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Integrating Mathematics and Other Content Disciplines in the Elementary Classroom

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Integrating Mathematics and Other Content Disciplines in the Elementary Classroom

by

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Thesis submitted in partial fulfillment of the requirements for the degree of

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Abstract

Curriculum integration is a growing trend in education. Researchers look at integration to alleviate the demand on educator’s time to teach while still meeting all core standards, whether they are state standards such as the Utah Core Standards or other standards such as Common Core State Standards. For my honors project I looked at curriculum integration applied to the elementary classroom setting. Having researched integration examples and best practices I created three lessons that were taught during my student teaching. My lessons met all Common Core State Standards and Utah Core Standards. Through an action research qualitative study I reflected on my experiences with curriculum integration. I answered the following research questions: (1) What does research say about integration in the classroom? (2) Is it effective to integrate two or more subjects? (3) Is it a sensible venture? The lessons were observed and critiqued by a cooperating teacher and evaluation assessment data were collected and analyzed for all students in the classroom. I used a journal to reflect on my practices of integration and my personal experience. Themes from the teaching journal are shared.
Dedication

This thesis is dedicated to all of my professors who have helped me through the research. I would especially like to thank Dr. Deborah Byrnes, Dr. Janet Adams, and Katie Anderson for supervising this thesis.
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Introduction

With the Common Core State Standards comes a push to increase student’s reading, writing, and math skills. Proponents of the Common Core State Standards (CCSS) claim that it prepares students for college and to become a successful part of the work force (National Governors Association Center for Best Practices, 2010). Other content areas have not been included in this initial revamp to education. What happens to those subjects like: science, art, music, social studies, or physical education? Even before the common core, teachers felt that their time was stretched. As one researcher said, “Fitting in one more thing for teachers is like adding more pressure to a pressure cooker; before too long, something is going to burst” (Compton, 2002, p. 448). How do they get more time to meet learning demands? Physical education, art, and music were cut from every day or every other day to half an hour once or twice a week. With the common core, there are more demands on the teacher’s time. Teachers see the need to still address the other content areas but how? “These pressures... can be relieved by integrating learning experiences in an in-depth, holistic way” (Zhbanova, Rule, Montgomery, & Nielsen, 2010, p. 252).

The integration of multiple subject areas into a lesson or series of lessons offers one solution to this problem. Integration is not just for elementary schools; in fact it is found in almost all levels of education from kindergarten to graduate programs -- including medical school. Since even higher education programs, including some medical schools, consider it important, perhaps we should take a look at the integration process (Malik & Malik, 2011). In this thesis, using the information I learned about integration I will share my experience
with developing and teaching integrated curriculum in a third-grade classroom. First, however, I will provide a review of the literature.

Literature Review

What is integration? Some researchers define integration as two or more content areas taught in the same lesson, more complex in nature, and designed to simulate real life problems. Schleigh, Bossé, and Lee (2011) argue that you cannot take a science lesson, ask students to solve a mathematical equation and say it is an integrated lesson. Instead they state that:

Truly integrated instruction may begin with a problem scenario posed in either subject, pass through either subject in investigatory phases, and find a resolution in either subject all the while ensuring that neither subject is subservient to the other and that the level of content and conceptual coverage in both areas is at least commensurate with that which would be covered in standalone subject matter courses. (p. 3)

When approaching an integrated lesson, there needs to be a fluid mixture of subjects. They should come together to help the student gain a more conceptual knowledge of both subjects. In the past, teachers taught how they learned, typically by traditional methods (Schleigh et al., 2011). Schleigh, Bossé, and Lee knew that to get the integrated curriculum to the students, the teachers would need to be educated. They proposed that through professional development, teachers would be taught to integrate (Schleigh et al.).
Schleigh, Bossé, and Lee (2011) were not the first researchers to try integration and bring it to their students, in this case in-service teachers. Zhbanova, Rule, Montgomery, and Nielsen (2010) compared integrated curriculum to traditional curriculum in their study. Through their research they found the two methods of teaching were comparable but had their differences. Overall, their research supported integrated curriculum. The integrated lessons had more “meaningful learning,” were more “motivating” for students, and were more complex (Zhbanova et al., 2010). The students had more meaningful learning because they were making “personal connections, interdisciplinary connections,” and were making more decisions (p. 256). The students’ motivation increased due to the lessons’ demand of teamwork and teacher’s praise. The researchers found that teachers gave more personal, positive praise in the integrated lessons than the traditional lessons. The lessons were complex in that the students did not follow along with a teacher at the front of the room. The integrated lessons were more demanding for the teachers as well; they had to carefully prepare the lessons to teach all the subjects intended and connect smoothly. Less behavior management was required in the integrated lessons (Zhbanova et al.).

William Wraga (2009) became involved in integration when he was asked, “Since this is social studies, spelling doesn’t count, right?” (p. 88) by one of his students. He knew the students were not making connections between different content areas. The students saw each class as separate and did not apply to the others, even English. Rather than arranging curriculum to prepare students from grade to grade, Wraga proposes teachers work on a curriculum that connects between content areas in the same grade. Integrated curriculum will help give “attention to the connections between and among student’s
Integrating experiences in the curriculum, both vertically and horizontally” (Wraga, p. 92). Integrated curriculum “recognizes... that experience is integrated” and “social problems and issues transcend disciplinary boundaries” (Wraga, p. 92).

Wraga did not just give rationale for interdisciplinary curriculum, he offered different approaches such as: correlated curriculum, where subjects are separate but curricula and instruction share connections; fused curriculum, combines two separate subjects into a new course; and integrative core curriculum, real experiences are given and subjects taught when appropriate (2009, p. 92-93). Other researchers have also brought up different way to integrate including theme approach, horizontal approach, or interest based integration (Mustafa, 2011). The single-subject view of education is being pushed aside by researchers who want students to be prepared for real life experiences and problems.

To further benefit the students, Compton (2002) believed integration should also be used to teach social or personal skills that can be taught by studying history or other subjects. Social and emotional skills are crucial to help students become well rounded and well prepared for the world, but these skills are becoming lost in the classroom. Researchers, like Compton and Wraga, have studied integration as a way to prepare students for real life problems.

Even before the common core was developed, integration was being encouraged in public education, especially early childhood education, K-3. For example, in 1996, a study was done at Utah State University to integrate the arts with science. Kindergarteners learned about animals in the wintertime and used arts and crafts to display what they had learned. They participated in activities with the arts such as a “cave expedition,” where
they were able to describe what it looks like to see a bear hibernating and other things they would find in a cave. After the lesson the students were encouraged to write, draw, paint, do dramatizations, or even make a bird feeder (Dever, 1996). The different mediums allowed the students to share what they learned about the scientific subject while still using arts and crafts.

In 2005, a junior high school in Davis School District integrated math, English, science, and geography. Students created a “Mars Project” as they studied Mars in the different classes. In geography classes, students studied Mars and the landforms found on Mars. In science they studied how Mars compares to Earth. In math, they were given math that related to Mars, such as the longest trench compared to Earth’s, the temperatures of Earth compared to Mars, etc. In English courses they took the research from the other courses and were asked to write a paper on Mars. Students were given many opportunities to show what they had learned. They were able to connect subjects by bringing all of their research together for a paper where they were asked to explore the idea of humans on Mars, how would they survive, and the overall geography of Mars. They found answers in one class for questions asked in another. The connections crossed content areas and helped students make more connections with Mars and with research in different disciplines (Davis, 2012).

A more recent article discusses how a school in the United Kingdom is currently integrating math and physical education. By using pedometers, the students become aware of their steps and their overall activity while monitoring themselves. To integrate math, the students were asked to walk the length of England (their country) throughout the 4-week study. They had to calculate how many steps they had taken each day, and using the
conversion rate they were given they figured out how many of their steps made a mile and how far they had walked in miles (Birch, Duncan & Woodfield, 2012). The researchers found that the pedometers increased students’ awareness for their own health and caused them to be more active. They remained active at least four weeks after the study as well (Birch et al., 2012). The students had developed a personal connection with the exercise and overall health, which had a stronger impact than simply telling students to exercise. They were able to see the need for health changes for themselves and they developed and practiced mathematical skills.

The United Kingdom and the United State have not been the only countries to adopt integration. Greece turned to integration in their educational reform in the last decade (Chtysostomou, 2004). They looked for horizontal development and making connections. They wanted to help reform their education by making those connections. They wanted material to be taught so it was not fragmented and put into sections or classes but instead blend together.

Research in Curriculum Integration Rationale

In this literature review, I shared current scholarly views on integration. With the benefits of integrated education, some educators are shifting their views. That said, integration is not a new idea. In the United States alone, integration dates back as far as 1927 (Beane, 1996). Beane reminds current researchers that integration is built up by “giants from the past” (p. 6). Since 1931, educators and researchers have been pushing for integration. Integration was a major topic until the 1960’s. In 1960 the idea received less attention in educational circles until the 1990’s. Integration has now resurfaced as a direction for education (Beane, 1996). With the pressure to address so much content and
so many skills in the classroom, new researchers are yet again studying ways to bring a contemporary view to integration. I wanted to have my own experience with integration. Through developing and implementing integrated curriculum as a novice teacher I hoped to gain a personal view of the pros and cons of integration.

Methodology

Participant Selection

This action research was done during my student teaching in a third grade class in Davis School District. The school is a Title I school with over forty percent of the students receiving free or discounted lunch. In mathematics the class overall was excelling compared to other 3rd grade classes in the school. The class had twenty-three students from various backgrounds, three of which were ESL and two students who were in resource. There were 15 males and 8 females. Eight of the students were below average on reading and mathematics. Five or six students fall below grade level for math specifically. The homeroom teacher teaches mathematics, reading, and writing instruction in the classroom. In third grade at this school, different teachers teach science, social studies, health, music, physical education, and computers once a week.

The three lessons taught by myself for this thesis were math integrated with science, math integrated with social studies, and math integrated with language arts. The philosophy used by the homeroom (cooperating) teacher is a teacher-controlled classroom. My lessons are taught through student interaction and hands on experiences. I, as a student teacher, was required to follow the routine taught by the homeroom teacher. Math was taught with the direct teaching approach with behavioral management patterns set by the homeroom teacher. In the classroom if the needed gains were not made the teacher
works with small groups. Working with smaller groups follows the “Response to Intervention” program the school has adopted (Jackson, 2013). I followed this same model for her students.

Data Collection and Analysis

I taught three math lessons integrated with other subjects. Students were given a pre-assessment and a post-assessment measure to find growth through the lesson. The cooperating teacher observed the students for both participation and engagement. I kept a journal of experiences preparing and teaching the integrated lessons. My notes and the notes of the cooperating teacher were analyzed. Through this action research, I hope to answer if integrated lessons were a sensible venture and if the lessons were effective.

First Lesson- Math Integrated with Language Arts

The first lesson was language arts integrated with math. Students were taught the vocabulary for fractions using language arts. The math objective was for students to understand a fraction is made of a numerator and denominator, how they are made, and how to interpret them. For the language arts objective the students were to use reference materials, such as beginning dictionaries, or glossaries to help with spelling and using reference materials to clarify the definition of words. The objectives came from the Common Core State Standards or CCSS. A 14-question formal pre-assessment was given to students to gauge their prior knowledge of fractions (see Appendix A). All students had room for growth. The average on the pre-assessment was 6.9 points, with a range of 1 to 11. Through the pre-assessment the researcher found that the students did not understand concepts such as numerator and denominator, and were not able to interpret or create fractions.
The premise behind the lesson was to increase students’ vocabulary and through the vocabulary increase their conceptual understanding of fractions. The math vocabulary lesson was taught using language art methods to improve students’ vocabulary. Students were able to use challenge based spelling to guess how to spell the vocabulary words such as fraction, numerator, and denominator. Afterwards students were able to write the words and as a class they created definitions. For each definition the students used a glossary in a fraction booklet provided for the unit to help guide their definition. After they learned the definition the students were taught methods to remember and understand the definitions. Using symbols and hand signals, the students learned how to remember the meanings of the words. As they moved throughout the math unit they were able to refer to the definition and signals they learned in that first lesson. During the integrated math lesson students learned that the denominator stood for parts in all and the numerator stood for the parts being considered. The students were able to use these definitions to make and interpret fractions. After the lesson the students were given a post-assessment to gauge their learning. Twenty of the 23 students improved. The average increased to 10.2 points, with a range of 4 to 14. From pre to post-assessment, students improved by 3.9 points on average. In analyzing the data it was evident that the students that were struggling in math did not do as well as their excelling peers. Comparing pre and post-assessments was an effective way to determine which struggling students needed to work one-on-one with the researcher. They were re-evaluated by informally answering questions similar to the ones on the test. After the one-on-one lesson the students that were struggling made improvements as well.
Student engagement was an important part of integration and throughout the lesson this was monitored by both the cooperating teacher and myself. I planned opportunities for group responses, such as choral reading, whispering the answer in their hands then when asked to “release” saying the answer aloud as a class, and mirroring the teacher. The cooperating teacher took notes on my teaching and reported that individual response opportunities were frequent. She reported in her notes that students were asked questions and answered individually on the pre-assessment, assignments, and students were asking questions throughout the lesson. During the lesson, every student was engaged. Four of the students were asking questions, all twenty-two of the students were responsive during choral activities, and choral response, twenty students were answered individual responses at various times throughout the lesson, and all twenty-two students completed the assignment. When asked to write on the board or answer a question, the students were quick to volunteer. The cooperating teacher and I found the material effective for keeping students’ attention. The students were actively involved in the learning process. Looking at the content of the lesson, the gains the students made, and the student engagement I found the lesson effective.

Second Lesson- Math Integrated with Science

The second lesson was science integrated with mathematics. The objective was to teach students about craters and the forces created in the making of the craters (Young 2013). The math objective was to have students measure and estimate in grams (CCSS). Twenty students were present for the lesson. The lesson began with a 5 question pre-assessment (Appendix B). The average for the pre-assessment was 2.1, with a range of 0 to 4. All twenty students had room for improvement. The lesson focused on the moon, a
subject the students had been taught previously, and brought in the two new concepts. The beginning of the lesson opened the students to the science portion of craters and how craters are formed when an object hits the surface of the moon or Earth. They learned that the size of the crater depended on the mass of the object. The science objective for the integrated lesson was for students to study this force and determine if objects that were heavier or lighter would make larger craters. The math objective was to teach students to weigh items in metric units. During the lesson students would weigh items and practice weighing and writing in metric units.

Throughout the year the students had been taught about the moon. When they were learning about craters they were excited. Using the students’ excitement about the craters, they were introduced to weighing. By weighing each item and predicting the weights in grams they were able to see how much each item actually weighed in grams and how this weight correlated with the depth of the craters. The lesson used a hands-on approach. The students were to learn about craters by creating their own craters. They created the craters using different objects dropped in flour.

The students are not accustomed or disciplined to participating in independent practice like this activity. Observations made by the cooperating teacher and notes made in my own teaching journal indicate that it was a struggle for a few of the students to follow the instructions and answer the questions. They were required to work as a group to create the craters and work on the table provided (see Appendix B). Some students excelled at organization and leadership skills to get their group focused and finished. Two of the students preferred to not work with others. With more training and practice with
this type of hands on activities, it would most likely become easier for the students and the teacher.

At the end of the lesson students were presented with the same 5-question assessment. The average on the post-assessment was 4.6, with a range of 1 to 5. The average improvement was 2.6. Nineteen of the twenty students improved throughout the lesson (see Appendix B). The students improved not only in the math concept but in the science concept as well. The student that did not improve worked with the researcher to discuss what she missed and reworked the problems she missed.

Student engagement varied throughout the lesson. During instruction, the students were attentive and engaged as the researcher gave instructions and talked about craters. According to the cooperating teacher’s observation, three of the twenty students asked questions, nine of the students answered questions, eighteen of the students raised their hands to answer questions, and all twenty were doing choral responses. During the group activity only sixteen of the twenty students were engaged. The four students who were not engaged struggled with the group activity and without constant guidance or supervision became distracted. Most of the students were engaged at all times and did well with the group activity.

The lesson was effective. Despite the struggles, the students learned and improved. It was an effective addition to the moon unit and a great way to study how the object’s mass affects the impact differently. The students were able to make the correct conclusions without direct teacher involvement. The lesson was essentially what Zhabanova, Rule, and Montgomery stated, the students’ motivation increased due to the lessons’ demand of teamwork and teacher’s praise. There was little need for behavior
management when the students were engaged. To reuse this lesson, I would do more activities beforehand. I would teach teamwork and give the students more opportunities to be successful with independent or group assignments.

*The Third Lesson- Math Integrated with Social Studies*

The last integrated lesson was math integrated with social studies. The objectives were to teach the major ecosystems while learning what fractions of the continents these ecosystems cover. The students were unfamiliar with ecosystems. Twenty-one students were present for the lesson. The students were given a 5-question pre-assessment (see Appendix C). The average for the assessment was .3 points with a range of 0 to 1. All students had room for improvement. The lesson allowed students to access background knowledge with pictures of each ecosystem. Then as they brought up their own knowledge they were able to make connections to the new material. Students were shown images that describe the ecosystem, such as plants or animals found in that ecosystem. Students were asked what other plants or animals can be found in that ecosystem. They were then asked to draw conclusions about the ecosystem, which were supported or disproven throughout the lesson. The conclusions were about climate or location. For example, when they discussed tundra, students saw images of polar bears, penguins, white jackrabbits, or grizzly bears. They were able to conclude it must be cold in this climate because all the animals have fur to help them keep warm. When each ecosystem was discussed students were asked on which continents they could find each ecosystem. In the example they were able to predict that the tundra is located at the top of Asia, Antarctica, and North America where it is cold and these animals are found. As they learned where each ecosystem was
located, they filled in the map with the correct fraction. This lesson was more lecture based, the researcher used direct instruction.

This lesson was an effective way to teach students to draw on background knowledge. They had never heard the terms for the ecosystems but with some guidance, the students understood that they knew a lot about ecosystems. When the students saw pictures of the different things that inhabit the ecosystem they were able to draw on their background knowledge. If a squirrel lived in the forest, then maybe a bird lived in the forest since they lived in similar environments. They were also able to predict the types of plants in the ecosystem, for example squirrels and birds would need trees to survive and trees were found in the forest. This lesson helped students to have a visual representation. They were able to use a map to illustrate the proportions of the different ecosystems. The visual representations helped many students. The students responded well to filling in the map themselves, rather than just looking at a map already filled in. After the lesson, the students were given the same questions in a post-assessment. The average for the post assessment was 4.6, with a range of 2 to 5.

As indicated by the cooperating teacher’s observation, engagement was evident in this lesson. As I presented the students with the pictures of the items found in the ecosystem, students were eager to answer. Eighteen of the twenty-one students were answering questions throughout the lesson. When I asked students to predict the fractions of the ecosystems it was initially difficult to get student responses. I began to incorporate different engagement strategies. By drawing sticks with the students’ names, students were engaged and prepared for their stick to be pulled. Names were replaced so students
could be called on repeatedly, keeping students engaged. This strategy helped keep all twenty-one students engaged, according to the cooperating teacher.

Overall the lesson was effective. The students made improvement, they were engaged, and they learned. The material was advanced for an hour lesson. The cooperating teacher critiqued it as “too much material for one lesson. It would be better to break it up into two lessons.” Though the students were following along, there was a lot of the material that was new and confused some students. It helped students strengthen the social studies while using math concepts they were familiar with. This lesson would be a great supplement to a unit on ecosystems, but as it is written it would need to be adapted.

Journal Analysis

Was the integrated lesson sensible? Using my journal I documented my experience with integration. I reread my journal entries looking for common themes through the thoughts and feelings about my experience with integration. I found certain strengths and weaknesses of integration to be recurring themes throughout the journal. These are discussed below.

Strengths

In all three lessons, the researcher used a topic the students were familiar with to introduce the new subject. By using something the students were comfortable with or interested in, the students were willing to learn the new material. In the fractions unit, the vocabulary was used to help the students learn fractions. In the science-integrated lesson, the students had previously studied the moon, adding the measurement and study of force using the moon was beneficial. In the social studies lesson, the researcher used fractions to
Introduce the idea of ecosystems. Integrating a new subject with something the students already knew helped the students transition into the new material. An example journal entry regarding this theme is: “There was a lot of stress making sure they understood both topics... It was great that way. When I asked them what the denominator means, they knew it was the total number of pieces in the whole and that it was found in the bottom. It was a great way to introduce fractions.”

The researcher found that particular subjects were easy to integrate. During the creation of the language arts and math lesson she found that, the “lesson flowed well.” It seemed “natural to teach the students the vocabulary extensively before learning the rest of the material.” After students understood what the words meant, they were able to understand fractions. The techniques were language arts based and helped the students practice their language arts skills while learning the math concepts. The science and math integrated lesson were also well blended. The science and math did not overpower each other. The resources were “easy to gather and the lesson flowed well.” The beginning of the lesson drew from the students’ background knowledge of the moon. Using the moon as the subject, bringing in gravity and measurement helped students create their own craters. The science and language arts were easy to integrate with mathematics.

The researcher described the lessons as “a great way to incorporate and expand on math concepts.” During the fraction unit the researcher took materials provided by the district and integrated language arts to build more knowledge for the students (Bowers et al., 2013). By giving the students “real experience” with measuring, integration helped students understand that they will use measurement. The science lesson provided
students with actual objects they were able to hold and touch in order to measure them and predict their weights, rather than just observe the teacher doing the experiment. The items were important, not just a simple math assignment. For the social studies lesson, the map allowed the students to visually see the ecosystems and how much of the earth they cover. Using integration helped expand and build on a pre-existing concept and teach a new concept.

**Weaknesses**

Keeping the content areas from overpowering each other was difficult for me. For example, I wrote in my journal, “The science and math lesson were easy to let one concept overpower the other. I could have made the whole lesson about weighing different items and their weight on the moon. I could have made the whole lesson on the moon and ignored weighing the items. It took time to find the balance between introducing metric weight and craters.” It meant keeping each lesson simple and not going too in depth in either area. In the language arts lesson, keeping the definitions simple was difficult but necessary. Using a dictionary such as Merriam-Webster would have given a technical definition. The students would need a simple, functional definition. Using the fraction booklet definition helped have the definitions on a 3rd grade level. In the science and math lesson, I was careful to keep the two concepts present and make a math lesson with some science or a science lesson with math. In the social studies lesson, the researcher could have “spent a whole lesson teaching the ecosystems.” Instead I had to balance the two concepts. Both concepts were taught and could be completed separately or together.

The lessons required planning and resources. The science and language arts lessons did not require specific resources and were easier to put together. The materials could be
brought in from both content areas. The social studies lesson was difficult for me. To integrate the ecosystems I wanted to use fractions and show the students what fraction of the earth were each ecosystem. The map required did not exist. I had to create a map. In my journal I recorded my struggle, “I searched for hours trying to find a map of the world divided into fractions. After I gave up, I took a map from a free website and had to figure out the fractions of ecosystems on each continent then divide the map into the corresponding fractions. It was more work than I originally planned, but I was still able to accomplish the task.” I had to find a way to make the lessons integrate. For all three lessons I had to know where the lesson was going and how I was going to help students get there. An integrated lesson requires content knowledge on the educator’s part.

Though the science and language arts lessons were easy to integrate, the social studies lesson was a challenge to integrate. I had difficulty finding a standard for social studies. During the preparation the original objective was to correlate time and map skills allowing the students to plan their own field trip using maps and providing exact times. The cooperating teacher decided that lesson would be too difficult for the students. To accommodate, the researcher changed the lesson to map skills and fractions. The students would fill in a map with fractions. Originally time and social studies were to be integrated, but after hours of planning, it would not work. Next, I was going to combine map skills with fractions. The map skills that would most easily correlate with the math concepts were not in the 3rd grade curriculum. Finally I combined fractions with ecosystems. I found that I could not just choose two concepts and integrate them together.

In this study I found that the integrated lesson went longer than expected. I planned for 40-minute lessons, but the lessons ended up being an hour. The time went faster and as
documented in my journal, “there was a lot of stress making sure they understood both topics.” When integrating two subjects, it may take more time to teach the lesson than originally planned especially when covering two broad topics.

Conclusion

For decades educators have been trying to find solutions for time demands in the classroom. Researchers have looked to integration. There are many benefits and concerns with integration. Using the practices I learned through the literature review, I created three integrated lesson. Through my experience with integration I wanted to answer the question if integration was sensible and effective? I learned that some subjects were easier to integrate. I also learned the benefits and struggles of creating integrated lessons. Overall, the creation of the lesson was not impossible or unreasonable. The students were able to improve and stay engaged through the lessons. The integrated lessons were effective. Through my experience and research, I would conclude that integration was sensible and effective.
References:


Appendices

Appendix A

*First Lesson: Pre-assessment*

1. John had a pizza with 8 equal slices. He ate 1 of the slices. Which fraction shows how much John ate?
   a. 1/8
   b. 2/8
   c. 2/6
   d. 6/8

2. Sam’s mom baked 12 cupcakes. He saved 1/3 of them to share with his friends. How many cupcakes did he save?
   a. 2
   b. 3
   c. 4
   d. 6
First Lesson: Pre-assessment - Here are a few problems found on the pre-assessment. The pre-assessment was provided from Davis School District. Through the pre-assessment the researcher found the areas that the students struggled with.
## First Lesson: Lesson Plan

<table>
<thead>
<tr>
<th>Lesson 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject:</strong> Math</td>
</tr>
<tr>
<td><strong>Number of students:</strong> 23</td>
</tr>
<tr>
<td><strong>Time:</strong> 20 minutes</td>
</tr>
</tbody>
</table>

### Core Objectives:

**Math**
- CCSS.Math.Content.3.NF.A.1 Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.

**Language Arts**
- CCSS.ELA-Literacy.L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.
- CCSS.ELA-Literacy.L.3.4a Use sentence-level context as a clue to the meaning of a word or phrase.
- CCSS.ELA-Literacy.L.3.4d Use glossaries or beginning dictionaries, both print and digital, to determine or clarify the precise meaning of key words and phrases.

### Rationale:
Students will encounter fractions in their daily life and need to know how to read and interpret fractions in cooking, reading, statistics, and other areas of life.

### Objectives:
- Students will know the definition of a fraction.
- Students will know the definition of a numerator.
- Students will know the definition of a denominator.

### Resources:
- Fraction booklet (From the District) pages 1-6
- 3” by 3” squares (you will need 5 per student, plus a few extra for mistakes)
- Vocabulary Notebooks
- Lined paper (if you do not use the notebooks)

### Procedures:

#### Pre-assessment:
- Unit pre-assessment

#### Launch:
- Who has heard of a fraction before?
- What does “fraction” mean?
- What are the two parts of a fraction?

#### Lesson:
- Pull out their vocabulary notebooks or papers.
- Let’s focus on the word fractions. Say it with me.
  - Let us clap it out. “Fractions.”
  - How do you think we spell fractions?
  - What do you think fraction means?
    - Can you give me some examples?
    - Can you give me non-examples?
    - What is it like?
- Now let’s look at the word numerator. Say it with me.
  - Let us clap it out, “num-er-a-tor.”
  - How do you think we spell numerator?
  - What do you think numerator means?
    - Can you give me some examples?
    - Can you give me non-examples?
    - What is it like?
- Now let’s look at the word denominator. Say it with me.
  - Let us clap it out, “de-nom-in-a-tor.”
  - How do you think we spell denominator?
  - What do you think denominator means?
    - Can you give me some examples?
    - Can you give me non-examples?
What is it like?
Now I am going to give you a book that will see if our definitions are right.
Read the first part of the book- write each definition on page 2.
Page 3- Show examples of fractions and non-examples. Talk about how it needs to be equal sized pieces. Have them draw their own fraction.
Now have them draw their own non-example. Have them write why this is not an example of a fraction.
Talk about a "set." Show a set of things up on the board. (ex: 6 dice- 2 are red, 1 is blue, 3 are green) As a class write fractions to show what fraction are red or what fraction are blue, etc.
Pages 4-6- Pass out colored squares.
Fold squares into fractions. Label each fraction.
Talk about the denominator shows how many pieces. Write halves up on the board. Talk about how that is two pieces.
Demonstrate folding the square in half so they have two pieces.
Repeat for thirds, fourths, sixths, and eighths.
Closure:
What did we learn today?
Put up a fraction example- is this a fraction? What is the numerator? What is the denominator?
Put up a fraction non-example- is this a fraction? Why not?
Put your thumb on your chin, wiggle your thumb if you can write a fraction. Wiggle your thumb if you can point to the denominator and numerator.
Accommodations:
Student A - Work with him alone while the other students are working.
ESL students- Speak slowly, have them work with a partner who will know what to do.
Assessment:
Ability to answer examples, and closing questions
Wiggle thumb
Unit Post-assessment

First Lesson: Lesson Plan- The lesson plan used for the first lesson required a unit pre and post assessment to help gauge students level of understanding. The lesson plan shows the researchers plans for the lesson.
First Lesson: Post-assessment

1. Chris had a pizza with 8 equal slices. He ate $\frac{3}{8}$ of the slices. Which fraction shows how much Chris ate? (NF1)
   
   a. $\frac{3}{5}$  
   b. $\frac{3}{6}$  
   c. $\frac{3}{8}$  
   d. $\frac{5}{8}$

2. Tom’s mom baked 16 cupcakes. He saved $\frac{1}{4}$ of them to share with his friends. How many cupcakes did he save? (NF1)
   
   a. 2  
   b. 3  
   c. 4  
   d. 8
First Lesson: Post-assessment- These are selected questions taken from the post-assessment given to the students. This assessment was designed by Davis School District and used to gauge student improvement.
Appendix B

Second Lesson: Pre-assessment

Name: 

1. What is a crater?  
   a line that is the 
   some on the edge line  

2. What does g stand for in measurement?  
   
3. Estimate the weight of a marble in grams:  
   
4. Estimate the weight of a book in grams:  
   
5. Which made the bigger crater, heavier or 
   lighter objects?  

Name: 

1. What is a crater?  
   a space record  

2. What does g stand for in measurement?  
   
3. Estimate the weight of a marble in grams:  
   
4. Estimate the weight of a book in grams:  
   
5. Which made the bigger crater, heavier or 
   lighter objects?  

Second Lesson: Pre-assessment- The pre-assessment was made up of 5 questions to gauge students’ understanding of both the science and math concepts. The pre-assessment was created by the researcher specifically tailored to this lesson.
Second Lesson: Lesson Plan

Science/Math Lesson

Unit: Moon
Title of Lesson: Creating Craters
Grade Level: 3
Subject: Math/Science
Number of students: 23-30
Time: 30 minutes

Core Objective:
Math:
CCSS.Math.Content.3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).

Science:
Standard 3 - Students will understand the relationship between the force applied to an object and resulting motion of the object.

Objective 2 Demonstrate that the greater the force applied to an object, the greater the change in speed or direction of the object. Predict and observe what happens when a force is applied to an object (e.g., wind, flowing water).

Rationale:
Students need experience weighing items on a scale.

Objectives:
- Estimate weights in grams or kilograms.
- Weigh objects using a scale in grams or kilograms.
- Predict the effect of different weights when dropped from the same height.

Resources:
- Video about craters: "Space Science- A Closer Look at the Moon" (4:50-7:05)
- Paper clips
- Book (for weighing)
- 6 Scales (1 per table)
- 6 bins (about shoebox size)
- 10 lbs of flour (Some in the bottom of every shoebox)
- 4 objects (X6, enough for 4 items for each table, each table will have the same items)
  Marble, dice, eraser, and blue stone
- Rulers [cm rulers]
- 6 cups (for students to weigh items such as marbles without them rolling)
- Pre-assessment sheet
- Recording Sheet

Procedures:
Pre-assessment-
Give each student the pre-assessment. Tell them to write their name on the paper.

5 questions:
1. What is a crater?
2. What does a g stand for in measurement?
3. Estimate the weight of a marble in grams.
5. What would make a bigger crater, heavier or lighter objects?

Lesson-
Rules:
1. Scales do not leave the table.
2. We do not throw materials.
3. Flour stays in the bucket.
4. We do not eat it, blow it, or throw it.

We have been talking about the moon in science. Today we are learning about craters. Who can tell me what a crater is? We are going to watch a video that talks about craters. Watch 2 minute video.

Who can tell me what a crater is?

How are they formed?
Where can they be found?

We are going to make our own craters. In the video it talked about how different sizes of meteors or asteroids made a different size crater. We are going to use different sized items to make a crater.
We are going to use the scales and items at your table to help us.
Who can tell me what a gram is?
A gram is a unit of measurement.
Have you heard of an ounce?
In Science we use what is called the metric system to measure.
To think about how much a gram is, I want you to think of two paper clips. (Raise two paper clips).
If I asked you how much a piece of paper might weigh in grams, I want you to think how many paper clips equals one sheet of paper. What are your guesses or estimates?
(Write them on the board). Now I am going to weight the paper to see how much it weighs. It weighs... Let’s look at our guesses. Oh, they were right/wrong. It’s ok.
Let’s guess again. What if I asked you how many grams this book weighs? Hmm... It’s probably a lot of paper clips. Let’s guess high, about 150 grams? Let the other students guess. Now measure it.
You are going to work as a group, but each of you need to fill out your own paper.
When I say go you will open your baggie. Write down each item, the marble, etc.
Then guess the weight in grams (remember the two paper clips).
Next you will need to pull out the red cup and put it on the scale.
Then turn on the scale. Measure each item. Remember to record each item!
Then you will put the ruler into the flour and drop the item from the top of the ruler (only 30 cm, not above the ruler).
Lastly, you will measure each crater and answer the questions

Closure:
Did heavier or lighter items make bigger craters?

Accommodations:
Using microphone for students with hearing disabilities.
Simplified assignment (fewer objects) for students, if needed.
Working in groups for students who need extra help.
ESL - video goes over vocabulary.

Assessment:
Pre-assessment
Ability to answer examples
Thumbs up, thumbs down on understanding
80% accuracy on worksheet (4/5)

Second Lesson: Lesson Plan - This is the science and math integrated lesson plan. It was an original lesson by the researcher.
Second Lesson: Post Assessment

<table>
<thead>
<tr>
<th>Object</th>
<th>Estimate weight</th>
<th>Actual weight</th>
<th>Crater depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>the fun thing</td>
<td>15</td>
<td>14</td>
<td>2 cm</td>
</tr>
<tr>
<td>the little thing</td>
<td>8</td>
<td>8</td>
<td>1 cm</td>
</tr>
<tr>
<td>dice</td>
<td>59</td>
<td>69</td>
<td>3 cm</td>
</tr>
<tr>
<td>ala ala ala</td>
<td>2</td>
<td>2</td>
<td>a hate</td>
</tr>
</tbody>
</table>

Which made the bigger crater, heavier or lighter objects?

The dice was the bigger.

Were your predictions right?

I right and the rest rogue

What is a crater?

A hole in the moon

What does g stand for in measurement? grams

Estimate the weight of a marble in grams: 8

Estimate the weight of a book in grams: 230
### Recording Data

<table>
<thead>
<tr>
<th>Object</th>
<th>Estimate weight</th>
<th>Actual weight</th>
<th>Crater depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>marble</td>
<td>5 g</td>
<td>2 g</td>
<td>half cm</td>
</tr>
<tr>
<td>dice</td>
<td>5 g</td>
<td>5 g</td>
<td>1 cm</td>
</tr>
<tr>
<td>circle</td>
<td>10 g</td>
<td>14 g</td>
<td>1 half cm</td>
</tr>
</tbody>
</table>

Which made the bigger crater, heavier or lighter objects?

__circle__

Were your predictions right?

__som__

What is a crater?

__a bowl in the Moon__

What does g stand for in measurement?

__gram__

Estimate the weight of a marble in grams: __7 g__

Estimate the weight of a book in grams: __2 kg__

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**Second Lesson: Post-assessment** - Using the same questions as the pre-assessment, the researcher was able to gauge student growth.
Appendix C

Third Lesson: Pre-assessment

1. What are the major ecosystems?
2. What continents have a desert?
3. Describe a Tundra.
4. What type of animals would you find in the forest?
5. What fraction of Europe is mountains?

Third Lesson: Pre-assessment - The pre-assessment was put on the doc-cam and the students were asked to answer the questions on a sheet of paper. The pre-assessment was created by the researcher.
Third Lesson: Lesson Plan

Social Studies/Math Lesson

Unit: Map
Title of Lesson: Map Fractions
Grade Level: 3

Subject: Math/Social Studies
Number of students: 23
Time: 30 minutes

Core Objective:
Math:
CCSS.Math.Content.3.NF.A.1 Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.

Science:
Objective 2
Describe how various communities have adapted to existing environments and how other communities have modified the environment.
1. Describe the major world ecosystems (i.e. desert, plain, tundra, grassland, mountain, forest, wetland).

Rationale:
Students will use fractions in their life.
Students will need to understand ecosystems and where they can be found.

Objectives:
Students will understand where ecosystems are located on the globe.
Students will be able to use a map.
Students will be able to make fractions.

Resources:
Global Map Sheet
Crayons
Instruction sheet
Ecosystem PowerPoint

Procedures:
Pre-assessment:
What are the major ecosystems?
Where can you find deserts?
Where can you find tundra?
What type of animals would you find in the forest?

Lesson:
Who knows what an ecosystem is?
An ecosystem is a place for specific plants or animals.
For example: when you think of the desert what do you think of?

Desert: Orange
It’s hot and dry.
There are animals such as coyotes, rabbits, lizards, snakes, and vultures.
There are plants such as cacti and flowers.
There is sand and no grass, etc.
 Covers 1/3 of Africa (find Africa and color 1/3), 1/2 of Australia, 1/8 of Asia, 1/6 of South America, and 1/10 of North America.

Let’s talk about the other ecosystems.

Forest: Green
Forests are cooler than deserts.
Forests have different animals such as deer, birds, chipmunks, etc.
Forests have trees, such as coniferous trees (pine trees) and deciduous trees (trees that lose their leaves).
There are tropical forests as well.
Covers 4/10 of North America, 1/4 of Australia, 1/2 of Europe, and 1/6 of South America

Plains/grassland: Yellow
Plains have lots of grasses and shrubs.
Very flat area, no mountains.
Animals include: elephants, lions, birds, etc.
Covers 1/3 of Africa, 1/6 of South America, 1/4 of Australia, 2/10 of North America, and 1/8 of Asia.
**Tundra:** *Blue*
- Cold, in the north.
- Always covered with snow and ice.
- Too cold for many plants.
- Animals include: arctic fox, caribou, ducks, bears, snowy owl, etc.

*Covers 1/10 of North America, 1/8 of Asia, and 1 whole of Antarctica.*

**Mountain:** *Brown*
- Elevated land.
- Usually cooler than plains, etc.
- The very tops of mountains do not have trees.
- Typically have a forests on the mountain.
- Animals- similar to forest.

*2/8 of Asia, and 2/10 of North America, and 1/2 of Europe.*

**Tropic:** *Bright color like purple*
- Warm, humid.
- Can have forest- like rainforest.
- Lots of water, birds, trees, etc.

*1/3 Africa, 3/6 of South America, and 1/8 of Asia.*

**Wetland:**
- Lots of water- swamps, marshes, or bogs.
- Animals include: frogs, reptiles, crocodiles, platypus, and fish.
- Plants include: Algae, moss, seagrass, trees, shrubs, lily pads, etc.

*Closures:*
- What are some ecosystems?
- Where can you find desert?
- What animals can you find in the forest?

*Accommodations:*
- Using microphone for students with hearing disabilities.
- Simplified assignment (fewer objects) for students, if needed.
- ESL- Working in groups for students who need extra help.

*Assessment:*
- Pre-assessment
- Thumbs up, thumbs down on understanding
- 80% accuracy on worksheet (8/10)

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**Third Lesson: Lesson Plan**- An original lesson plan created by the researcher. Integrates social studies and math.

**Third Lesson- Post Assessment**
Integrating Mathematics in the Elementary Classroom
Third Lesson: Post-assessment- During the lesson the students created their own map. The first map was the teacher's copy. The map was found from Super Teacher Worksheets and adapted by the researcher with fraction lines. They were assessed by their ability to answer questions and their ability to complete the map.
Author Biography

Jessica Billingsley grew up in Bountiful, Utah. She graduated from Bountiful High School and lettered in academics. She received the Presidential Scholarship and Research Fellowship at Utah State University. She attended Utah State University as a 2nd generation Aggie following both her mother, Renae, and her father, Steve Billingsley. She is studying Elementary Education. She is a member of the Honors Society and will graduate in Spring of 2013. She hopes to attend graduate school and pursue a masters and doctorate.