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Using a multi-sensory teaching approach to impact learning and community in a second grade classroom

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USING A MULTI-SENSORY TEACHING APPROACH TO IMPACT LEARNING AND COMMUNITY IN A SECOND GRADE CLASSROOM

by
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Abstract

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The purpose of this study was to examine how multi-sensory education impacts learning and community in a second grade general education classroom. Lesson plans that targeted multiple senses – and oftentimes included team-building activities - were developed and implemented in the classroom. Qualitative data was collected through interviews, focus groups, student work, and a teacher research journal. After analyzing the data, it was revealed that multi-sensory education can lead to student motivation and engagement, as well as provide a generative space for the use of technology and making connections to the outside world. Multi-sensory education can also help teachers to access students' needs and aid in fostering a positive classroom environment. Finally, using a teaching approach that targets the senses promotes the development of a student-centered classroom, and can encourage students, who may have been silent within traditional classroom settings, to emerge and have a voice within the multi-sensory classroom. Teaching through multi-sensory methods has enormous implications for new teachers, such as this teacher researcher, who are seeking ways to actively and meaningfully engage students within the classroom.

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Chapter I

Scope of the Study

Introduction

"Kindergarten?" I asked my field partner incredulously. *"Kindergarten?* How are we supposed to teach science to *kindergartners*?" I asked, emphasizing the "kindergarten" part. It was the fall of 2009 and my Collaborative Education cohort had just received our junior field placement assignments. As part of the field assignment, we were required to teach a science mini-unit. I was frantic. There was no way I could teach five year-olds about chemistry or physics or biology. In fact, as I tried to remember back to my own kindergarten experiences, I could not even remember being taught science at such a young age. What were we going to teach? And, how were we going to get the students to grasp the concepts? I had a feeling I was being set up for failure.

Nevertheless, my field partner and I, being perfectionists, began working hard to create a "close-to-perfect" science lesson regarding the properties of matter. Oftentimes we would run to each other with "great" ideas, only to remember that we had one major limitation: most of the students in the class were just learning to read and write. As the day of our lesson loomed closer, I felt my blood pressure rising. *How were we ever going to pull this off?*

Just about one week before our lesson was to be conducted, my field partner and I finally got an idea. As part of our field assignments for the semester, we had to create and implement an interactive bulletin board in our classroom placement. We decided it might be fun to incorporate the bulletin board into our lesson plan: and so it began. The next

thing I knew, we were gluing felt onto the tri-fold board that would act as our bulletin board.

In an attempt to teach students the difference between solids, liquids, and gases, we pulled together real-life items that would represent each property of matter. For instance, we used a pencil to represent solid, a juice box to represent liquid, and a balloon to represent gas. We collected enough items so that every student in the class would have one object, and then we placed Velcro onto each. We divided our felt board into three columns and labeled them "solid", "liquid", and "gas."

On the day of our lesson, I was worried it would be a failure. The properties of matter, particularly the property of gas, can be extremely tricky concepts - especially for kindergarten students. But soon enough, we had to begin. My field partner and I began by discussing each property of matter followed by a think aloud as we sorted pictures into the categories of solids, liquids, and gases. We purposely made mistakes and asked the students if they agreed. It was not too long before the kindergarteners appeared to be grasping the concept.

Then, the moment of truth arrived. My field partner and I each selected one Velcro item and modeled how to decide which category the item should be placed in on our makeshift bulletin board. Next, we began calling up students. Each student selected an item, placed it in one category on the bulletin board, and then explained to the class why the item belonged in the selected category. I looked out at the class; all of the students were eagerly waving their hands around in hopes of being called up next. The entire classroom of kindergartners appeared to be engaged in our lesson and seemed to listen to one another. I was shocked – regardless of ability level, students took their turns

and correctly categorized their selected item. The lesson I had spent so much time worrying about was a success!

Although I was elated after this small victory, I was soon pondering *why* the lesson appeared to be so successful. As student after student correctly categorized the objects on the bulletin board, I had begun to think that I could actually be a good teacher. I wanted to hold onto that feeling, and to do so, I needed to understand how this triumph arose. Finally, it hit me. I did not know how I could not have seen it before. This was an area of teaching that I had been interested in for quite some time. We had provided the students with instruction that was not only interactive, but appealed to a variety of senses. The students had to listen, look at visuals, and touch objects.

I was startled. I had just completed my first multi-sensory lesson and I barely realized it! *"Wow,"* I thought, *"If multi-sensory education has this potential, should it be implemented more?"*

To answer this question, I decided to conduct an online search for information about multi-sensory education. I soon discovered a variety of available research – all validating the positive impact of utilizing the senses in learning. It appeared that my hunch about multi-sensory instruction was backed by educational research.

Purpose Statement

State and national accountability standards pressure many districts and teachers to gear instruction towards the test. This results in the elevation of some subject matter over others. In an effort to provide students with the necessary information to pass standardized tests, teachers often turn to lecture style teaching methods to the detriment of interaction and activity (Gaus & Simpson, 2009). Many classrooms are becoming

teacher-directed rather than constructivist (Skoning, 2010). Multi-sensory education is a way for teachers to incorporate both academics and interaction within student-centered lessons that will successfully educate and prepare students for future testing.

Research shows that students perform statistically better on standardized achievement and attitude tests when they are taught and/or tested through a method that appeals to their individual learning style (Kritsonis, 1997/1998). Multi-sensory education focuses on a variety of teaching strategies that appeal to different types of learners. The process allows more neural pathways in the brain to become stimulated as a range of senses are utilized (Christie, 2000).

By teaching through multiple senses, teachers are ensuring that students who learn through visual stimulation, auditory stimulation and movement are all being addressed and reached (Christie, 2000).

There are strong correlations between multi-sensory education and brain research. Scientists have found that permanent memory is stored in the form of imagens, which are composed of mental images, smell, taste, and kinesthetic sensations (Ewy, 2003). Additionally, our memory system is based on cues related to location. Every life experience is in some way related to the context of the situation. This means that all learning is connected to sight, sound, smell, location, touch and emotion that help to provide contextual cues for memory recall (Jensen, 1998). Hence, learning through the senses is more likely to create lasting memory.

To assist students in memory recall and learning, a wide range of teaching methods including the materials used, grouping, field trips, guest speakers, games, student teaching, and multi-age projects should be considered. Additionally, it is

important to change the décor of the classroom walls every two to four weeks to stimulate students visually and create a comfortable classroom environment (Jensen, 1998). Finally, it is necessary that instruction target both affective and cognitive engagement. Students should feel motivated and enjoy learning (affective engagement), but also be able to understand the content and skills of the material, discuss the material, and make meaning out of the information (cognitive engagement) (deWet, 2006). It is possible to achieve both styles of learning by creating interactive lessons that appeal to all learners through their senses.

Simply put, the brain is hardwired to learn through the senses. About 80% of the information the brain intakes is visual (Wilmes, Harrington, Kohler-Evans, & Sumpter, 2008). Additionally, infants develop auditory language through hearing adult speech. Furthermore, movement is linked with academic success. Innovative teachers will be able to find creative ways to incorporate all elements of the senses into effective academic lessons that will benefit all learners cognitively, emotionally, and physically (Jensen, 1998).

Statement of Research Problem and Question

In a world of high-stakes testing and the 2001 implementation of No Child Left Behind legislation, teachers are struggling to help their students make the grade. Oftentimes the emphasis on the standardized test subjects of reading, writing, mathematics, and science leads to the diminishment – or even elimination – of untested subjects such as social studies, art, music, and physical education.

Classrooms are becoming less interactive as teachers most frequently lecture students on the necessary material and provide worksheets to drill content. In the pressure

of getting students prepared for end-of-the-year standardized testing, many teachers have eliminated the creative presentation of material. Students no longer create paper mâché volcanoes to demonstrate eruption and destruction. Programs, such as Everyday Mathematics and certain reading programs including the Science Research Associates Reading Mastery Program (SRA), are becoming so scripted that teachers are simply reading out of a book to the class. Meanwhile, the students who do not excel when material is presented in a lecture-format are sadly, and ironically, being left behind. Personally, I can remember back to my own educational experiences, and recall the number of times I felt lost and frustrated as a teacher lectured the classroom. Students learn differently and many need more interactivity, movement, visual demonstration, and excitement. Artistic disciplines – such as music or the visual arts - should also be utilized in classrooms to maximize opportunities for all students to learn.

Based on these concerns, my question becomes: *How does a multi-sensory teaching approach impact learning and community in my second grade classroom?* Related sub questions include: *How can multi-sensory education be implemented effectively in a classroom? What multi-sensory activities can students complete that are academically based, but also incorporate elements of social and emotional development? How can multi-sensory education benefit all learners and encourage motivation?*

Story of the Question

"And on the next slide..."

My eyes snapped open. I had almost fallen asleep in my sophomore college biology class for the third time. Apparently these professors believed that if they slapped

a PowerPoint up on the board, they would be able to maintain the interest of twenty college students.

"I cannot be the only one dying of boredom," I thought to myself. I glanced around the room. Most of the students in the classroom seemed to physically reflect the way I felt (and probably looked). I saw various drooping eyes and heads on desks; one boy was even sleeping! *"No one is retaining this material,"* I thought. *"There has to be a better way to teach."* Class droned on. Soon enough my eyes were closing.

It seemed to take forever to be dismissed from class, but the time finally arrived to leave. As I walked back to my dormitory, I began to reflect. Thinking back across my educational experiences – particularly at the university level – many of my classes were presented in lecture format. In these classrooms, I was rarely encouraged to interact with the presented material. In fact, as I contemplated my classroom experiences, I came to discover that I was spending much of my time studying material that I had not managed to retain in the classroom. Furthermore, my favorite classes – the ones that I believed were the most valuable and educational - tended to incorporate my senses into the learning process and engage me in the material. I struggled through lecture-oriented classes – and I realized that I was probably not the only one. I began to wonder if a multi-sensory teaching approach could positively impact student learning and retention.

Several years after my terrible experience in biology class, I was faced with the problem of choosing a thesis topic. Selecting to write about my concerns regarding multi-sensory education appeared to be the obvious choice. I was eager to finally research the effects a multi-sensory approach could have on learning. However, as I had continued on

my educational journey and entered more classroom environments, I had discovered another educational barrier: developing a positive classroom environment.

In my Fall 2010 field placement, I was spending four days a week in a fourth grade general education classroom. I loved the kids - particularly one dynamic, outgoing, humorous boy who could make me laugh and appeared to be an all-around sweet kid. Needless to say, I was shocked when I discovered he had been teasing another girl in the classroom because of her performance in gym class.

Unfortunately, this teasing was not an isolated incident. It did not take long for me to realize that practically the entire fourth grade bullied one of their classmates - a boy with disabilities who spent most of his time in the resource room. The fourth graders would run around tagging each other in order to get rid of the "cooties" they believed they obtained when this boy touched one of them. I would also constantly hear his name tacked onto negative sentences containing words like "ew" or "stop!" I began to wonder how children could be so cruel to one another. Meanwhile, the teachers seemed uncertain about what to do to stop the bullying and appeared fed up with the situation.

I began to think about ways to change the student behavior that I found inappropriate. I tried to make speculations about how I, as a future teacher, would react if I were faced with a similar dilemma. I became curious about the power of team-building. Could positive interactions between students as they work together reduce instances of bullying? While I contemplated this new thesis topic, the deadline to submit my question loomed closer.

Soon, the big day arrived: I was going to need to hand in my thesis question - and I was still uncertain about which subject to choose. Finally, it struck me. Why not

combine the two? Could multi-sensory education, utilized effectively, not only improve academic performance, but also contribute to a positive learning environment? "*Is that practical?"* I pondered to myself just moments before I had to make the big decision. I contemplated the topic for a few minutes, ultimately deciding that it would be relatively simple to add team-building elements to some multi-sensory lessons.

I jotted down a roughly crafted question and handed it in. I walked out of class feeling like a million dollars. The stress of choosing a topic was no longer weighing on my shoulders. And, I was actually happy with my decision! Now, it was time to begin research. I was hopeful that I would be able to find information about the topic I had selected.

Organization of the Thesis

Chapter two reviews some of the literature available in regards to multi-sensory education and its effects on classroom learning. Topics will specifically include the connection between multi-sensory education and Howard Gardner's multiple intelligences theory, the benefits of using multi-sensory techniques in the classroom, and finally, the effective use of classroom instruction appealing to the senses. Chapter three discusses the context of the study and the design of the research. Chapters four and five discuss the results of the study, its implications for the field, and the need for further research.

Chapter II

Review of the Literature

Introduction

Despite the vast array of research encouraging multi-sensory education, the effective use of this teaching strategy remains absent from many elementary classrooms. Chapter two presents a review of the literature regarding multi-sensory education and its relationship to learning. It will also examine research on the use of multi-sensory approaches in the classroom. The first section describes the theory of multi-sensory education and its pertinence to Howard Gardner's theory of multiple intelligences and to student-centered classrooms. The second section examines a list of the various forms of multi-sensory education and their importance within the classroom. The third section focuses on examining how multi-sensory education can be incorporated into the classroom. Finally, the chapter concludes with research regarding the importance of incorporating multisensory education into the curriculum, and how this study will hopefully provide some insight for utilizing multisensory education in the classroom.

Multi-Sensory Education

The human brain is a tremendously complex, powerful, and still relatively mysterious organ within the body. Despite all of the research being conducted in regards to the brain, the entirety of the brain's capabilities is still unknown. Yet, it is through this research that scientists have been able to identify the effects multi-sensory education can have on learning. Jensen (1998) believes that there are several key factors that influence both brain development and academic achievement including exercise, the arts, genes, nutrition, feedback and love. According to these beliefs, the senses play a key role in

development, whereas genetics is only a minor factor. In fact, according to brain research, heredity provides only somewhere between 30% and 60% of our brain's wiring, while environmental factors make up somewhere between 40% and 70% (Wilmes et al., 2008).

It is well known that the brain receives, processes, and interprets all information (Christie, 2000). Scientists have found that over 80% of all information the brain absorbs is visual, making lighting and color particularly important factors in the learning environment. Additionally, medical research has found that the ear has more extensive brain connections than any other nerves of the body. Therefore, factors such as sound and music have been identified as possible significant contributors to the classroom learning environment. In fact, even smell has an effect on learning and work production. It, too, has its place in education (Wilmes et al., 2008). Based on this information, it can be concluded that environmental stimulation that affects the brain's wiring will be registered through the five senses.

The use of multi-sensory education in the classroom has produced some promising results. A study conducted by Kast, Meyer, Vogeli, Gross, and Jancke (2007) found that targeting multiple senses during a writing training program helped students with and without developmental dyslexia to improve writing skills. Students within the study were placed in one of four groups: a group of students who all had developmental dyslexia and received writing training in the first three month period; a group of students without developmental dyslexia who received writing training in the first three month period; a control group of students who all had developmental dyslexia and did not

receive writing training until the second period; and a control group of children without developmental dyslexia who did not receive writing training until the second period.

During the training period, students completed computerized writing training four days a week for fifteen to twenty minutes. The training program had three games that all incorporated the senses. For instance, students learned associations between a letter and a particular color. This game was meant to help students with dyslexia associate letters that are easily confused, such as "t" and "d", with different colors. Students would then use the colors to segment words and manipulate phonemes. Finally, in the last game, students would hear words dictated to them and a song associated with the word (Kast et al., 2007).

The study concluded that students who took the writing training during the first period strongly improved their writing skills and ability to write words correctly – particularly those students who had developmental dyslexia. Meanwhile, the control group hardly improved their writing skills. During the second training period, the control group participated in training and also improved their writing skills. It was concluded that all students benefited from the training (Kast et al., 2007).

In another study, the effects of multi-sensory education on letter recognition, phoneme identification, and pseudo-word decoding were examined. Kindergarten students from both low-income and average-income backgrounds explored letters through either a strictly visual means or through tactile and visual means. Students took a pre-test prior to the letter exploration. After instruction, students took both a kindergarten post-test and a first grade post-test. The study concluded that students performed better in post-tests for letter recognition and initial phoneme identification after tactile and visual

exploration rather than after just visual exploration. Additionally, students who explored letters both visually and tactilely scored higher in the first grade post-test for pseudo-word decoding (Bara, Gentaz, & Cole, 2007). Thus, as can be seen through this study, instruction that targeted multiple senses increased the likelihood of student learning and retention.

With the understanding that the brain uses the five basic senses to obtain insight on the world, it is unsurprising that utilizing multiple senses increases the probability of knowledge absorption (Christie, 2000). In its simplest form, the theory behind multi-sensory education is to provide each child the advantage of lessons taught through multiple senses that would increase the likelihood of the child absorbing the material. In more complex terms, instruction targeting multiple senses stimulates more neural pathways within the brain (Christie, 2000). Therefore, educators who effectively target more than one of the senses in every lesson would likely have a higher percentage of student comprehension than those educators who do not rely on the potential of the senses in teaching.

Relating Multi-Sensory Education to the Theory of Multiple Intelligences

The concept of multi-sensory education can be clearly promoted through Howard Gardner's theory of multiple intelligences. This theory states that every person has distinct strengths and weaknesses that can be attributed to personal areas of intelligence (Lash, 2004). IQ can no longer stand alone as a measure for success - instead it counts for only 20% (Özdemir, Güneysu, & Tekkaya, 2006). In fact, theorists now believe that an individual's cognitive ability should be discussed in terms of several intelligences rather

than a single intelligence (Moran, Kornhaber, & Gardner, 2006). In his theory, Gardner has identified nine different areas of intelligence:

- Linguistic Intelligence: the ability to understand and use spoken and written communication.
- Logical-Mathematical Intelligence: the ability to understand and use logic and numeric symbols and operations.
- Musical Intelligence: the ability to understand and use such concepts as rhythm, pitch, melody, and harmony.
- Spatial Intelligence: the ability to orient and manipulate three-dimensional space.
- Bodily-Kinesthetic Intelligence: the ability to coordinate physical movement.
- Naturalistic Intelligence: the ability to distinguish and categorize objects or phenomena in nature.
- Interpersonal Intelligence: the ability to understand and interact well with other people.
- Intrapersonal Intelligence: the ability to understand and use one's thoughts, feelings, preferences, and interests.
- Existential Intelligence: the ability to contemplate phenomena or questions beyond sensory data, such as infinite and infinitesimal.

(Moran et al., 2006).

While Gardner's theory incorporates more intelligences than those related to just the senses, it does suggest the importance of the senses in learning. In fact, proponents of

multiple intelligences in education believe that the only way to promote learning across intelligences is for the teacher to offer "rich experiences - activities in which they can engage with the material personally" (Moran et al., 2006, p. 25). For instance, one study conducted by Özdemir et al. (2006) used the multiple intelligences theory. They placed students randomly into one of two science groups. One group, the control group, received "traditional" science instruction with lectures and worksheets. The second group, the experimental group, targeted the multiple intelligences in instruction. Students in the experimental group completed tasks such as drawing pictures, composing, watching a performance, dramatizing and playing with puzzles - all instructional methods appealing to multiple senses. At the end of the study, it was discovered that students in the experimental group had better acquisition and retention of knowledge than students in the control group (Özdemir et al., 2006).

These positive results of education targeting multiple intelligences were secured in another study. This study compared direct instruction and multiple intelligences instruction of eighth grade mathematics students. All students took a pre-test about mathematics concepts. Then, students received mathematics instruction either in the form of direct instruction or instruction targeting the multiple intelligences. Students receiving direct instruction were taught through teacher-directed lecture, note-taking, and practice problems on worksheets. Students receiving multiple intelligence instruction were taught with activities, logic problems, creation of rhymes to remember mathematical concepts, building models, and invention of board games. Students who received instruction through the multiple intelligences scored an average of 25.48 points higher on the post-

test than the pre-test compared to 17.25 points for the control group (Douglas, Burton, & Resse-Durham, 2008).

The success of studies surrounding the multiple intelligence theory is likely because students are being taught through different modalities. Each learner has a different learning profile with unique sets of strengths and weaknesses within the intelligences (Moran et al., 2006). Targeting instruction towards a range of learners would have a greater chance of reaching all learners. Thus, proponents of the multiple intelligences theory believe that it is imperative for all assignments, projects, and even evaluations to appeal to a variety of intelligences (Lash, 2004).

According to Vygotsky (1978), experience is important in both cognitive and personality development. Students who receive the same learning material will have unique experiences with the material based upon their personal backgrounds, strengths, and challenges. This can be seen clearly in the multiple intelligences theory as well. It is believed that students approach material differently based on their learning profile. For instance, students who have strength in spatial and bodily-kinesthetic intelligence may benefit from learning about math through dance choreography or sculpture (Moran et al., 2006). If teachers target students' instructional needs, lessons will be taught through the senses and comprehension of material should increase. However, to create appropriate instruction, teachers must first understand their learners.

Multi-Sensory Education: Developing a Student-Centered Classroom

Student-centered classrooms thrive on several key beliefs. First, the teacher does not hold all of the power. Instead, students share power and discover their capabilities as learners. Second, students are encouraged to think critically and question presented

material. Third, teachers are also learners within the classroom – and seek to be taught as much as they, themselves, may teach. Fourth, students have control of their learning. This means that students are able to focus on their learning style and receive instruction that helps to target that style. Finally, assessment is not just a grade, but a way to aid student learning. For instance, when a student does poorly on an assessment, the student and teacher may work to help the student understand the material better (Weimer, 2002). Thus, teachers must possess a strong understanding of students' needs to help direct students to reach learning in a way that suits the individual.

Many researchers believe learner-centered classrooms are more effective than traditional classrooms – both in helping students achieve higher test scores as well as helping students emotionally and socially. Student-centered classrooms offer students the opportunity of choice. Students are able to follow their interests and highlight their personal skills in assignments that encourage demonstration of learning to be presented in unique ways. Additionally, students are encouraged to be active participants in the classroom and in their own learning (Salinas, Kane-Johnson & Vasil-Miller, 2008).

Student-centered classrooms are believed to encourage higher retention rates of material. One study conducted at Central Connecticut State University asked students from entry-level psychology classes to evaluate their professors. Students took a survey, which helped researchers identify professors who encouraged learner-centered practices within their classrooms. Participants in the study all completed multiple choice final examinations as part of their coursework. Researchers then administered the same test to participants one month later. Students with learner-centered professors scored an average of 8.5 points lower on the second test as compared to students with non-learner-centered

professors who scored an average of 27.8 points lower on the second test (Salinas et al., 2008).

The benefits of learner-centered classrooms do not end with academics. As a study conducted by Wohlfarth et al. (2008) found, students tend to view student-centered classrooms positively. In this study, graduate students were asked to evaluate their college classroom experiences for one course. Students agreed that the class was very learner-centered and noted that the classroom opportunities were extremely important in helping students to learn.

The core belief behind student-centered classrooms is that students participate in their learning, rather than sit back as passive recipients of knowledge (Wohlfarth et al., 2008). To achieve this goal, teachers must understand students' needs and learning styles to provide appropriate direction. To reach all their learners, teachers may use multi-sensory methods to encourage students' interactivity with the material.

Impact of the Senses on Learning

Redcliffe Elementary School in Aiken, South Carolina was struggling. Students' test scores were in the lowest 25% of the district. Yet, instead of placing even greater emphasis on academics, the school made a different decision: a stronger arts curriculum was implemented. Students were given the chance to dance, participate in music, drama, and visual art instruction on a daily basis. In six years, the school's test scores rocketed into the top 5% of the district (Jensen, 1998). The entire climate of the school had changed.

In a high-stakes testing atmosphere, it is unlikely that school administrators will opt to increase the time students spend in "specials" such as music or physical education.

A school-wide reform, such as that experienced in Redcliffe Elementary School may be doubtful, but small-scale changes – such as within a classroom – can certainly affect students. There are a wide variety of studies that discuss how classroom environment can stimulate the senses and affect learning. For instance, one study conducted to examine the effects of color on IQ found significant results. Classrooms with low ceilings were painted in an array of colors. Students were IQ tested prior to being placed in the different colored rooms, and then they were IQ tested again after being placed in the different colored rooms. Students placed in the light blue, yellow, yellow-green, and orange classrooms increased their IQ score by an average of twelve points. Students placed in white, black, or brown rooms made lower scores (Wilmes et al., 2008).

Lighting is another environmental factor that can impact learning. In another study, a researcher removed fluorescent bulbs from several elementary school classrooms and replaced them with full spectrum lighting. There was an impressive 65% reduction in absenteeism among the students in the affected classrooms (Wilmes et al., 2008).

Visual stimulation is not the only way to affect learning in the classroom environment. Auditory and olfactory prompts can also be effective. For instance, soft background music has been shown to improve reading comprehension. Additionally, aroma can institute change in the environment. Peppermint and lemon scents are known to energize, whereas fresh coffee and popcorn raise anticipation. Vanilla, chamomile and pine create a relaxed atmosphere. A combination of floral scents has been shown to double the speed of learning (Wilmes et al., 2008).

Unfortunately the environment can negatively impact the senses and learning as well. Most likely teachers will be unable to change the lighting unit or color of the

classroom. Also, many schools are faced with older air conditioning and heating units that rumble and cause disruption in the classroom. Classroom lights may buzz in a manner that aggravates the children. Effective teachers will find ways to work around these environmental concerns to create a classroom environment that positively appeals to the senses and is conducive to learning (Wilmes at al., 2008).

Multi-Sensory Education and the Classroom Community

While there is certainly a multitude of materials available on building a successful classroom community, there appears to be little research specifically focused around the impact of multi-sensory education on classroom community. However, one study did find a way to link multi-sensory education to classroom learning and community building through cooperation. This particular study focused on literature lessons conducted in a kindergarten classroom (Molenda & Bhavangri, 2009).

Using eight cooperative sub-skills discussed by cooperative learning gurus Johnson and Johnson, the teachers selected four children's books (*Swimmy*, *Finders Keepers*, *Angelina and Alice*, and *The Little Red Hen*) that appealed to the various elements of cooperation. The teachers would read a book; then the students would have to complete some kind of team building activity targeting cooperation and movement. For instance, in *Swimmy*, the students sat on scooters and pretended to swim. They had to pick up puzzle pieces from around the room and put them together to create a picture of a group of fish. The class had to work together as a unit to get the puzzle pieces and decide where each piece belonged (Molenda & Bhavangri, 2009).

At the end of the study, researchers concluded that all of the social activities from all four books had promoted social skills, had encouraged social conversations amongst

the students, and had excited the students enough to become emotionally involved in the activities. This study also seemed to correlate with Piaget's theory which states that young children learn abstract concepts introduced in books, such as cooperation, by applying it with kinesthetic movement (Molenda & Bhavangri, 2009). By targeting both academic and social goals, the teachers in this study were able to establish both academic learning and community within their classroom.

Benefits of Visual Stimulation in the Classroom

According to brain research, the brain can register 36,000 visual images per hour (Wilmes et al., 2008). With this information, it is unsurprising that visual aids can enhance learning – particularly when the relationship between attention and the visual system are compared. When the eyes intake information, it is sent from the eyes to the thalamus, and up to the visual cortex in the brain. Feedback returns from the visual cortex through the thalamus and to the eyes. This feedback is the mechanism that maintains attention (Jensen, 1998). Therefore, if the eyes are receiving a low level of stimulation, such as watching an immobile lecturer, it will be harder to pay attention.

Based on this knowledge, Wilmes et al. (2008) suggests that teachers move around the classroom to increase and decrease distance from students. Additionally, with more than thirty distinct visual areas in the brain for visual stimulations such as color, movement, hue, and depth (Jensen, 1998), it is quite obvious why Wilmes et al. (2008) also suggests using visual displays to demonstrate content, color-code materials, and turn off the lights for a few moments to give students a chance to internalize the material they learn. It is believed that a rich classroom – one that is full of visual stimulations such as posters, mobiles, maps, pictures, and graphic organizers – will impact student learning at

some level. In fact, one study researched recovery times of patients in a hospital. The patients located in a room with a view had a faster recovery time than those patients who had a brick wall for a view. It was concluded that the stimulation feeds the brain (Jensen, 1998).

Visual aids utilized in the classroom can do more than simply enrich learning. Items on the walls can encourage and inspire learners. More importantly, these visual aids can create a comfortable environment where learners can feel safe and welcome (Jensen, 1998). This is particularly significant because studies have shown that students who experience stress in school may enter "fight or flight" survival mode, which, depending on the severity of the issue, could last for several days (Wilmes et al., 2008). Vision can particularly be affected when a student enters the fight or flight mode because, under stress, the eyes naturally change their focus from forward vision to peripheral vision as a way of searching for predators. This makes tracking words across a page nearly impossible (Jensen, 1998).

Finally, visual stimulation is essential to learning because it is necessary for understanding. Imagery is what helps us comprehend and remember material. While it may be possible to recite abstract concepts, they are not truly understood until imagery is evoked (Ewy, 2003).

Benefits of Auditory Stimulation in the Classroom

Auditory stimulation, like visual stimulation, is beneficial to student understanding and development. For example, auditory stimulation is critical to language development. In infancy and early childhood, the brain develops a map of sounds familiar to the child, which may include sounds such as the rolled "r". These early sounds,

including music and rhythm, help to shape the brain. Early exposure to an array of vocabulary helps children in language development. Parents are encouraged to use less "baby" language when speaking to infants. Even in youth, children learn language from the language they hear (Jensen, 1998).

One aspect of auditory stimulation is music. Music is believed to enhance spatial-temporal reasoning, which is necessary for concepts such as proportional reasoning and geometry (Johnson & Edelson, 2003). For instance, one study conducted at the University of California at Irvine studied the effect Mozart's "Sonata for Two Pianos in D Major" had on spatial-temporal reasoning. Participants were separated into three listening groups: one group listened to relaxation music, one group had no music, and one group listened to Mozart's "Sonata for Two Pianos in D Major." After just ten minutes of listening on a headset, Mozart's music temporarily improved spatial-temporal reasoning. Additionally, brain research has indicated that infants are quite receptive to and discerning of music. Thus, exposure to music at an early age is highly encouraged (Jensen, 1998).

Music has other benefits for helping the brain. In the brain, neurons are constantly firing across neural pathways as a means of communication. Clear thinking results when the neurons fire in a specific pattern determined by speed, sequence and strength. Select pieces of music can be a trigger to a pattern – hence, some people may work better with quiet music playing (Jensen, 1998).

The benefits of music do not stop with the brain. Music is described as able to "enrich the human intellect and spirit" (Wilmes et al., 2008, p. 662). Teachers may use music to reach all learners through the emotional, cognitive and psychomotor elements of

the brain (Wilmes et al., 2008). Thus, music may be implemented in the classroom as a method of arousal. For instance, teachers may use music to perk up their students or to create a relaxing atmosphere (Jensen, 1998). Additionally, music is described as a universal language. People from all over the world experience music. This distinct universal nature of music may assist in developing community in the classroom (Wilmes et al., 2008) as well as assist students with limited verbal skills (Jensen, 1998)

Listening to music is believed to engage the whole brain. Moreover, the melody of music assists students in memorizing the words to songs. Many teachers will utilize this information in the classroom by presenting information through song. This ensures that the students are engaging their brains to their fullest capabilities, which increases the likelihood of remembering the material (Jensen, 1998; Wilmes et al., 2008).

Benefits of Movement and Tactile Experiences in the Classroom

Like auditory and visual stimulation, utilizing movement and tactile experiences in the classroom have a variety of benefits. Researchers discovered that the part of the brain that processes movement is the same part that processes learning. Thus, movement is believed to stimulate learning. Additionally, exercise releases a natural substance that assists neurons in communicating with one another more effectively. This enhances cognition (Jensen, 1998); hence, movement has a strong correlation to increased learning. For instance, one study discovered that aerobic exercise improves cognitive functioning – particularly understanding and retention (Skoning, 2010). The cognitive benefits of movement do not end there. Rolling, rocking, crawling, tumbling, and matching are believed to create considerable gains in attention and reading throughout life (Jensen, 1998).

The significant educational outcomes of movement can impact all learners. Students who learn kinesthetically will be able to remember the movements of the body and use this as a bridge to make connections to the information learned (Skoning, 2010). Research has also found that physical activity assists students who may otherwise have trouble concentrating, sitting still, and paying attention in class. This is because it allows students a time to wind down and relax (Gaus & Simpson, 2009).

Movement can also affect educational performance. For instance, in one study, students learned language arts concepts through dance activities. The students who were involved in these activities boosted their reading scores by 13% in six months; whereas district-wide student reading scores dropped by 2%. Another study found that children who spend an extra hour a day in gym class performed significantly better on exams than their peer counterparts who did not exercise. Exercise has been proven to have a variety of academic benefits for students. One such correlation between exercise and academics has been discovered in brain research. The adrenaline-nonadrenaline response of the body and rapid recovery from physical exercise actually trains the body to respond to challenges more quickly (Jensen, 1998). This will assist students to become faster problem-solvers.

Aside from the educational benefits, movement can also boost children's attitudes toward school (Jensen, 1998). In a cross-cultural study, researchers found that students who experienced movement in the classroom reported a greater sense of joy while learning. Movement has also been linked to an increase in students' self-esteem, emotional expression and self-regulation, and social function (Skoning, 2010). These

emotional benefits of exercise and movement can help teachers as they develop classroom community.

Effective Use of Visual Aids in the Classroom

While multi-sensory education has some incredible outcomes, it is imperative that instruction targeting the senses be effective – otherwise, few emotional or academic gains will be achieved. There are a variety of ways teachers can utilize visual aids in the classroom. The mode of presentation can vary from traditional chalkboards and whiteboards to bulletin boards to PowerPoint and even to new technologies like the interactive whiteboard (also referred to as the Smart board). Visual aids can improve learning up to 400% (Stein, 2009). This means teachers must put careful thought into building interactive and effective visual aids to help their learners.

One such visual aid, the bulletin board, can be used for a variety of methods such as supplying information or increasing interest. Additionally, the bulletin board may invoke suspense, capture interest, or inspire. It is an effective way to reinforce learning or give helpful reminders. The purpose of the bulletin board is to provide the most important elements of a topic in a short and sweet message. To ensure that the bulletin board is effective for its viewers, there are several methods teachers must use. First, the font should be in a large text so that it is easy to read. Second, the bulletin board should be set up in a way that encourages the eye to follow the flow. Third, the board should be attention-grabbing and appealing to encourage students to view the material. Finally, while color is important because it can improve retention by 75%, too much color can be quite distracting (Stein, 2009).

Bulletin boards that use interaction are especially effective as they will likely excite the viewers and encourage participation with the information. Another important

rule is that the boards should be changed every two or three weeks. This allows students enough time to view the complete bulletin board in short spurts. If the bulletin board is not changed out after three weeks, it will likely fade into the background. Finally, effective bulletin boards typically use about 20% text, 40% graphics, and 40% white space (Stein, 2009).

Aside from bulletin boards, teachers can convey information through PowerPoint presentations. One study conducted in an undergraduate Introduction to Behavioral Statistics course found that PowerPoint has both positives and negatives. For instance, in a survey, students reported that PowerPoint presentations allowed them to understand the lecture material better and made note-taking easier. However, the study also found that PowerPoint prevented interaction between students and teacher. Additionally, the interest level was low. There was limited discussion – partially due to the fact that the lights were dimmed. The study concluded that PowerPoints that used graphics and limited animation could be beneficial during lecture (Nowaczyk, Santos, Patton, 1998).

As can be seen through the PowerPoint study, more often than not teachers will use PowerPoint ineffectively and incorrectly. However, as de Wet (2006) suggests, PowerPoint – when placed into the right hands – can be brilliant. One of the greatest mistakes teachers make with PowerPoint slideshows, as is evident with the PowerPoint study, is to use the slideshow to the detriment of interaction and discussion (Cyphert, 2004). Other mistakes teachers have been known to make with PowerPoint include keeping the lights dimmed which results in student boredom, not allowing students to interact with the presented material through discussion and application, speaking in the dark, and reading word-for-word from the slides (Cyphert 2004; Klemm, 2007).

Teachers who create effective slideshows use a variety of essential PowerPoint presentation methods. The most important element of PowerPoint is to remember to organize material so that it logically flows. Additionally, PowerPoint should be utilized to aid in explaining important concepts particularly through the use of illustrations and examples (de Wet, 2006). It is essential for teachers to remember that PowerPoint should be used to aid the message, not become the message (Cyphert, 2004).

Other techniques teachers use in effective presentations include delivering instruction in short time segments of about ten minutes. Students should then be allowed to work uninterruptedly with applying the material. This allows students the time to turn their temporary memories of the lessons into a more permanent form. The presentation of new information will interfere with this process. Furthermore, by presenting a few slides at a time, students can enter into discussion and the teacher can question the class to check for understanding (Klemm, 2007).

In fact, a study conducted by Gier and Kreiner (2009) found that using content-based questions during PowerPoint presentations resulted in significantly higher assessment scores. The study examined the test scores of undergraduate students in two college-level psychology courses. While students were presented with the same information, PowerPoint materials, and assessments in both courses, students received different styles of instruction. In the "traditional" class, students received PowerPoint instruction followed by group discussion. In the other class, students received PowerPoint instruction followed by response and discussion of content-based questions. Students in the content-based question class scored an average of 10 points higher on assessments than students in the traditional class. The study was then replicated in another psychology

course, yielding the same results (Gier & Kriener, 2009). This demonstrates that PowerPoint presentations can be beneficial for students if used effectively.

Aside from using content-based questions, effective PowerPoint presentations use mostly pictures, diagrams and illustrations with animation. Teachers will also move around the room during the presentation, rather than stand before the classroom in a lecture-style. These slideshows will contain information that clarifies material, motivates students, provides suggested reference materials, and illustrates difficult concepts in an effective manner (Klemm, 2007).

In today's technology boom, PowerPoint presentations may be created for the interactive whiteboard (IWB). This whiteboard is another unique tool in teaching and interacting with students through visual aids. These new interactive whiteboards are one of the only educational tools designed for whole-class instruction. One study conducted by Gillen, Staarman, Littleton, Mercer, and Twiner (2007) examined the effectiveness of IWBs by viewing how four different teachers in urban settings utilized the technology. It was found that IWBs are particularly useful for presenting material in a way that allows the order of items to be varied while facilitating a smooth, speedy presentation that can provide interactive lessons and innovative teaching styles. The IWB can be used to stage events – such as demonstrating the water cycle – when the event in real life could cause potential health or safety concerns. Additionally, the teacher can establish student understanding of a topic by asking students to come up to the board to move items into appropriate categories (Gillen et al., 2007).

Effective Use of Auditory Aids in the Classroom

Similar to visual aids, auditory aids can be easily implemented in the classroom. Music, in particular, can be utilized in a variety of ways. Some of the most popular functions of music in the classroom include use on special occasions, use as background music, and use as integration with other subjects (Giles & Frego, 2004). Giles and Frego (2004) conducted a study of general education classroom teachers' attitudes about music. Through this study, they have identified four styles of music integration used in the classroom setting. The first, the Subservient style, includes methods such as analyzing poetry and comparing them with music lyrics or creating songs to remember science concepts. The second style, the Affective style, utilizes music as background – particularly during language arts and writing lessons. The third style, called the Social Integration style, is when teachers incorporate patriotic music in the classroom. Finally, the Co-equal, Cognitive style is when teachers teach students concepts of harmony through singing songs in rounds. The Subservient style of music integration is the style most frequently used in the classroom, whereas the Coequal, Cognitive style is used least frequently (Giles & Frego, 2004).

Music or other auditory methods, such as clapping, can be used for a wide range of instructional techniques. For instance, clapping can be used to teach patterns. Students are encouraged to listen to the pattern and predict what sounds come next. This technique can also be used to gain attention or aid in transition. The prediction of clapping patterns helps to prepare children for the concept of number patterns. Other ways music can be used to assist students in mathematics include teaching one-to-one correspondence with the use of instruments. Children can also be assigned to specific instruments and then

identify the ratio of instruments to one another – such as three saxophones to one drum. For more advanced ratio concepts, students can be assigned to different "bands" with different ratios of instruments and compare the ratios in each "band". Finally, students who have a strong concept of music can use music to learn fractions. A measure of music contains four beats. Students can learn fractions by studying how one whole note (four beats) equals two half beats or four quarter beats or eight eighth beats (Johnson & Edelson, 2003).

Auditory aids can also be utilized in language arts lessons as well. For instance, books on tape may accompany books on print. Additionally, some books may include a song soundtrack. These auditory aids can assist students who struggle with reading and can enhance comprehension and memory of the material read. Evidence of the effectiveness of audio books may be found in a study conducted by Pearman (2008). In the study, second grade students from an elementary school were provided with a book in the form of both a traditional print text and on a CD-ROM storybook based on the students' developmental reading level. Students were randomly assigned to read either the print text first or use the CD-ROM first. Results showed that students' retellings scored significantly higher after the students used the electronic text. It is believed that the CD-ROM storybook provided sound effects and animations that assisted students in understanding context, vocabulary, and maintaining attention (Pearman, 2008).

Music – as is sometimes used in audio books - can also be used to establish the concept of prediction, which is another effective method for increasing comprehension. Students can listen to songs such as "The Old Lady Who Swallowed a Fly" and predict what animal the old lady will swallow next. Furthermore, teachers and students can use

clapping, stomping, or musical instruments to denote different characters within a text. Students will associate each character with a specific sound to aid in memory recall (Flohr, 2006). Comprehension is not the only aspect of reading that music can foster. Clapping beats can help students learn the concept of syllables (Johnson & Edelson, 2003)

Effective Use of Movement and Tactile Experiences in the Classroom

When teachers think about movement in schools, they will generally consider it in the context of the physical education classroom. However, teachers can utilize movement in their own classrooms. The activities used in an academic classroom may not be as time-consuming or strenuous, but can still be beneficial to the classroom environment. There is a wide range of games and activities that can be used to help students in all academic subjects. For example, in mathematics, movement may be used to teach students about fractions. Students can stand together to represent parts of a whole (Gaus & Simpson, 2009).

In social studies, teachers can utilize simple games such as Simon Says. Students can learn various geography terms, such as north pole, south pole, latitude and longitude. Students can assign movement to each of these terms. Touching the head may represent the north pole while toes represent the south pole. Latitude may be represented by extending both arms out, while longitude, the students may put their arms straight over their heads (Gaus & Simpson, 2009).

Language arts may also be represented through movement. Teachers may incorporate theater with reading. One study, conducted by Brinda (2008) broke students into "production teams" made up of a director, set designer, lighting designer, sound

designer, costume designer, and actors. Students then created scenes to act out from *A Wrinkle in Time*. The teachers immersed students in theater – for instance they analyzed the differences among film, theater, and television. At the end of the project the students were able to see a stage adaptation of the book. The teachers found that incorporating theater into reading made most of the students more willing to read and participate. Furthermore, over half of the class improved their reading and continued to read for enjoyment (Brinda, 2008). For younger students who might be unable to conduct full theater productions, theater can be utilized in another way. A great example is using the motion vocabulary in animal books for movement. These young readers may act out the actions within picture books, such as running like a tiger or hopping like a bunny (Gaus & Simpson, 2009).

Teachers can also use picture books with pro-social messages and multiple social skills to build classroom community and teach students about cooperation. Students may complete movement tasks that help them to further understand the concepts discussed in the book. For instance, students may learn about teamwork and then have to work together to place puzzle pieces in the correct location (Molenda & Bhavangri, 2009).

Tactile experiences are also incredibly important in the classroom. Many researchers, such as Piaget, speak of the importance of experiential materials to aid learning. There is a range of suggested examples of manipulatives that can be easily utilized in the classroom. These manipulatives can include blocks, plastic cubes, colored rods, geoboards, and tangrams. The belief is that students who can see and manipulate materials in their own environments will learn in ways that students who only read and listen to lecture cannot (Campbell, Campbell & Dickinson, 1999).

Conclusion

As this literature review proposes, multi-sensory experiences implemented effectively in the classroom can benefit students academically, socially, and emotionally. Brain research has found that teaching to the senses can aid and build understanding, create a positive classroom atmosphere, and increase student achievement. Multi-sensory teaching is also important to the classroom because it actively engages students in their learning. There are immense benefits to using multi-sensory education and there are a variety of ways to incorporate multi-sensory education into the academic classroom. Unfortunately, many teachers often overlook this type of learning and instead incorporate lecture and worksheets to input knowledge into students through the quickest means.

This study hopes to shed greater light onto the use of multi-sensory education in a second grade elementary classroom. A variety of activities and strategies will be employed to assist in facilitating academic learning and classroom community. The next chapter of this thesis will look at the design of my research study which is centered on the current research of incorporating multi-sensory education into the classroom.

Chapter III

Context and Methodology

Introduction

Chapter three is separated into two sections: the context of the study and the research design. Section one focuses on the community, school and classroom where my research was conducted. Section two describes the rationale for teacher research and the qualitative research paradigm within this study. It also discusses the sources of data I utilized to help inform my research.

Context of the Study

Community. Voorhees Township, a suburb in the Greater Philadelphia Metropolitan Area, is nestled about twenty miles east of Philadelphia in Camden County, New Jersey. Voorhees also stands about midway between Washington D.C. and New York City. Hence, the township has acquired the motto, "In the center of everything… and away from it all." Voorhees Township is 11.6 square miles and 26% of its area is made up of water.

Voorhees was established as a Township separate from Waterford Township on March 3, 1899 after Governor Foster McGowan Voorhees gave his permission for the division. Prior to its establishment as a township, the Voorhees territory housed Native American residents. Its lush forest was ideal for plant foods and hunting and the various lakes and streams nearby were perfect for fishing. This led the Lenni-Lenape Native American tribe, as well as a small Osage tribe of Sioux Native Americans, to settle in the area.

In the 1700s, wealthy families were attracted to the area that would become Voorhees due to its location near the Delaware River. These wealthy families built homes, sawmills and farms, attracting the working class to the area. The Voorhees area continued to develop as small communities formed. Voorhees was particularly affected when the Camden and Atlantic Railroad was built along the west side of Voorhees and linked Philadelphia and the seashore. This development helped to encourage farming in the area, which continued until the middle of the twentieth century.

Today, Voorhees has a population of 28,126 according to the 2000 US Census. It is composed of five sections: Ashland, Kirkwood, Kresson, Glendale, and Osage. Voorhees Township is known as a bedroom community with many of its residents commuting to work in Philadelphia, Pennsylvania or Cherry Hill, New Jersey. To encourage local workers to live in Voorhees, the township offers the "Live Where You Work- Voorhees" program, which offers low interest mortgage loans to potential home buyers who work in Voorhees and are seeking to live in Voorhees.

Voorhees Township currently has 10,489 households and 7,069 families. It has one of highest median family incomes in South Jersey. In fact, the median household income in 2000 was $68,402 and the median family income was $86,873. However, a 2007 estimate contends that these figures have risen to $82,035 and $105,933 respectively. Also, according to the 2000 US Census, 78.26% of the township residents are White, 8% are African American, 11.44% are Asian, 0.14% are Native American, 0.03% are Pacific Islander, 0.55% are identified as "other" races, and 1.59% are two or more races.

Voorhees Township School District serves students from kindergarten through eighth grade. The school district has four K-5 elementary schools: Edward T. Hamilton Elementary School (511 students), Kresson Elementary School (438 students), Osage Elementary School (614 students), and Signal Hill Elementary School (575 students). The district also has one middle school, Voorhees Middle School, which serves 1,170 students in grades sixth through eighth.

Students who graduate from Voorhees Township Public Schools may attend Eastern Camden County Regional High School District. This school district has Eastern Intermediate High School for grades nine and ten, and Eastern High School for grades eleven and twelve.

School. Osage Elementary School is a public K-5 elementary school situated on Somerdale Road in Voorhees, New Jersey. The school was named in honor of the Osage Native American tribe that was believed to have once lived in the area. Of the four elementary schools in the district, Osage Elementary School has the highest enrollment of students - at about 614 students. Osage Elementary School has an average class size of 17.5 students. School-wide, 56% of students are male and 43% of students are female.

Osage Elementary School is unique from the other elementary schools in the district because it contains a significantly greater range of cultural diversity in the school. Osage Elementary School's racial makeup is as follows: 50% of students are White, 27% are Asian/Pacific Islander, 17% are Black, and 6% are Hispanic. Of the other three schools in the district, the average racial makeup is 73.3% White, 16% Asian/Pacific Islander, 6.7% Black, and 2.3% Hispanic. Additionally, in 2007, Osage identified 3.5% of its students as Limited English Proficient, compared to an average of 1% in other

schools in the district. About 80% of students at Osage used English as their first language at home. Finally, Osage has a greater population of students who are eligible for the free and reduced lunch program (14% of students) than the other elementary schools (average of 5% of students).

Osage had a student mobility rate of 15.3% during the 2009 and 2010 school year. This is likely due to the large number of apartment communities within Osage's school zone. In addition, the school had a 95.5% daily attendance rate for students and a 97.1% daily faculty attendance rate.

As the elementary school with the highest enrollment of students in the district, Osage Elementary School is quite large and contains many additions to its original building. There are six half-day kindergarten classes, six first grade classrooms, five second grade classrooms, five third grade classrooms, four fourth grade classrooms, and four fifth grade classrooms. The school has been organized to provide instruction for core academic subjects in the elementary classroom, and special area subjects such as physical education, art, music, library, computers, and health. Additionally, the school uses Title I funding to support a Basic Skills Improvement Program to aid struggling students.

Osage Elementary School emphasizes the use of technology within the school. All classrooms are equipped with desktop computers and a Smart board. Additionally, each grade level has a cart of laptops. The school also has a computer lab for student use. Teachers each have a website that they may update with classroom and school-wide information. Some teachers utilize blogs on their website and encourage students to respond to critical thinking questions on the blog. Finally, all classroom teachers have the ability to Skype with one another and with other teachers within the district.

With 15.9% of Osage's population requiring an Individualized Education Program (IEP), there is a strong group of special educators at Osage. Osage has inclusion classrooms, resource rooms, and self-contained classrooms to suit the needs of its students and to ensure students are placed in their least restrictive environment. Additionally, Osage utilizes a Response to Intervention method to ensure struggling students are receiving the necessary supports within their classroom. As part of the intervention, staff members may bring struggling students before the Student and Teacher Assistance Resource Team (START).

A case manager will gather information about the student from pertinent individuals such as the classroom teacher, special teachers, specialists, aides, guidance counselor, parents and student. After the case manager gathers the information, the START committee will meet to discuss ways to support the student in the classroom. Some supports START may recommend include language arts and mathematics instruction in the Basic Skills classroom or Homework Helpers – an afterschool program that meets twice a week. Homework Helpers uses fifth grade students, supervised by two faculty members, to assist struggling students with their homework.

Perhaps it is the supports Osage offers to its students that has allowed the school to make Adequate Yearly Progress according to New Jersey's 2009 – 2010 School Report Card. The school utilizes the following assessments: the TerraNova in reading and mathematics for second grade students, the NJASK3 in Language Arts Literacy and Mathematics, the NJASK4 in Language Arts Literacy, Mathematics, and Science, and the NJASK5 in Language Arts Literacy and Mathematics.

Classroom. Mr. Derek Dupont's second grade classroom, in which this study took place, is made up of twenty-three students. These students each have their own personal learning style, personality, and needs. Of the twenty-three students, fourteen students are male and nine students are female. The classroom is incredibly diverse. Students within the classroom have family origins in Bangladesh, India, Cambodia, Ukraine, Syria, Turkey, Azerbaijan, Africa, the Dominican Republic, and Israel. Several students in the classroom were born outside of the United States or spent some time living outside of the United States.

Three male students in Mr. Dupont's class are classified under the Individuals with Disabilities Education Improvement Act (IDEIA). Patrick is identified as Other Health Impaired. Michael is identified as having Multiple Disabilities. Christopher is identified as having a Specific Learning Disability. These three students received language arts and mathematics instruction in a resource room, and returned to the general education classroom for morning routine, lunch, specials, and social studies/science instruction.

Patrick is believed to have sensory issues and Attention Deficit Hyperactivity Disorder (ADHD) – perhaps stemming from a difficult and premature birth. Patrick recently began to take medicine to increase his ability to focus. Prior to receiving medication, Patrick was unable to read. However, since he has begun taking the medication, he has made great strides in reading and reads at a beginning second grade level. He is extremely impulsive and has a low frustration tolerance. Patrick has low self-esteem and often speaks in a self-deprecating manner about his academic abilities. He tends to have behavioral problems – particularly with physical and verbal aggression -

and receives a behavior consultation once a month. In addition, he receives occupational therapy services once a week for thirty minutes.

Michael has Cerebral Palsy, seizures, and struggles with fine motor skills. He uses adaptive technology, such as the I-pad, to accommodate his difficulty with writing. While he is generally well-behaved, he is drawn to computers and may refuse to listen while working on the computer. Michael is also known to stutter; however, his speech has greatly improved and the stuttering appears to be going away. He receives speech services and occupational therapy twice a week. Due to his seizures, he has been assigned a one-on-one aide.

Christopher also has ADHD and struggles with staying on task. He earned the nickname of "The Wanderer" in his general education classroom because he will frequently get out of his seat and walk around the classroom during instruction. He is an excellent reader, but struggles with comprehension. Christopher needs frequent reminders to stay on task – although, when on task, he can usually grasp the concept of instructional material.

Other students in Mr. Dupont's classroom receive support services. For instance, two students, Erik and Jennifer, receive speech services. Additionally, Steven, who was retained last year and is currently repeating second grade, receives language arts and mathematics Basic Skills instruction. Steven is joined by Jane, Trevor, and Tanya for mathematics Basic Skills instruction.

Finally, Mr. Dupont's classroom has one English Language Learner student, Robert. Robert recently moved to the United States with his mother. He is a beginner with the English language. Typically, Robert ignores classroom lessons and instead

colors or plays with items in his desk. However, there are several students who sit near Robert who will help him with his work.

Table 1

Representations of Diversity in Mr. Dupont's Second Grade Classroom

Element of Diversity	Categories	Number of Students/Percentage	
Ethnicity	White	12	(52.2%)
	African American	5	(21.8%)
	Asian/Pacific Islander	4	(17.4%)
	Hispanic	1	(4.3%)
	Two or more races	1	(4.3%)
	Total Number of Students	23	(100%)
Special Needs	Other Health Impaired	1	(4.3%)
	Multiple Disabilities	1	(4.3%)
	Specific Learning Disability	1	(4.3%)
	Speech Services	3	(13.0%)
	Basic Skills Instruction (Total)	4	(17.4%)
	Basic Skills Reading	1	(4.3%)
	Basic Skills Mathematics	4	(17.4%)
	English Language Learner	1	(4.3%)
Students who were born or lived outside of the United States.	Syria	1	(4.3%)
	India	2	(8.7%)
	Bangladesh	1	(4.3%)
	Israel	1	(4.3%)
	Ukraine	1	(4.3%)
	Cambodia	1	(4.3%)
	Dominican Republic	1	(4.3%)
	Azerbaijan	1	(4.3%)
	Total Number of Students	9	(39.1%)

Mr. Dupont has several behavioral concerns within his classroom. There are specifically four students within the class who must be assigned "line spots" when the class is walking to and from specials and lunch. These four students have the tendency to hit and fight with one another – and will purposely seek one another out during unstructured time.

Despite these behavioral problems, most of the students in Mr. Dupont's classroom seem excited to learn and participate in classroom activities. In general, the students are eager to ask and answer questions. These students also love to share stories, experiences, and background information whenever possible. Unfortunately, Mr. Dupont struggles with ensuring students receive the education they deserve while balancing a classroom community and the behavioral concerns of the classroom.

Research Design and Methodology

The primary purpose of teacher research, as used in this study, is to assist the teacher in building an understanding of his/her students as well as developing ideas to improve his/her practice (Hubbard & Power, 1999). Teacher research is a thriving movement that encourages teacher researchers to "examine their own assumptions, develop local knowledge by posing questions and gathering data – and in many versions of teacher research – work for social justice (Cochran-Smith & Lytle, 2009, p. 40)."

Cochran-Smith and Lytle (2009) believe that teacher research should not be used as a means to increase standardized test scores or regulate teaching practice. Instead, the purpose is "about generating a deeper understanding of how students learn – from the perspective of those who do the work" (Cochran-Smith & Lytle, 2009, p. 58). Teacher researchers conduct studies based on a deep and personal sense of accountability for students' learning (Cochran-Smith & Lytle, 2009).

Teacher researchers gain an understanding of the learning process from others. For instance, in this type of research, a student's statement may be quoted as an academic source that is used in other, more traditional forms of research (Cochran-Smith & Lytle, 2009). This is because teacher research is largely composed of qualitative research

(Hubbard & Power, 1999). Teacher researchers have detailed, specific, concrete information that is in the form of example (Cochran-Smith & Lytle, 2009). Stories are believed to be "a critical tool for illuminating the deeper theories or rules governing the way a classroom community works" (Hubbard & Power, 1999, p. 2). Additionally, with focus on qualitative research, the researcher has the opportunity to observe any and all effects of the implemented study instead of only working to solve a specific problem (Cochran-Smith & Lytle, 2009).

Research study. In this research study, multi-sensory education was incorporated into a second grade classroom. First, I utilized this teaching method in a science unit plan while I closely observed what happened to the children and classroom environment throughout the implementation of the unit. The unit plan sought to teach students about the solar system while targeting at least two or more of the senses in each lesson. For example, students were asked to move around to demonstrate Earth's revolution around the sun. Additionally, students viewed the solar system on the Smart board and even made their own moons out of Play-doh.

After the students were accustomed to the multi-sensory teaching approach, I incorporated multi-sensory education into the instruction of other subject areas. I found ways to target the senses in mathematics, language arts, and social studies. Students were encouraged to learn through art, music, and movement. Finally, many of the lessons I implemented included elements of collaboration between students. During each aspect of the study, my observations about the students and the classroom were documented in my teacher research journal.

Sources of data. To ensure that each phase of the study was well-documented, four types of data-collection were used: individual interviews with the students, focus groups, student work, and my personal teacher research journal.

The first data source, individual interviews, allowed students the opportunity to provide reflection and opinion on the multi-sensory lessons conducted in the classroom. I met with students individually to ensure that they each had an opportunity to discuss their personal viewpoints candidly without concern of their peers' thoughts. During these interviews, students were provided with the opportunity to discuss their attitudes towards multi-sensory education. Example interview questions included:

- Did you enjoy the lesson? Why/why not?
- How, if at all, did the movement/touch/visual aids/auditory aids used in the lesson help you learn the material?
- Was there any one part of the lesson that stood out to you? What was it and why?
- What, if anything, would you change about the lesson?

The second data source, focus groups, provided students with the chance to discuss their learning styles with one another. Student volunteers were placed into groups of three or four and held discussions about their preferred learning methods, if and how these methods have been incorporated into classroom instruction, and generally discuss their personal development. By holding group discussions, the students were able to reflect on their learning and develop a free-flow of thought that allowed them to touch on topics that might otherwise have been missed in an individual interview.

The third data source, student work, allowed me to determine if the students understood the material presented through multi-sensory methods and see if they made

any insightful comments about multi-sensory education. Additionally, I was able to examine student work to establish each student's strengths and weaknesses, which allowed me to target my lessons towards the needs of my students.

The final data source, my teacher journal, includes all of the notes, observations, thoughts, questions, and ideas I had regarding the use of multi-sensory education in the classroom. Additionally, I documented any notable moments that stood out to me and incorporated notes on the everyday occurrences within the classroom. The reflective writing found within the journal provided information about the classroom community and student development throughout the semester.

Data analysis. The data amassed throughout the study was analyzed to draw conclusions about what occurs when multi-sensory education is used to teach academic and social content in the classroom. This qualitative data was reviewed for patterns and categories that emerged throughout the study. This information was used to help determine how multi-sensory education may impact students and the classroom community. I searched the data I collected for evidence both supporting and negating my original research. First, I reviewed the data to determine if any commonalities or themes existed within the research. After I identified the themes, I combed through my four data sources to list evidence of each theme. Finally, I reviewed my data again to ascertain that I had covered all themes and did not miss important evidence.

What is Next?

Chapter four discusses the results of the individual interviews, focus groups, student work, and the information within the teacher research journal. Chapter five

presents the conclusions and implications of the study and any recommendations for future research.

Chapter IV

Data Analysis

Introduction

Chapter four analyzes the data collected during the research study examining the question, "How does a multi-sensory teaching approach impact learning and community in my second grade classroom?"After reviewing all data sources, four themes appeared to prevail across the study: encouraging student motivation and engagement with a multi-sensory approach; accessing students' needs with multi-sensory teaching methods; fostering a positive classroom environment utilizing collaboration; and providing a generative space for the use of technology and making connections to the outside world.

Science Unit and Accompanying Lessons

As stated in chapter three, I conducted my research in two parts. First, I developed a multi-sensory science unit plan about the solar system. Next, I immersed the students in multi-sensory mathematics, language arts, and social studies lessons.

To construct the science unit, I referenced the classroom textbook *Science* by the publisher MacMillan/McGraw Hill. I utilized the information within the textbook, as well as my own research, to create a solar system unit plan infused with multi-sensory activities. When I developed the unit plan, I kept in mind the key beliefs of student-centered classrooms. As can be seen in the chart below, the use of the senses corresponds to student-centered classrooms.

Table 2

Using a Student-Centered Approach within my Multi-Sensory Solar System Unit

Student-Centered Classroom Statement	Evidence within the Multi-Sensory Lessons
Teachers are not all-powerful. Students should be guided to discover learning on their own. (Weimer, 2002).	• Students were able to demonstrate concepts about revolution and orbit through movement with minimal direction from the teacher. • Students dictated the pace, flow and direction of material. When students expressed an interest in specific material, I provided the class with opportunities to expand their knowledge on that subject.
Students think critically about the material (Weimer, 2002).	• Students looked at evidence to form a hypothesis about solar system concepts. For instance, students looked at how aluminum foil reflects a flashlight's light to determine why the moon shines. • Students discovered the position of the moon, sun, and earth during each moon phase through the use of a flashlight and beach ball.
Teachers are learners within the classroom (Weimer, 2002).	• When students had questions that I did not know the answer to, we worked as a group to pinpoint our answer. • Students became "experts" on a celestial entity and were able to teach their classmates and me about the entity.
Students take control of their own learning (Weimer, 2002).	• Students use accessible materials – such as the internet or classroom textbook – to understand the Solar System. • Students worked in centers to learn about constellations. Each student learned about a different constellation and presented that information to his/her classmates.
Assessment is used to the benefit of the class (Weimer, 2002).	• I utilized a review game to determine if the students were ready for the unit test. • Students demonstrated understanding of concepts through classroom activities – such as demonstrating the moon phases with Play-doh moons or answering questions on a Smart board game – that allowed me to determine if more time with a specific subject was needed.

As can be seen above, there are five basic concepts that contribute to student-centered classrooms. First, teachers within student-centered classrooms do not hold all of the power (Weimer, 2002); therefore, I tried to place myself in the position of "director" of students' learning. I wanted to assist students to discover the material on their own. Second, in student-centered classrooms, students think critically about the material (Weimer, 2002). To encourage this, I informed students about the changes within the solar system and recent scientific discoveries (such as Pluto being classified as a dwarf planet.) I asked students to remember that we do not know everything about the solar system and are still making discoveries.

Third, teachers are learners within the learner-centered classroom (Weimer, 2002). I let the students know that I was not an expert on the solar system. If I was presented with a question that I did not know the answer to, we worked as a class to find the correct answer. Fourth, students take control of their own learning in the student-centered classroom (Weimer, 2002). To accomplish this, I assisted students in pursuing their interests and becoming "experts" in a specific area of the solar system. Finally, as is done in a student-centered classroom, I used assessment to the benefit of the class (Weimer, 2002). Every day I conducted simple informal assessments, such as asking questions or having students use hand signals (i.e. thumbs up or thumbs down) to check for understanding. I also reviewed student work. At one point I realized that students needed an extra day to work with the material so I made the appropriate adjustment.

The students guided the pace, flow, and even direction of the material we covered. As such, I planned the unit plan in a constructivist manner. While I developed certain ideas for the unit prior to its start, I made necessary changes and continuously altered my

plans to accommodate my learners. It was not until the unit was completed that I knew what the final product looked like.

Outlined below are the multi-sensory lessons I developed for this study followed by an in-depth description of each lesson

.

Table 3

Outline of the Multi-Sensory Lesson Plans Created

Subject	Lessons
Science	Lesson One: Study of the moon. • Movement: Demonstrated Earth's revolution around the sun. • Auditory: Discussion about craters • Tactile: Created Play-doh moons and demonstrated moon phases. Lesson Two: Study of moon phases. • Visual/Tactile: Flashlight and aluminum foil to view reflection of moon and determine moon's position during moon phases. • Movement: Demonstrated orbit of moon and revolution of Earth. Lesson Three: Study of solar system. • Visual: Online simulation of the movement in the solar system. • Visual/Tactile: Conducted research about a celestial entity. • Visual/Tactile: Labeled celestial entity and its orbit on poster. Lesson Four: Study of the solar system. • Visual: Solar system Smart board game about solar system. Lesson Five: Study of constellations through centers. • Visual/Tactile: Center One: Wrote a story about a constellation. • Visual/Tactile: Center Two: Drew a constellation of own. • Auditory/Visual: Center Three: Read/spoke about constellations. Lesson Six: Review of Unit • Visual: Played a "Hollywood Squares" style review game.
Math	Lesson One: Study of symmetry • Tactile: Painted symmetrical butterflies. Lesson Two: Learning to measure with paper clips • Movement/Tactile: Used paperclips to measure real-life items.
Language Arts	Lesson One: Using music in reading • Auditory/Movement: Read poems, sang, stood for vocabulary. Lesson Two: Reader's Theater • Movement/Auditory: Reader's Theater activity.
Social Studies	Lesson One: Learning about careers • Tactile/Auditory/Visual: Made career people. Held Career Day.

Science unit lesson one. In the first lesson, the class studied the moon. I assigned students to be the moon, sun and earth. The students moved around each other to demonstrate how the sun does not move, how the Earth orbits and rotates around the sun, and how the moon orbits Earth. Students also discussed the moon and its craters. They made predictions about what causes craters in the moon, and then validated or invalidated their guesses by checking the answer in the textbook. Finally, students used Play-doh to create a moon – complete with craters. Then they were asked to use their Play-doh moon, a piece of paper acting as the Earth, and their own bodies acting as the sun to demonstrate where the moon is during the full, half, and new moon phases.

Science unit lesson two. In the second lesson, we continued to discuss the moon and its phases. First, we watched how a flashlight (the sun) helped the moon (a piece of aluminum foil) to shine. Students hypothesized about why the moon glows at night. Next, I directed students through a demonstration about how the moon circles the earth. We discussed how the moon does not rotate, but merely orbits the Earth. Students visually demonstrated this concept. One student acted as the Earth and another student sidestepped around the Earth – exposing only her front side to the Earth. Then, students worked with a beach ball and flashlight to demonstrate the moon phases. Students found that if the sun was behind the moon, the Earth could not see the moon (new moon); if the sun was to the right or left side of the moon, the moon could partially be seen from earth (half moon/crescent moon); and if the earth was between the sun and the moon, the full moon could be seen from earth (full moon). Finally, students utilized their textbook to draw and paste the moon phases for the first fourteen days of the cycle on a calendar.

Science unit lesson three. In the third lesson, students viewed how the solar system looks on the Smart board. The program showed all of the planets and their rotation and/or orbit around the sun at different speeds. Students were then partnered and asked to research one of the planets, Pluto, the Sun, or the Moon. Each pair was given a laptop to conduct their research and provided with age-appropriate websites to view. After students completed their research, they wrote down two facts about their solar system research and drew a picture of the celestial entity they researched. Finally, they used their research to label their celestial entity on a poster, label the entity's length of orbit, and (for the students who researched planets) determined whether it was an inner or outer planet. Students were invited to play an educational space game when they completed their work. When all students were finished, they shared what they learned about their planet with the class.

Science unit lesson four. In the fourth lesson, students worked on the Smart board with a program I downloaded. Students were invited up to the Smart board to move the planets into the correct order. Next, they saw images of the Solar System and were able to press on the planets to learn more about them. Students were then quizzed on their knowledge with a game. The screen had balloons with facts written on the balloons. Students had to read the fact, make an educated guess about which planet the fact was referring to, and then press the balloon to "pop" it to determine if their guess was correct. Finally, the class watched a "rap video" that discussed the planets.

Science unit lesson five. In the fifth lesson, students worked in centers. There were three centers and three to four students were assigned to a center. There were two sets of each center to ensure that the center groups did not get too large. At one center

students read about constellations and then made their own constellation on black paper with white chalk. At another center, students each received a paper with a story about Little Bear, Draco, Gemini or Leo. Students read about their constellation, connected the dots (stars) to make their constellation, and then explained the story of their constellation to the rest of the group. In the final center, students read a story about the constellation, Orion. They learned about how people wrote constellation stories. The students then wrote their own constellation story.

Science unit lesson six. The final lesson I conducted was to help students review the material. I developed a PowerPoint game inspired by Hollywood Squares (a tic-tac-toe-based TV game show). The game included review questions about the main ideas of the material we covered, "bonus" questions about more obscure points of the material we covered, and pictures to help students make an association with the material. The class was divided into two teams. Students were able to come up to the Smart board and select the "celebrity" (a celestial entity) square. Each square led to one review question and several bonus questions. Students worked as a team to answer the main question to "win" the square. They also had the opportunity to answer the bonus questions.

Multi-sensory approaches in other curricular areas. When the science unit was complete, I designed multisensory lessons in other academic subject areas. For instance, in mathematics I had students complete a symmetry lesson. During the lesson, students first learned the concept of symmetry with a mathematics program on the Smart board. Then students were able to bring symmetry to life. Each student received a symmetrical butterfly. They painted one half of the butterfly with any design. The students folded the butterfly in half and pressed the painted side onto the unpainted side

to make the butterfly symmetrical. In another mathematics lesson, students learned about measuring with paperclips. Once again the students observed the concept on the Smart board. After the Smart board lesson, students broke into groups and used paper clips to measure everyday classroom objects.

I also developed multi-sensory lessons in language arts. For example, I included music and poetry into my lessons. The goal was to get students to improve fluency by developing a rhythm when singing the song or reading the poetry. We also identified vocabulary words to search for within the song or poem. Groups of students were assigned different words. They were to stand up when their specific vocabulary word was used. Each specific group was responsible for using the context clues of their word to identify its meaning. I also had students conduct a Reader's Theater activity. During Reader's Theater, every student in the class was assigned a role. They were allowed to read off of the script during the play. Students practiced their parts on their own and with partners. Then we rehearsed as a class. Finally, students performed the Theater for another second grade class in the school.

In social studies, I developed a lesson about careers. After discussing different careers in the classroom, I asked students to draw a picture of themselves on a small, construction paper person in the outfit of their future chosen profession. They also had to write what profession they wanted and why they wanted that profession. This activity gave me an idea to bring parents and community members into the classroom for a career day. Several weeks later we welcomed a few parents into the classroom to discuss their careers.

In addition to these lesson plans, during my interviews and focus groups, many students continuously referenced a fossil science unit plan I had conducted previous to the start of the study. I had created the unit based on the multi-sensory ideology. Some of the lessons in the unit plan included students making their own fossils with clay and seashells, excavating chocolate chips from chocolate chip cookies with a toothpick to demonstrate the difficult work of extracting dinosaur bones from the ground, and conducting a play about how a fossil is formed. As review at the end of the unit, I created an interactive bulletin board with pictures of fossils. Questions were written on the fossils and students were able to flip up the fossil paper to reveal the correct answer

Interpretation of the events that transpired during the study. Based on the research I conducted about multi-sensory education and my personal experiences, I believe that the lessons I created during my time at Osage Elementary School represented the effective use of multi-sensory teaching methods. The following data was collected during my time at Osage, and reflects my interpretation of the events that transpired during the study. I will discuss the major themes that emerged throughout the study.

Encouraging Student Motivation and Engagement with a Multi-Sensory Approach

As I began reviewing my data, I immediately noticed one theme consistent across the study: fun. In nearly every interview and focus group I conducted, the word "fun" was spoken at least once. I also found much evidence within my teacher research journal to suggest the students were having fun during the lessons. This information led me to consider the implications of fun within the classroom. Did fun mean more to the students than just "enjoyable?" I reviewed my data again, directing my focus around "fun." Based on this data, I found that "fun" had many meanings. First, "fun" implied that students

were engaged in the lessons. Second, "fun' suggested that students were interested in the lessons and wanted to learn more. Finally, I found that "fun" truly instills a love of learning in all students. After making this discovery, I found that my conclusions were consistent with the results of the study Molenda and Bhavangri (2009) conducted, which stated that students become emotionally involved in multi-sensory activities in the classroom.

"Fun" as means of engaging students in classroom activities. There was quite a bit of evidence from all data sources that students were engaged in the classroom. For instance, looking in my teacher research journal, I found that when three students demonstrated with movement how the sun stands still, the Earth revolves around the sun, and the moon orbits the Earth, students "oohed" and "ahhed." One student even exclaimed, "Wow! That is crazy! There is so much movement." My teacher research journal indicates similar responses from the students when I showed them a visual on the Smart board of the solar system with all of the planets moving. In addition, when the students were told they would be making Play-doh moons, they all cheered. Cheering became common in the classroom. In fact, during our Hollywood Squares review game, students became so invested in the game that their cheering became so loud that it attracted other teachers into the classroom to see what we were doing.

I also noticed that students appeared motivated during independent time throughout the lessons. For instance, when students were supposed to look up celestial entities on the internet, every group immediately got to work. There was none of the procrastinating that I had sometimes noticed a few of the students in the classroom

usually did before starting an activity. I noted similar motivation in my research journal during the Play-doh and symmetrical butterfly activities.

During interviews and focus groups, students discussed how fun aided them in their learning process. One student stated that she got to, "Learn from the textbook in a fun way." Another student described Reader's Theater as "exciting" because it was "challenging to act." Students also expressed their appreciation for the lessons directly to me without prompting. For example, a student came up to me after a lesson to inform me, "I am happy that I am having fun learning."

"Fun" as means of developing interest and promoting further learning. After continuously hearing the word "fun" thrown around so much, I decided to ask students to define the importance of fun in education during focus groups and interviews. I found one focus group discussion particularly enlightening. Students were discussing how much "fun" they had during the Smart board solar system activities.

> Me: I noticed that a lot of you use the word 'fun' to describe the lesson. How do you think 'fun' is important to your learning?
>
> Christopher: "Fun is important to learning because if students are bored they will not learn as much."
>
> Jennifer: Yeah. If students are bored, they are probably daydreaming and missing the lesson. Fun lessons get students to pay attention.

I found Jennifer and Christopher's explanations to be quite realistic and plausible. In fact, I did notice students were paying attention in the classroom. Furthermore, they were so engaged in the multi-sensory lessons that many of the students wanted to do more work than was necessary. For instance, during the lesson where students were partnered on laptops to research celestial entities, many students came up to me to ask if

they could look at other links on the website so that they could learn about more than just their own celestial entity.

Earlier in the year, after the class had completed the fossils unit, I had noted in my teacher research journal that several students asked me if they could look back at the interactive bulletin board review game during free time. I found this particularly interesting because it correlated with my research that stated that interactive bulletin boards will likely excite viewers and encourage participation (Stein, 2009). Students certainly seemed excited by the bulletin board and wanted to interact with it – even after the unit was over.

Additionally, when the class began working on the Reader's Theater activity, they expressed a desire to perform the material for other classes around the school. This led me to set up a presentation for another second grade classroom. This desire for "more" was also evident during interviews when students expressed a desire for harder questions in the Hollywood Squares review game. They also stated that they wished there were more questions. From these interviews, I discovered that the impact of fun on students' learning even expanded beyond the classroom. After the Play-doh lesson, two students informed me that they had gone home and use Play-doh at home to make their own solar system.

Students also demonstrated their interest in the activities we completed when they brought in supplemental materials from home. For instance, during the fossil unit, one student brought in a variety of fossils that he and his mother had collected. Meanwhile, during the solar system unit, a student brought in a video about the planets. I also continuously had students bring me books they discovered had information about

dinosaurs or planets. In addition, students often made me pictures of the science concepts we were learning. During the fossil unit, I encouraged students to incorporate mathematics concepts into science. If students finished their work early, they were instructed to trace geometric shapes to make dinosaur pictures. Long after the unit was over I was still getting dinosaur pictures addressed to, "Ms. Stoffers, the most fun teacher ever."

When we began the solar system unit, students once again were excited to make me pictures. This time it was not a suggested assignment. Instead, students simply decided to draw me pictures of stars, moons, Earth, planets, and the sun. I received multiple solar system pictures, which continued long after the unit was complete. In fact, almost two months after the unit was complete, it was my time to leave. As a going away gift, the students each wrote me a letter. Many of the letters included pictures of the solar system – one student drew a picture of the solar system and even labeled the planets in order.

After reviewing the evidence of students' desire to learn more, I discovered that it was consistent with the fourth principle of student-centered classrooms. Students were taking control of their own learning (Weimer, 2002). By asking for more work, seeking more information, creating pictures, and bringing in supplemental materials, the students were seeking ways to enhance and expand their learning beyond my instruction.

"Fun" as means to instill a love of learning. I viewed the students' enthusiasm for the lessons as evidence that they were learning to love learning. As is substantiated above, students wanted to be involved in their learning. They asked for and created

activities that supplemented their learning. The description of lessons as "fun" suggests that students viewed learning as fun.

To further affirm this belief, I completed an exit interview with every student. I asked students if they enjoyed school and asked that they name their favorite things about school. In general students responded that they did indeed enjoy school. They cited "fun teachers", "fun activities", and "fun specials" as things they particularly enjoyed about school. During interviews and focus groups, students often mentioned that it was, "fun to learn fun facts." These pieces of evidence suggest that students are enjoying school because it is fun. If students are able to view school as fun, they should learn to associate learning with fun as well. Therefore, using multi-sensory lessons that encourage fun is a way to instill a love of learning in students.

I will admit that while conducting my research, I did find myself concerned by the number of times students responded that an activity was "fun." As a teacher, I wanted to ensure that my students were not just enjoying school, but also learning. Oftentimes, when students would describe something as "fun" during an interview, I would ask them a comprehension question to ensure that learning had taken place. I was particularly concerned after the Play-doh lesson because I was not sure if students just enjoyed Play-doh, or if they really learned from the lesson. I asked one student, Briana, during her interview, "Why did we play with the Play-doh?"

> Briana: Because we were making moons. And it was fun because we got to put craters into it. It kind of reminds me of when we excavated those cookies like a paleontologist.

From Briana's response, I knew that she had learned something. She was able to use the proper terminology – not only from the Play-doh lesson, but also from a lesson I had conducted three weeks previously in the fossil unit.

Conclusions. Based on the data, it appears that students who view lessons as "fun" are more likely to be engaged in the classroom. Furthermore, "fun" encourages students to take control of their learning and seek more information. Students who are having fun in school want to learn. They are also more likely to develop a love of learning. As is made clear throughout the data, multi-sensory lessons can be a great catalyst for engagement that students find to be fun

Accessing Students' Needs with Multi-Sensory Teaching Methods

In analyzing my data, I found that multi-sensory education provides an opportunity to differentiate instruction because it appeals to different learners. It also encourages enthusiasm for learning, which helps to reach all students.

When interviewing students, I asked them to name different things that help them learn. Some students provided more than one answer. The table below shows the results:

Table 4

Student Identification of Strategies that Aid Learning

Strategies	Number of Students
Seeing (Visuals) – includes pictures	7
Reading	2
Discussions/Listening (Auditory)	3
Studying	1
Touch	7
Notes	3
Moving	1
Thinking	1

As can be seen by the above table, students described many different ways they access learning. While touch and visuals appeared to be the most common responses, multi-sensory education ensures that all students – even the single student who learns best by moving or thinking – are taught in a manner that suits them. Looking back upon my research, this belief is consistent with the multiple intelligences theorists' promotion of creating lessons around "rich experiences – activities in which they can engage with the material personally" (Moran et al, 2006, p. 25).

One student, Jennifer, who responded that she learned better through thinking, informed me that free time was important for students because, "if you do not have time to think – you are not going to remember." These words, which were spoken with wisdom well beyond her seven years, coincide with the belief that students should work in short segments to turn temporary memory into permanent memory (Klemm, 2007). Jennifer's statement is a reminder that every teacher should be conscious of mental processing time.

Another student also spoke wisely when he said, "Kids learn really well when there are activities." This student's opinion was affirmed by the many interview and focus group discussions, which almost always led to a conversation about how students learn better when they are involved in their learning, rather than if they are lectured to. Most of the students agreed that activities were beneficial to learning because activities allow the students to *see* the concepts.

Learning through the senses. A very intelligent young boy in the classroom named Gregory, informed me that he enjoyed getting to participate in the Play-doh activity about the moon and its phases because it allowed him to see where the moon was

in relation to the Earth and the sun. Other students described the activity that allowed students to watch the human representation of the Earth and moon moving around the sun as essential to helping students see how movement works in the solar system. As a student named Amy stated, "You are not just telling us. We are getting to see it."

Amy's statement brought me back to the theory of student-centered classrooms. Based on the interviews and focus groups, it appeared that students were supporting many of the principles of student-centered classrooms. For instance, by expressing their interest in learning beyond lecture, I concluded that students wanted teachers to relinquish some power (Weimer, 2002). Students wanted more power within the classroom so that they may critically think about the material before them (Weimer, 2002). Hence, students continuously referenced the fact that they enjoyed activities where they were able to see and interact with material.

Other students agreed that being able to see first-hand different elements from the solar system was "good to see and not just read about." Students cited other visual activities that aided learning. One such example was when the students got to use a flashlight on a ball to demonstrate the moon phases and how the moon glows because it reflects the sun's light. Another example was when students were able to view the movement of the entire solar system on the Smart board. Finally, another student expressed her enthusiasm for getting to "see Mars and see what it had on it".

Students also agreed that it was nice to move away from the book during the Smart board activities. Students stated that moving the planets into their correct order on the Smart board, as well as the Hollywood Squares review game, were useful because they were able to think back and picture the activities during the test.

The ability to see information also assisted students during the measuring math lesson. Students were able to first witness how to measure with paperclips on the Smart board. They were then able to take that knowledge and apply it to actual measuring scenarios. Multiple students described the Smart board as beneficial during math lessons. "The Smart board helps me get ready for when we do it ourselves," one student informed me. The Smart board activities appeared to work as an excellent guided practice for students.

Aside from visuals, students described other activities that helped them learn. In many of the science interviews and focus groups, students discussed activities from the fossil unit. They specifically mentioned the cookie excavation and dinosaur story as helpful in learning because the students were able to "actually do it." Students also made a similar reference to the Play-doh activity in the solar system unit. Another activity students thought was helpful for learning was the laptop activity. As one student stated, "When you read a book, you only get a piece of it. But, when you search different planets you learn more stuff."

Potential academic implications of multi-sensory education. While I cannot prove a direct correlation between students' grades and multi-sensory education, I did find that students performed higher on the science units that were conducted with a multi-sensory approach. Between the two summative science assessments taken after multi-sensory methods were incorporated into the classroom (one for the fossil unit, and one for the planets unit), students scored an average of 92.04 points. In the two summative science assessments taken directly prior to the implementation of multi-sensory education, students scored an average of 88.065 points. Therefore, students scored an

average of 3.975 points higher when multi-sensory methods were implemented. The students' test scores are listed below:

Table 5

Students' Test Scores

Test Score after Multi-sensory Unit (Out of 110)	Test Score after Multi-sensory Unit (Out of 100)	Test Score after Lecture-Style Unit (Out of 100)	Test Score after Lecture-Style Unit (Out of 110)
103	81	83	80
110	95	83	100
97	62	38	70
97	100	90	90
97	76	88	110
110	91	70	110
110	90	90	100
110	90	100	90
97	62	70	100
103	71	80	100
97	97	96	110
93	62	75	80
73	88	91	110
110	100	91	110
83	95	71	110
90	83	86	110
103	71	54	90
103	86	55	90
97	90	73	100
97	97	90	100
103	97	77	90
83	100	84	90
Average: 98.45	Average: 85.63	Average: 78.86	Average: 97.27
Average of Two Tests: 92.04		Average of Two Tests: 88.065	

* Note: Robert, the English Language Learner, does not have his test scores listed.

There were two students that stood out for me in regards to the impact multi-sensory education appeared to have on their learning and involvement in the classroom.

Steven. First, I found that Steven, the student who had been retained, benefited from multi-sensory methods. Many times during my student teaching experience, I became frustrated when I felt as though I just could not reach him. Getting Steven motivated to complete any work – especially in reading - seemed next to impossible. He could spend hours finding every possible way to avoid doing any work, and would very rarely ever participate in class.

However, during interactive science lessons, Steven would often be found raising his hand. He also tended to finish his work around the same time as other students during the multi-sensory science lessons, when he would rarely do so in other subject areas. However, it was the Reader's Theater activity that truly brought Steven's progress to my eyes. As an attempt to encourage Steven's self-esteem and enthusiasm, I gave Steven a small speaking role in the first scene of the Reader's Theater script.

When we first began practicing, I worried that I had made a poor decision. Steven fumbled over many of the words and often needed assistance in pronunciation. He read much slower than his other classmates. I worried that I was accomplishing the opposite of my original intentions. I did not want to make Steven feel embarrassed. However, as we continued to practice, Steven became more confident with his lines. He began reading a bit quicker – although still markedly slower than his classmates. When the big day arrived to present the Reader's Theater script to another second grade class, Steven read his lines well. I felt happier with my decision, but still worried I had caused more harm than good.

My fears were washed away the next day when I interviewed Steven about the lesson. I said, "Steven, I wanted to speak to you about Reader's Theater."

Without hesitation, Steven looked at me and said, "It was fun! That's it." His tone was very positive and enthusiastic. He was smiling and appeared happy. He stated that he liked his part and he thought the class did a great job during the presentation. It appeared to me that Steven was proud of himself for performing his role well.

However, the significance of Reader's Theater for Steven did not truly hit me until I was sitting in lunch with the second grade teacher whose class had watched our production. She turned to me and said, "You blew me away. I could not believe it. Steven was my student last year. He could not even read last year. He refused to read any time I asked him to. Now he is standing in front of another class and reading for them. I could not believe it."

Reading had obviously never appealed to Steven; however, by making reading "fun" and interactive and by building it around a multi-sensory foundation, Steven became interested and motivated. I had finally reached him.

Robert. Another difficult student in Mr. Dupont's classroom was Robert. Robert's limited English skills made it difficult for him to participate in the classroom. In fact, I noticed Robert almost immediately after entering Mr. Dupont's classroom for the first time. It was obvious that he was not engaged with instruction. He sat at his desk at the end of a row, coloring what appeared to be a color-by-number picture. He seemed to not be paying attention to the math lesson about subtracting double digit numbers. When Mr. Dupont, had a moment, he came over and explained, "That is Robert. He speaks virtually no English. He moved here last month. Robert was born and raised in the Dominican Republic. His mother just got married to a man who lives in our town."

As I continued to observe Robert, I found that he did not ever participate in activities. During instructional time, Robert would typically color, draw or scribble on a chalkboard tablet. Mr. Dupont was constantly telling Robert, "Put your coloring away, you do math with us." He would also run to the bathroom nearly every half hour.

Having no experience working with English Language Learners, I worried about how I could support Robert in the classroom as I began to teach. To gain a little knowledge, I followed Robert to his ELL class one day. His ELL teacher explained to me that typically English Language Learners developed in stages: first they observe in silence, then they speak, then they read, and finally they write. Robert was clearly in the first stage of silence – and his progress in English was coming along extremely slow. However, during this lesson I also discovered that I was under the misconception that Robert could not understand any English. In reality, he did understand a little more than he let on in the general education classroom.

As I began developing multi-sensory lessons for the classroom, I noticed a change in Robert. He seemed a bit more involved. For instance, he made a beautiful fossil and did not color during science. But, the real turning point came when we did our fossil play. I would read a story and selected students would act out the story. As I came up to an "acting" part I would call on a student or two to perform the duty. About halfway through the story, I was blown away when I noticed Robert's hand eagerly waving in the air. This represented the first time I had seen Robert participate in the classroom.

The role was the wind. Robert and one of his classmates were to act as the wind and place pieces of construction paper over a construction paper dinosaur. This was to symbolize the first step to making a fossil: dirt and clay burying an animal. I told Robert

and his classmate, “Be the wind!” and even acted as the wind myself. Robert followed my movements and the movements of his classmate – imitating her as she placed the piece of construction paper on the dinosaur. He then returned to his seat, recognizing that his role was over. I was elated. This multi-sensory activity had brought Robert out of his silence. He elected to participate in the classroom activity. Many of his classmates acknowledged his participation by telling him that he did a good job.

I later wrote an enthusiastic description of the event in my teacher research journal, “Today was the first time Robert has ever participated in class! When I saw his hand in the air, my heart nearly jumped out of my chest. And when he was finished, tears sprung to my eyes. I think I’m reaching him through these multi-sensory lessons. I think that this is the best way to get him involved in our classroom.”

Over the course of the next few weeks, Robert continued to participate during my math and science lessons. For instance, when we excavated the chocolate chips out of chocolate chip cookies with toothpicks, Robert was one of the first students to safely remove all of his chips. He also worked wonderfully with his partner to research a celestial entity on the laptops. Robert’s enthusiasm for multi-sensory activities appeared again during the Hollywood Squares review game. He eagerly waved his hand in the air in the hopes of getting to pick a square. When I called him up, he picked a square and then worked with his classmates to find the answer. After his team got the correct answer, he cheered along with everyone else.

Additionally, when we made symmetrical butterflies, Robert not only made a beautiful butterfly, but also completed his math workbook pages – a feat I had never ever

seen him attempt before! His involvement in math continued through the measuring unit. Robert continued to work with his peers to complete mathematics work.

Based on my observations, multi-sensory activities appear to have encouraged Robert to participate in his classroom. I also believe that this has been a way to transcend language barriers because Robert can learn about the activity he must complete by observing his classmates. For instance, he watched his classmates to learn that he must double click the Smart board to pull up a question during the Hollywood Squares activity. Using multi-sensory techniques also provides Robert with the opportunity to complete parts of the activities that do not require language knowledge – such as drawing a picture of a planet or making a moon out of Play-doh.

Conclusions. Based on the data I collected – especially my observations with Steven and Robert – I believe that multi-sensory education allows teachers to provide for all students' needs. In nearly every lesson, students each cited different components of the lesson that they enjoyed. Moreover, students stated that they were happy that they had different activities to participate in within every lesson. This stands as proof that different activities appeal to different learners. Even if students struggle with one aspect of a lesson, there will be other aspects within the lesson that appeal to their strengths.

Certainly, students who struggle academically may benefit from multi-sensory instruction when lessons are presented in an engaging and meaningful manner. For instance, hesitant readers such as Steven may find value in reading when provided with a multi-sensory activity that brings excitement and meaning to the student. Steven was able to build a confidence in his reading as he learned to enjoy himself. Additionally, because multi-sensory education uses the senses to reach all learners, all students – regardless of

ability level or language – may benefit from the approach. Students such as Robert can become more engaged in the classroom community through multi-sensory education. Robert was able to participate in the class activities because he was not always required to understand English – he just needed to observe his classmates' actions. For Robert, multi-sensory education was able to transcend the language barrier. Furthermore, multi-sensory education appears to have a positive impact on student learning.

Fostering a Positive Classroom Environment Utilizing Collaboration

A third theme found within the data suggested that multi-sensory activities that encouraged team-building did appear to have a positive impact on classroom environment. However, the progress was not as marked as I had hoped. Certainly, the classroom did not make a major transformation in the way of classroom environment, but the activities did appear to encourage students to be friendly and collaborate.

Generally, after a team-building activity, students in interviews and focus groups would mention that working with others helped the classmates get to know one another better. It also helped to make new friends. For instance, during the laptop research activity in the solar system unit, I partnered Frank and Patrick up. They were an unlikely pair. Frank was a student who received good grades and worked hard. His behavior usually seemed to be dependent on the students surrounding him. If he was with talkative students, he tended to disrupt the class a lot; however, when he was around other hardworking students, he appeared to work harder as well. Patrick, on the other hand, had a reputation for bullying and was a low-level reader. Yet, the duo worked together perfectly. At one point, I heard Patrick and Frank collaborating.

"Which fact do you want to write, Patrick?" Frank asked. He read two facts to Patrick. Patrick picked the one he wanted to write, and started working on it. In the meantime, Frank started drawing a picture of Saturn. Frank kept erasing his picture until he finally exclaimed in frustration, "I cannot do it!"

Patrick looked up from his writing, "You can do it. Here, you draw the circle and I'll draw the rings. Then we'll color it together." This teamwork was rare to find within the classroom – especially when Patrick was involved. Later, during an interview, Patrick said that working with a partner was nice because, "We both got to do something."

In addition, I found that after partnering Amy and Robert up for an activity, the pair seemed inseparable. Whenever the students worked in pairs, Amy would request to work with Robert. She would also work with Robert to help him understand math concepts – even when students were not working in groups. Her enthusiasm encouraged other students to want to work with Robert as well.

After students completed team-building activities, they would inform me that they felt closer to their classmates. Many students also thought it was "more fun to work together." When the class completed the Hollywood Squares review game, Jennifer told me that she liked working in teams because she knew "there were people to back you up. Someone was always there to pick you up."

During team-building activities, I found students working together to collaborate. For instance, during a mathematics lesson where students worked in pairs to measure classroom objects with paperclips, students worked as a team. I wrote the following interaction between students down in my teacher research journal:

Gregory: What object do you want to measure next?

Allen: How about the desk? I'll hold this end of the paperclips and you hold that end.

Gregory: We don't have enough paperclips!

Allen: Briana, can you and Jennifer share your paperclips? We want to see how high this desk is.

Briana and Jennifer came over and the four students worked together to determine the height of the desk. When they were finished, Allen and Gregory thanked Briana and Jennifer for their help.

I also found students collaborating as they practiced for Reader's Theater. I had encouraged the students to use expression in their voices and to even move around the classroom to act out parts of the story if they felt comfortable doing so. As students practiced their lines, I heard Louis and Tanya critiquing each other.

Tanya: I think that you should be really excited during this part. You should yell or jump up and down or something.

Louis: (Re-reads the line again.)

Tanya: That was perfect. Now it's my turn to read. (Tanya reads her line.)

Louis: It says that you are playing outside. Maybe you should pretend to jump rope or playing tag.

Tanya: Ok. Let me try that.

Unfortunately, despite the team-building efforts, the classroom still had its difficulties. For instance, no matter how much I tried, one student named Henry was always named as a "bad partner." Henry was very argumentative and bossy with his classmates. He insisted the work get completed the way he wanted – which usually meant that he wanted to use the computer for the entirety of the activity and not share materials. In one lesson, he rolled his eyes when he found out who his partner was.

The negative behavior within the classroom did not diminish either. Despite the changes with Robert, I still caught students trying to teach him to say inappropriate words. We also continued to have an issue with hitting in the classroom.

Perhaps if I had conducted more social lessons using multi-sensory activities, the students may have benefited. However, incorporating team-building activities in the classroom did appear to have some positive effects on most students, although it did not entirely change the classroom climate. Students generally developed collaborative skills, got to know classmates better, and enjoyed their partnerships.

Multi-Sensory Education as a Generative Space for the Use of Technology and Making Connections to the Outside World

When reviewing my data at the end of the study, I discovered one unanticipated consequence of using multi-sensory education in the classroom. To reach learners through the senses, I often incorporated technology, family, and community members to assist me in my endeavor. I discovered that using multi-sensory teaching methods in the classroom encouraged me to find ways to bring material into the classroom that might not have otherwise been accessible to the students.

This strongly correlates with my research that suggests that all learning is connected to sight, sound, smell, location, touch and emotions. These senses provide contextual cues for people to create lasting memories (Jensen, 1998). By utilizing technology and the outside world in the learning environment for the students, they were able to bring personal meaning - through the senses - to material that might otherwise have been quite abstract (i.e. the solar system). Additionally, students were asked to think about the material critically, which relates to the basic principles of student-centered classrooms (Weimer, 2002).

During my discussions with students, they cited many examples of the effective use of the technology and the outside world. For instance, during interviews and focus groups, students often spoke about the benefits of computers in the classroom. During the solar system unit students continuously mentioned that the computers allowed them to see the planets. They were able to see actual pictures of the moon and Mars. Students could also see the solar system in full movement. No matter how well I could describe the different orbits and rotations of the planets within the solar system, nothing made the concept so real to students as seeing the movement on the computer in a simulation.

Students also discussed how the Smart board and computer "gives you more information on a topic and lets you learn about it instead of just telling you." Students stated that they believed that the use of computers allowed them more control over their learning, once again relating back to student-centered classrooms (Weimer, 2002). They were able to research in-depth material that might not necessarily have been found within their textbook or even any of the books within the classroom. Additionally, the internet allowed students up-to-the-minute information about the solar system. While the classroom textbook still described Pluto as a planet, the students were able to learn more about its new classification as a dwarf planet on the internet.

Another important source of information came from videos. For example, one student insinuated that it was possible to "use videos to learn more." Students thought that the planet rap video helped because it provided information about the planets in a song. Some of the students were actually able to quote pieces of the rap. They also mentioned that the rap video helped to clarify some of the concepts about the planets. They were able to watch people dressed metaphorically as the planets – such as Saturn

who rapped while hula-hooping. Students were able to connect Saturn's rings to the hula hoop.

I also used classroom lessons to help students make personal connections to the material. For instance, after students completed an activity drawing and writing about themselves in their future career, I found that students still appeared to struggle with the idea of careers. As in any student-centered classroom, I utilized this informal assessment information to benefit student learning (Weimer, 2002). I wanted them to learn about different jobs directly from the source. This encouraged me to invite family and community members into the classroom to discuss different professions. Our classroom Career Day brought five presenters: an engineer, an aircraft technician, a Postal Service fraud analyst, a UPS driver, and a state trooper. These presenters were able to bring in different materials that encouraged students to make connections to the careers. For instance, as I recorded in my teacher research journal, students were able to view video footage of the inside of a plane's engine, they watched a rocket launch, and were able to touch a police badge. During the event, students asked the presenters many questions in an attempt to understand the careers better. For instance, they wanted to understand what a catwalk was, and why it was used to catch fraud within the Postal Service.

Other ways I brought the "outside" into the classroom was through a chocolate chip cookie excavation, movement demonstrations of orbiting planets, and Reader's Theater. The cookie excavation helped students understand the job of paleontologists. Students were able to discover the difficulty of extracting bones from the ground during this lesson. During the movement demonstration of Earth revolving and the moon orbiting, students were able to see, in person, a sample of movement within the solar

system. Students were able to understand the complexities of the solar system. Finally, prior to the Reader's Theater activity, the second grade went on a field trip to see *The Sound of Music* performed at the local middle school. I was able to connect that performance to Reader's Theater to help students understand how actors should behave.

Although the use of technology and the outside world was an unanticipated consequence of multi-sensory education, I found it a valuable and relatively easy way to utilize the senses and bring meaning to the material.

Summary of Data Analysis

As stated in chapter two, there are several key factors that influence both brain development and academic achievement including exercise, the arts, genes, nutrition, feedback, and love (Jensen, 1998). The theory behind multi-sensory education is to provide each child the advantage of lessons taught through these multiple senses to increase the likelihood of absorbing material (Christie, 2000). After conducting this research study and analyzing my results, I believe multi-sensory education is certainly an effective instructional technique. Based on all my data sources, I have come to find four key themes. First, multi-sensory teaching methods provide students with opportunities to become engaged in material and develop a love of learning. Students appeared motivated to learn, were excited by material, and even wanted to complete work beyond that required of them. Second, multi-sensory instruction can provide a generative space for the use of technology and making connections to the outside world. By incorporating elements of technology including computers, the internet, videos, and the Smart board, by using outside resources such as family and community members, and by developing lessons that bring abstract concepts into the classroom through meaningful experiences,

students will develop an understanding of the world outside the classroom. Third, multi-sensory education can target the instructional needs of all students. By targeting multiple senses, all students and their personal learning styles are guaranteed to be accessed during instruction. Fourth, by incorporating collaboration within multi-sensory lessons, students can develop some sense of teamwork. While teachers should probably incorporate social lessons into the classroom as well, students do learn how to collaborate effectively and enjoy working in groups.

In addition to these themes, I discovered that multi-sensory education encourages a student-centered classroom. Furthermore, I found that students, such as Jennifer, emerged in powerful ways within the classroom. Jennifer was not necessarily the most powerful student in the classroom, but she provided me some of the most insightful comments during interviews and focus groups. Other students also emerged within the classroom, such as Steven, who struggled academically, and Robert, who was learning to speak English. Perhaps in more traditional settings, these students would have been silenced. Ultimately, my research has found that multi-sensory education is a worthwhile instructional method that teachers should consider implementing in their classroom.

Chapter V

Summary, Conclusions, and Implications

Restatement of Findings

As discussed in chapter four, I have come to find that multi-sensory education has many benefits in the classroom. After implementing my teacher research study in a second grade classroom, I analyzed multiple qualitative data sources to help me understand the impact of multi-sensory teaching methods on academics and classroom community. Using my teacher research journal, interviews, focus groups, and student work I discovered four main themes within my research.

First, during multi-sensory lessons students seemed engaged in their learning and were eager to complete more work than was required. Students described multi-sensory lessons as "fun." When prompted, students stated that "fun" was important to learning because it helped students pay better attention and learn more. In my teacher research journal I also found notes that suggested students were excited about lessons. For instance, several times students "oohed", "ahhed", or cheered when material was presented. Additionally, many students asked for opportunities to learn more about the material we were covering. Students also mentioned that they tried activities from class at home. Based on the data, it appeared that students were developing a love for learning through multi-sensory education.

Second, I discovered that multi-sensory education provided teachers a means of accessing students' instructional needs. Multi-sensory education encourages teachers to incorporate different instructional components into one lesson. This makes it possible to differentiate instruction and reach multiple learners. Although I could not prove a direct

correlation, I did find that students performed an average of 3.975 points higher on tests when the material was presented through a multi-sensory method than when material was presented lecture-style. Finally, I found that students with different needs benefited from instruction – including low readers such as Steven, who developed a confidence and love of reading through a Reader's Theater activity, and English Language Learners such a Robert, who was able to transcend language barriers through the use of multi-sensory instruction to become an active participant in the classroom community.

The third theme that appeared during data analysis was that multi-sensory education helped to foster a positive classroom environment by utilizing collaboration. Students often worked on team-building activities during instruction. Most students described these collaborative experiences as opportunities to make friends and get to know classmates better. During interviews and focus groups, students informed me that they hoped they could have other opportunities to work with groups. However, I still noticed that negative behavior existed in the classroom. I realized that while collaboration does add some positive elements into the classroom, it does not extinguish every concern.

The fourth theme was an unanticipated consequence of using multi-sensory techniques in the classroom. By attempting to appeal to students' senses, I utilized technology and encouraged students to make connections to the outside world. For instance, to provide students access to material, I incorporated the use of computers, the Smart board, and videos. I also encouraged parent participation and tried to bring activities into the classroom that would help students make meaning of abstract concepts. By bringing elements from outside the classroom in, I discovered that multi-sensory

instruction can provide a generative space for technology and encourage students to make connections to the world beyond the class' four walls.

Overall, I discovered that multi-sensory education can help to develop student-centered classrooms and can have a positive impact on students and within the classroom.

Conclusions

As the research suggests, multi-sensory education can have many benefits. Brain research indicates that over eighty percent of all information the brain absorbs is visual (Wilmes et al., 2008). Additionally, Ewy (2003) discovered that permanent memory is stored in the form of imagens, which are composed of mental images, smell, taste, and kinesthetic sensations. In my study, I found that students were able to describe this storage of memory to me when they discussed how they were able to visualize memorable lessons from the Smart board to help them on the end-of-unit assessment.

Brain research suggests that more neural pathways within the brain are stimulated when a person is asked to use multiple senses (Christie, 2000). Therefore, it is unsurprising that research implies that students perform statistically better on standardized achievement and attitude tests when they are taught or tested through a method appealing to their individual learning style (Kritsonis, 1997/1998). I saw similar results in assessment scores during my teacher research. Although I could not draw a direct correlation, I found that students performed 3.975 points higher on unit science tests when multi-sensory education took place than when lecture took place.

I also found that my data analysis correlated with the beliefs put forth by de Wet (2006) which stated that students should experience both affective engagement (joy for learning) and cognitive engagement (an ability to understand content, discuss material,

and make meaning out of information) in the classroom. In my study, students appeared extremely engaged in the material, were excited to learn, and used their classroom experiences to develop and understanding of abstract material. Students were able to make meaning of concepts such as excavation, orbiting, and rotating through multi-sensory activities. Such critical thinking indicates that students were participants in a student-centered classroom (Weimer, 2002).

Finally, as Jensen (1998) suggested, innovative teachers will incorporate all elements of the senses in lessons that benefit learners cognitively, emotionally and physically. I experienced this first-hand as the students learned material while developing a positive classroom and environment. Students both learned and understood material, but they also discovered how to work within a team setting.

Implications for Practice

At the conclusion of this study, I learned that the positive impacts of multi-sensory education could be valuable information for other teachers. Based on my data, experiences, and observations, I have found that students tend to value "fun" within the classroom. A multi-sensory teaching approach can encourage educational fun. Within the confines of my study, the data suggested that "fun" promotes motivation and engagement of students. Furthermore, it fosters a love of learning among students.

In this particular study, one student named Jennifer, emerged within this study in a powerful way. She spoke with wisdom beyond her years and was able to, quite simply, break down the important components of student learning. Her discussions about how the multi-sensory lessons were beneficial were essential to understanding the impact teaching to the senses can have within a classroom. Ironically, Jennifer was an average student,

and her thoughtful responses would likely have been overlooked in a traditional classroom.

Other students, who may have been overlooked in a traditional classroom, also emerged within this study – particularly Steven and Robert. Steven was a student who struggled academically, especially in language arts. However, a Reader's Theater activity prompted Steven to discover a love of reading and build confidence in his reading ability. Meanwhile, Robert, an English Language Learner who rarely participated in class, was finally able to transcend the language barrier through multi-sensory lessons. Based on the data, it appears students of all abilities and all cultures were reached through multi-sensory techniques.

Implications for the Field

In an educational climate where standardized testing is a norm and where teachers are resorting to lecture and worksheets to cram as much material as possible in every lesson, multi-sensory education can make an impact. Using a multi-sensory teaching approach can be an effective alternative to lecture. Through the multi-sensory instructional approach, teachers can ensure that standards are being met, while also encouraging student motivation and fun. Multi-sensory education will likely produce strong test scores while also reducing the redundancy of completing worksheets, as well as reducing students' animosity for learning due to boredom in school. In addition, teachers who struggle to find ways to meet the needs of all learners can use multi-sensory methods to differentiate instruction. Furthermore, a multi-sensory teaching approach can help teachers to develop student-centered classrooms. Based on this study and my research, I can conclude that multi-sensory education is an effective instructional method,

that, when utilized correctly, can encourage academic learning and assist in building a positive, student-centered classroom environment.

Limitations of the Study

While conducting this teacher research study, I found there were several key factors that limited the study. First, I had only a few short weeks to complete the study. Given more time, I could have conducted a much more extensive study that would have allowed me to examine the long-term effects of using multi-sensory education in the classroom.

I was also limited by the fact that I was a visitor within the classroom. While my cooperating teacher made every effort to make me feel at home in the classroom, I was not with the students from the beginning of the school year. I was not in the classroom to help establish the rules and norms from the beginning of the year. I believe that this impacted my ability to conduct lessons in the classroom. I could not always direct lessons in the manner that I would prefer because I had to ensure consistency for students within the classroom.

Suggestions for Further Research

Based on the limitations I discussed above, further research should be conducted to determine other impacts of a multi-sensory teaching approach. While I was able to discover the short-term effects of using multi-sensory teaching methods, I am still curious to learn if there are other ways multi-sensory education could impact the classroom environment in the long-term. By having more time in one's own classroom, the long-term effects of multi-sensory education may be determined.

Due to the limited scope of my teacher research, I was still left with questions at the end of my study. For instance, how can multi-sensory education assist in developing classroom community when social lessons are conducted? If more time was available to complete the study, perhaps multi-sensory lessons focusing on social aspects – such as bullying or discussing angry feelings - could be incorporated into the classroom curriculum. Would such lessons have an impact on the classroom environment?

Another question I developed at the end of this study pertains to the positive impact of multi-sensory education in other classrooms. While a multi-sensory teaching approach was successful during its implementation in my student teaching placement, can this be true of all classrooms? Every classroom has a different dynamic and culture. Reserved students may not appreciate multi-sensory activities that encourage activity and, in the case of Reader's Theater, public speaking. Perhaps the results of this study would not be replicated in every classroom.

Finally, I am curious about the impact multi-sensory education would have within a special education classroom. From this limited study, I found that students of all ability levels were reached during my lessons. However, would this hold true in a classroom where students have special needs – especially if the classroom contained students with severe disabilities? Through further research, many of these questions can be answered. In the meantime, I plan to continue my work with multi-sensory education in my future classroom.

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