores, however, proved to be fairly consistent across the board. He received an 85 on the projects assigned to him prior to my project. On his RAFT project he received an 87. With only a two point difference between these two, this is not a significant increase.

I want to point out the fact, once again, that fourteen students said writing about science made writing more enjoyable. I also want to compare this to the fact that when given assignments like *The Lorax* (Seuss, 1971) prompt and the essay on saving the earth, the students performed very well on these tasks.

Interpretation

Given that students were observed on task in science twelve more times during my lessons than during previous experiences suggests a few things. First of all they may have been observed on task on so many more occasions because science was incorporated in almost every task in which the students took part over the course of two weeks. I like to think, however, that students were on task more because they were more engaged with the lessons. The survey results support this assumption. Fourteen out of eighteen students said that science makes other subjects more interesting and engaging, so chances are the on-task behavior was the result of the majority of my students being interested and thoughtfully engaged in my lessons.

Students were never exposed to lessons explicitly designed to link other content areas with science prior to my arrival in the classroom. This is the reason students were never observed on-task or off-task when science was combined with other subjects prior

to my lessons. Students did not really partake in interdisciplinary lessons. Many of the lessons in my unit, not just the three differentiated lessons, incorporated science with math, social studies, reading, and writing. Despite the fact students as a whole were only observed on task during these interdisciplinary lessons six times, I feel the final products of the interdisciplinary assignments were of higher quality than previous work that was not interdisciplinary in nature. This was especially true in the area of writing.

In regards to the RAFT project and grades, I was very nervous in assigning this task. I was not sure how students would handle it and if they would even turn them in on time. I was amazed that every student turned the project in on time. Many students' grades remained the same across projects, and this is because most of them are diligent students who work hard on all tasks assigned. Having seven students' grades increase, two of which failed to complete a previous project assigned to them, was a great triumph for me. I asked Jose how he was able to complete the RAFT assignment on time. He said it was because I helped him during his recess and gave him the supplies he needed. He said, "At home no one can help. You helped me so I could do it" (Field Notes, April 16, 2009).

In looking at the science test averages and the RAFT project scores, there is a significant difference between the two. Only three students' grades remained the same when the two were compared. Two of those students are students who do well consistently across the board no matter what the subject. The other student was Jose. Science is his favorite subject and usually the one in which he performs the best. It is interesting to note that the two other projects he did not do so well on were for social studies and did not involve any choice. I am inclined to believe that even though Jose did

not perform better when science tests were compared to a science project, he performed much better on the project directly related to science than the two that were not related to science at all.

In addition to science projects and tests, Jose also performed well on the writing tasks I assigned. He worked hard on his essays, creating four paragraph essays without complaining. This is a great improvement in his attitude toward writing. Usually, he would raise his hand and ask how long his writing has to be and tell me it is too hard for him to complete. It would take him a very long time to complete writing assignments; even when give extra time to complete it, he would always need more. When writing about science, Jose did not do any complaining but did ask for clarification of the directions before he completed the assignments.

I also want to add that he showed much enthusiasm during the assignment where students had to create their own commercial, advertisement, or jingle. During the assignment he told me, "I don't like this stuff, I have never been good at it" (Field Notes, March 26, 2009). He went on to tell me though that "working with my friends on this is fun" (Field Notes, March 26, 2009). Even though Jose told me he did not like doing the assignment, my field notes provided evidence to the contrary of this. Jose himself said it was "fun," and my field notes show him very engaged in the project. At one point Jose asked me for my camera so he could go around to other groups and take photos of them for me. During this time, I observed him carefully and noted he was highly engaged in what the other groups were doing. He was asking questions about what they were doing while talking and laughing with these groups. Even though he claimed he did not like assignments like this, he did a great job on this one and was highly involved.

Many students in my classroom have struggled with writing from the day I first met them. When students responded in the survey that science actually makes writing more enjoyable for them, it was a major victory for me. Aside from the differentiated worm lesson, I also had students write a prompt using the book, *The Lorax*, by Dr. Suess (1971). Students loved this prompt, and many of them wrote four to five paragraph essays, which is something many of them had not done all year. I think incorporating a subject they really love (science) into one they do not particularly like was successful in helping them produce higher quality work. Reading *The Lorax* (Seuss, 1971) and having the discussion on saving the earth may have also helped to build background knowledge for students. It also helps that this story is highly entertaining. This may have aided them in relating more to the writing assignment and in producing better work.

CHAPTER V

Summary, Conclusions, and Recommendations

Summary

My action research explored what would happen if interdisciplinary, differentiated instruction was used during a science unit on recycling in a fourth grade classroom. Four differentiated techniques were used throughout the unit. These included a tiered writing assignment, student choice based on interests, centers, and a RAFT, which was a summative assessment that allowed for student creativity based on their own interests and readiness. Using field notes, journal entries, student grades, and student surveys the data revealed a notable difference between previous science test grades and the project grades, with the science project grades being higher than the test grades. Students also revealed a greater interest in writing assignments when the writing assignment is based around science concepts. Student writing greatly improved, with students being more engaged in writing and writing more when the writing assigned was based on science concepts taught in class.

Conclusions

The data reveals that students enjoyed writing more when science content was the foundation for the assignment. I think it is also important to note that along with those writing assignments there were also hands-on activities that included tangible objects for

the students to work with and discuss. In addition to this Dr. Seuss's *The Lorax* (1971) was also a highly engaging story that the students thoroughly enjoyed. Based on Tomlinson's model of differentiation, interest plays a large part in engaging students in learning. Using this interest in science seemed to spark a new found love for writing that some of them did not realize could exist However, it should also be noted that using interdisciplinary lessons along with engaging learning activities also contributed to student enjoyment of writing in this project as well.

The fact that project grades were higher than science test averages for all but three students supports the conclusion that the RAFT project was a successful use of differentiation. When students were given a choice for their projects' format and an option to present it in a unique way that interested them, they excelled in its completion. The key thing to note is that all of the content requirements for the project were the same for all students, regardless of what format they chose. This content is the same content I would have included in a written test at the end of the unit, if I had chosen to assess student understanding in this manner.

The difference between a test for this unit and project was that I wanted students not only to create projects containing my required content, but also to learn from constructing the projects as well. It was my hope the projects would help students gain their own insights into the content of the unit through their completion. Indeed, the projects allowed the students to creatively present what they had learned in a format that they chose, instead of through a series of test questions that I constructed for them.

From the time it was assigned up to the date it was due, my students showed great enthusiasm for the RAFT project. Some even chose to give up their recess time to stay in

and speak with me about it. I would sit, with my lunch in one and hand and pencil in the other, and help students formulate ideas for their projects. I think my attentiveness to their interests and needs further enhanced their enthusiasm for the project. I was amazed at the results.

The students in this inclusion classroom responded well to the combination of differentiation and interdisciplinary strategies that were used in the classroom. Due to the nature of the assignments that were given throughout the unit, students seemed to have been more motivated to complete assignments while staying on-task. As a result of this willingness and increased motivation, students showed an improvement in their writing and science assessments.

Recommendations

I think it is important to always keep in mind student interests, readiness, and learning profiles when planning lessons and assignments. This is to ensure student engagement in the activity is maximized, and a child gets the most out of the learning experience. It should also be kept in mind that student interests can include the content, the nature and interactivity of the approach, and the element of choice. It is also important that teachers keep in mind students do not necessarily demonstrate their knowledge best with a paper and pencil test. Summative assessments that provide students with interesting options and are oriented more toward performance than recall can prove to be a great tool for assessment.

I am curious to see if this type of interdisciplinary, differentiated instruction would have been successful in any classroom, with any subjects and any participants. I am uncertain if students enjoyed this unit plan and the activities involved because I knew

that most of them had an interest in science. I wonder if this would work for a social studies unit or another subject. I also would like to explore using some of these strategies with English Language Learners. I would like to see if using interdisciplinary, differentiated instruction could help to improve their performance.

One thing I set out to determine, which I feel has gone unanswered, is if differentiation helped motivate students to complete assignments. Since all students did turn their RAFT assignment in, I would like to think it does, but I do not feel as if I have explored this question thoroughly enough. In relation to that, I would also like to see if differentiated instruction can help boost student self images and increase the value students put on learning. In other words, if differentiated instruction is successful and student grades increase, will students' self images improve?

REFERENCES

Beecher, M. & Sweeny, S. (2008). Closing the achievement gap with curriculum enrichment and differentiation: One school's story. *Journal of Advanced Academics, 19(3),* 502-530.

Cronin, D. (2003). *Diary of a worm.* New York: Scholastic Incorporated.

Ginsberg, M. (2005). Cultural diversity, motivation, and differentiation. *Theory Into Practice,44(3),* 218-225.

Jacobs, H. H. (1989). *Interdisciplinary curriculum: Design and implementation.* Alexandria, VA: Association for Supervision and Curriculum Development.

Kondor, C. (2007). *One size may not fit all, but the right teaching strategies might: The effects of differentiated instruction on the motivation of talented and gifted students.* Unpublished master's thesis, Portland State University, Portland Oregon.

Mastropieri, M., Scruggs, T., Norland, J., Berkeley, S., McDuffie, K., Tornquist, E., et al. (2006). Differentiated curriculum enhancement in inclusive middle school science: Effects on classroom and high-stakes tests. *The Journal of Special Education, 40(3),* 130-137.

Mills, G. E. (2007). *Action research: A guide for the teacher researcher* (3rd ed.). Upper Saddle River, NJ: Pearson.

McElroy, K. (2007, December 15). *Schools development authority.* Retrieved February 11, 2009, from http://www.njsda.gov/Archive/2007/12/12.15.07/nr_12.15.07.htm

Scruggs, T. & Mastropieri, M. (2007). Science learning in special education: The case for constructed versus instructed learning. *Exceptionality, 15(2),* 57-74.

Shepardson, D. & Britsch, S. (2006). Zones of interaction: Differential access to elementary science discourse. *Journal of Research in Science Teaching, 43(5),* 443-466.

Sondergeld, T., & Schultz, R. (2001). Science, standards, and differentiation: It really can be fun! *Gifted Child Today, 31(1),* 34-40.

Seuss, D. (1971). *The lorax*. New York: Random House Books for Young Readers.

Tobin, R. (2008). Conundrums in the differentiated literacy classroom. *Reading Improvement, 45(4),* 159-169.

Tomlinson, C. (2008). The goals of differentiation. *Educational Leadership, 66(3),* 26-30.

Tomlinson, C. (2003). Deciding to teach them all. *Educational Leadership, 61(2),* 6-11.

Tomlinson, C. (2005). *How to differentiate instruction in mixed-ability classrooms* (2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc.

White, R. (2006). Success for all is just a heartbeat away. *Science Scope, 30(4),* 61-63.

APPENDICES

APPENDIX A

Sample Consent Form

March 12, 2009

Dear Parent/Guardian:

My name is Laura Oliver and I am a graduate student in the Education Leadership Department at Rowan University. I am pleased to tell you that under the guidance of Mrs. Smith and Mrs. Gaetano I will be teaching in your child's classroom over the course of the next three months. As part of my master's thesis, I will be conducting a research project under the supervision of Mrs. Smith and Dr. Beth Wassell. The goal of the research project will be to determine how differentiation strategies affect student learning during a unit on recycling.

Throughout this unit, students will be doing hands-on science projects as well as some writing projects. I will be making copies of some student work and taking some field notes on students. Please note students names and the name of the school will not be disclosed in this study.

Your decision whether or not to allow your child to participate in this study will have absolutely no effect on your child's standing in his/her class. At the conclusion of the study a summary of the results will be made available to all interested parents. If you have any questions or concerns, please contact Mrs. Smith at 856-641-8502 ext 6559. Thank you.

Sincerely,

Laura Oliver

Please indicate whether or not you wish to have your child participate in this study by checking the appropriate statement below and returning this letter to your child's teacher.

___ I grant permission for my child _____to participate in this study.

___ I do not grant permission for my child _____to participate in this study.

_____

(Parent/Guardian signature (Date)

APPENDIX B

Sample Student Survey

Name: _____ Date: _____

Answer the questions below using the following scale:
1- too hard, frustrating! 2- about right for me! 3- waaay too easy!

1. How did you feel about the worm writing assignment we completed during our unit on recycling?

2. How did you feel about the commercial, advertisement and jingles we made in class?

3. How do you feel about your RAFT project?

4. How did you feel about the recycling centers you completed?

Answer the questions below using COMPLETE sentences.

5. Explain your answer to number 1. (For example, if you rated the worm assignment a 1, tell me why you thought it was too hard.)

6. Did you like having a choice between and advertisement, commercial, or jingle? Please explain why or why not.

7. Did you like having a choice with your RAFT project? Why or why not?

8. What was your favorite thing we did while learning about recycling?

9. The thing you liked least about our recycling unit was….. (and tell me why)

10. When writing assignments are given that involve science (our essay on saving the earth, The Lorax prompt, and the worm writing assignment) do you enjoy writing more than you usually do? Why or why not?

11. When science is used in other subjects (like math, social studies, reading, and writing) does it make you more interested in those subjects?

12. How did our bulletin board, and display of the worm writing/pictures make you feel? Did it make you more proud of your work than you usually would be? Why or why not?

APPENDIX C

Sample Worm Center Worksheet

Herman the Worm Center

1. Go to http://urbanext.illinois.edu/worms/

2. Answer the following questions in COMPLETE sentences on the paper provided:

- How many hearts does a worm have?
- Where do earthworms live?
- Do earthworms have eyes? Why are they sensitive to light?
- How do worms help the soil?
- How do worms eat their food?
- How do earthworms breathe?
- How did earthworms get to the US?
- What do you think would happen if all the earthworms disappeared?

APPENDIX D

Sample Math Center Worksheet

Math Center

1. Read the facts about recycling on the cards provided.
2. Complete the math problems below on a sheet of notebook paper.
3. You MUST show all of your work!!!!!!

Question 1: Mrs. Oliver started saving her newspapers six months ago. Her newspapers reach an amazing 24 feet in height. If Mrs. Oliver recycles all her newspapers how many trees will she be saving?

Question 2: There are 20 students in your class, how many diapers from this class are in landfills?

Question 3: How many feet of trash would Washington D.C. be covered in over the course of 10 years? 100 years?

Question 4: If Washington D.C. was 6 miles long, how many years would it take to cover that distance in trash? (HINT: There are 5,280 feet in a mile)

Question 5: The Empire State Building is 1,250 feet tall. After 80 minutes, how many feet high is the stack of cars?

Question 6: The Earth is about 221, 463 miles from the moon. How many miles would three months worth of beverage cans reach?

APPENDIX E

Sample Renewable and Non-renewable Center Worksheet

Renewable and Non-Renewable Resources

In a box are items that are renewable and non renewable resources. You have learned about these in class already. Renewable resources can be replaced over time and, if taken care of, will not run out. Non renewable resources are non living things that won't re-grow in time; they are found in a fixed amount. It is your task to separate the items into renewable or non renewable resources. The items in the bin include:

- picture of gas
- rocks
- piece of wood
- an apple
- Pictures of animals
- Paper
- Aluminum can
- Glass jar
- Rice
- Picture of coal

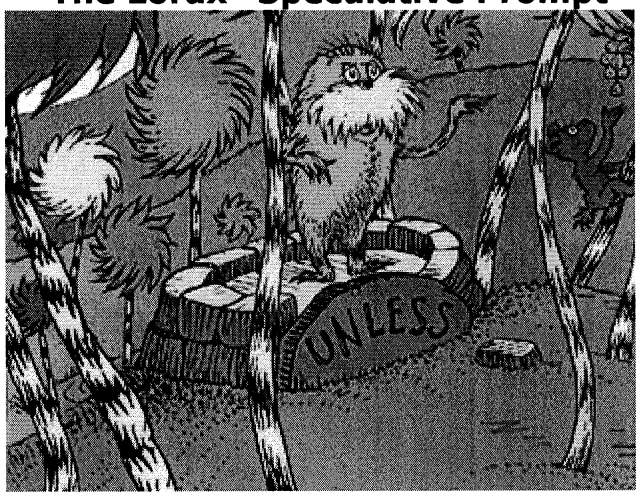
After you sort the materials in renewable and non renewable resources I would like you to write 5-6 sentences explaining how we can conserve resources in the environment, regardless of whether they are renewable or not.

APPENDIX F

Sample The Lorax Writing Prompt

Name:_____ Date: _____

"The Lorax" Speculative Prompt



The Once-ler threw the Truffula seed from his window into your hand. It is the last Truffula seed on earth. You catch the falling seed from the window and then.....