## CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

# AN ANALYSIS OF THE EFFECTS ARTS INTEGRATION HAS ON STUDENTS’ DEVELOPMENT OF SELF-CONCEPT IN THE ELEMENTARY MATHEMATICS CLASSROOM 

A graduate thesis submitted in partial fulfillment of the requirements For the degree of Master of Arts in Education, Elementary Education

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# ABSTRACT <br> AN ANALYSIS OF THE EFFECTS ARTS INTEGRATION HAS ON STUDENTS’ DEVELOPMENT OF SELF-CONCEPT IN THE ELEMENTARY MATHEMATICS CLASSROOM 

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This mixed methods study investigates the extent to which the integration of arts into the study of mathematics influences the development of students' learning self-concept. The participants are third grade students whose participating classroom-teacher was exposed to a STEM and Arts Integration Professional Development with training on how to explicitly teach arts integrated lessons. Prior to the training, students of the teacher were given a survey to articulate their understanding of self-concept and how it relates to their successes in mathematics. Following the transfer and application of the integrated arts instruction, students were administered a post survey. Additionally, interviews of a randomized sampling of participating students and classroom observations were done to further understand how arts integration impacts students' academic self-concept. These findings lend support to the supposition that integration of the arts into the study of mathematics could be beneficial for student engagement and improved self-concept.

Key Terms: arts integration, self -concept, mathematics, engagement

## Introduction

Teachers often hear students refer to themselves as either "artists" or "math" people. Are these perceptions malleable? Where do they begin? How are they formed? Do teachers throughout the elementary school years have any leverage in changing negative academic perceptions? Is it possible that by explicitly integrating the arts into STEM (science, technology, engineering, and math) disciplines, we can improve students' self-concept in STEM subjects about which they feel the weakest and most apprehensive? This research investigates the extent to which the integration of arts into the study of mathematics influences the development of students' learning self-concept.

Research by Heyman and Dweck (1998) concludes that once children reach ten years of age, they have begun to view their personal intelligence in an academic subject as fixed. Once they have evaluated their own abilities, they integrate their evaluation with their self-concept, perceiving that what a person does is equivalent to what kind of person they are (1998). Research by Dweck, Chiu, and Hong (1995) additionally supports the observation that children as young as preschoolers display effects of negative self-attributions and decreased persistence when they have encountered salient failure and criticisms.

Staggeringly, only seven percent of students have only positive experiences with mathematics in their kindergarten through college academic experience (Jackson \& Leffingwell, 1999). They believe core assumptions of their own abilities to be a determinant of their own reality, which in turn determines behavior. They create a kind of framework, or mindset, in which their beliefs about themselves cause reactions and judgments about their own abilities (Dweck, Chiu, \& Hong 1995). Linnenbrink and

Pintrich (2002) found that this negative student self-concept is in fact malleable. It is changeable and receptive to student engagement supported by features of the classroom environment. How can we take advantage of this malleability and affect this negative mindset created by students who have had such challenges in the mathematics classroom? Arts integration may provide one answer.

Theorists as far back as the 1800s, such as Horace Mann and his contemporary John Dewey, have proposed that "the correlation between instruction in the arts and cognition to be positive" (Gullatt, 2008, p. 13). More recent theorists such as Catteral, Eisner, and Gardner have suggested that arts are integral to the education of the "whole child" (Gullatt, 2008, p.12).

Additionally, Gardner finds humans distinctive in their intelligence and argues that no form of our intelligence exists entirely alone (Gardner, 1999). He acknowledges that people hold multiple intelligences through different strengthened perspectives and that by combining these strengths people can better integrate knowledge (Gardner, 1999). Integrating the arts into the content curriculum allows use of intelligences such as spatial, bodily kinesthetic, and musical to engage students in their learning (Gullatt, 2008). These varied intelligences offer multiple entry points for involving students in the learning process. More entry points could generate more positive experiences for students in the mathematics classroom.

Drawing upon Gardner's theories of multiple intelligences, the visual, musical, and kinesthetic nature of many arts disciplines may give students who have not experienced academic success a new point into challenging subject matter (Gullat, 2008).

Additionally, Eisner (1992) comments that the more intelligences students use to participate in learning experiences, the deeper they find their understanding of content.

Furthermore, arts integration has also proven to supply intrinsic motivation for students (Walker, Winner, Hetland, Simmons, \& Goldsmith, 2011). Arts integration could provide an entry point for students who typically struggle in academic areas such as mathematics by engaging students who otherwise would not participate (2011). Allowing students to build upon their strengths can shape a challenging academic experience and leverage it into a success. As students' feelings of success increase, perhaps their perceptions and ideas of self-concept will continue to improve. Is it possible that by integrating the arts into the math curriculum, we can improve students' comfort level in subjects in which they continually encounter challenge? Can we increase students' comfort level and interest in mathematics by integrating arts into the curriculum?

The purpose of this study is to test how integration of the arts curriculum can influence the development of third-grade students' self-concept as related to the study of mathematics. The grim fact of the matter is that America will create nearly 800,000 jobs between 2008 and 2018 that require a graduate degree in STEM fields. Based on current trends, only 550,000 native-born Americans are on track to earn STEM graduate degrees during this time (Tai, Liu, Maltese, \& Fan, 2006). Without students becoming fluent in STEM disciplines, our graduates will not be able to fulfill the U.S. workforce needs. If students continue to discount themselves as being "not good in math" or "not a math person" they will have removed themselves from the growing number of young adults necessary to meet the demands of the present and future job market. Therefore, it is a
significant challenge for elementary educators to provide appropriately-constructed curriculum and instruction that engages and supports students to develop both confidence and competence in STEM disciplines (Massey, 1989). This study investigated integration of arts into the mathematics curriculum as an aid to address the critical need for students to develop self-confidence.

To test this method, the researcher used embedded mixed methods design. It involved collecting quantitative data first and then comparing the quantitative results with in-depth qualitative data. In the first quantitative phase of the study, survey data on students' attitudes about mathematics were collected from a volunteer class of third-grade students after interaction with their typically implemented, school-adopted math curriculum. The researcher observed this class during typical school-adopted math curricular lessons documenting evidence of behavioral engagement. Subsequently, the volunteer third-grade teacher was given an hour-long professional development on integrating arts into mathematics. The volunteer teacher was asked to teach four artsintegrated math lessons. The researcher observed the students during these arts-integrated lessons for evidence of behavioral engagement. An identical post-survey was given to the students to assess whether arts integration had affected students' ideas of self-concept in mathematics. The second qualitative interview phase was conducted as a follow-up to the quantitative results to probe deeper in order to explain the lived experiences of the students. The result found that based on an analysis of the surveys, observation data, and interviews, arts-integrated lessons do impact a student's engagement in the mathematics classroom. Additionally, interpretation of the same data also lends itself to the conclusion
that arts-integrated math curriculum can in fact influence and increase students' selfperceptions in the mathematics classroom.

Answers provided by this study may help other educators have a greater understanding of how integration of the arts affects student engagement and self-concept in mathematics. This could have wider-reaching impacts on student achievement, engagement, and self-perceived success in mathematics. Finally, a change in selfperception in mathematics could encourage more students to take mathematics coursework. Students may choose to major in more STEM-related fields, thus making them eligible for STEM positions in our national and global economy.

## Literature Review

## Self-Concept

Lerner and Fisher (2005) define self-concept as "stable perceptions and evaluations people have of themselves and their own attributes" (p. 971). The ages between six and fourteen are an important time of developmental growth that is central to creating a child's sense of personal identity and self-concept (Eccles, 1999). During this time, children look toward adulthood by becoming self-aware and independent (Munley, 1975). They develop a sense of self-esteem and begin to compare themselves to peers (Eccles, 1999). At this time, self-concept becomes increasingly intangible. It shifts from concrete descriptions like physical characteristics and behavior, to social constructs and psychological constructs such as being smart and popular (Lerner \& Fisher, 2005).

According to the seminal developmental psychologist Erik Erikson, humans go through eight different developmental stages in a lifetime, coping with a central psychosocial problem or crisis in each stage (Munley, 1975). During middle childhood (between the ages of six and ten), children begin to develop a personal sense of identity, self-concept, and an understanding that achievement will play a significant role in shaping their success in academics and beyond (Eccles, 1999). This is what Erikson describes as "industry versus inferiority" (Munley, 1975, p. 314). It is this time when children begin to understand that working industriously, following expectations and cooperating with peers and adults, can lead to success and social status (Eccles, 1999). It is also when they categorize themselves as "inferior" (Munley, 1975, p. 314).

Research done on motivational patterns in young children suggests that children as young as preschoolers associate negative affect and decreased persistence after
encountering failures on tasks that are meaningful to them (Dweck, Chiu, \& Hong, 1995). When students are in academic settings, Heyman and Dweck (1998) say, "a major focus in academic situations is on measuring the abilities of one's self and others as opposed to processes that might promote learning" (p. 399). These experiences often produce negative experiences (Heyman \& Dweck, 1998). However, these negative effects can be changed when understood through the lens of a malleable theory of human attributes. This lens sees human attributes as dynamic and changeable, being frequenlty developed by different experiences (Dweck, Chiu, \& Hong, 1995).

Additionally, Eccles (1999) lays out key factors contributing to children's selfconcept. These include cognitive changes that enhance a child's ability to be selfreflective as to his or her own successes or failures and an exposure to social comparison situations in the classroom. As students encounter their peers successfully meeting academic challenges, those that do not begin to repeatedly self-reflect upon their failures. Repetitive negative academic experiences contribute to a decline in self-concept, which may prevent students from taking classes in challenging academic subject areas (Eccles, 1999). Additionally, research studies have revealed that there is a positive relationship between perceived ability and academic achievement (Multon, Brown, \& Lent, 1991). Therefore students' self-perceptions of their own abilities become an essential factor in educating students (Tirri \& Nokelainen, 2011).

Zimmerman (1998) believes that self-reflection begins with self-judgment, or the process by which individuals compare themselves to standards or goals set by others (Schunk \& Zimmerman, 1998). The individual may interpret a failure to reach these goals as a result of too little effort and then exert more work to meet the goal. However,
if an individual interprets the reason for failure as a lack of ability, then the impact to that individual's self-perception will be negative (Tirri \& Nokelainen, 2011).

## Engagement

Fredriks, Blumenfeld, and Paris (2004) find that student engagement can be divided into three constructs: behavioral, emotional, and cognitive. They define behavioral engagement as observed by students following rules and staying on task. Others, like Birch and Ladd (1997), define behavioral engagement as displaying efforts of persistence, contribution in class discussions, and asking questions. Behavioral engagement is considered crucial for advancing positive academic outcomes (Fredricks, Blumenfeld, \& Paris, 2004). Similarly, Fredriks, Blumenfeld, and Paris find that emotional engagement is interpreted in the positive and negative feelings students have about a school's teachers, academic content, and other students. Emotional engagement can be demonstrated by a student's interest, happiness, sadness, anxiety, or boredom in the classroom (Skinner \& Belmont, 1993). Additional research by Epstein and Mc Partland (1976) suggests that emotional engagement is related to students' attitudes. Cognitive engagement is defined as the willingness and desire to put in the necessary effort to master complex ideas within the classroom (Fredricks, Blumenfeld, \& Paris, 2004). There is difficulty when it comes to measuring cognitive engagement in the classroom. Fredricks, Blumenfeld, and Paris say that because cognition is not easily observable, and is often happening inside a student's mind, it must be inferred from behavior. Additionally, they say that measuring cognitive engagement of elementary grades is particularly difficult due to children's continuing growth and development of
cognitive processes (2004). However, cognitive engagement can certainly be measured by achievement (Linnenbrink \& Pintrich, 2002).

There have been several studies linking positive self-concept to classroom engagement. Connell, Spencer, and Aber (1994) explain that perceived self-confidence has been found to correlate with behavioral and emotional engagement in elementary school. Valenski and Stipek (2001) also found that first graders' positive self-perceptions of academic ability were significantly linked with high classroom engagement. Linnenbrink and Pintrich (2002) found that high academic self-concept leads to engagement and thus higher academic achievement. They also find that this relationship is reciprocal, that achievement can then lead to higher self-concept. The more students engage, and the more they learn, the higher their academic achievement. Their selfconcept improves and they are more likely to re-engage in the classroom. Similarly, Linnenbrink and Pintrich (2002) also found that students who have low self-concept are much less likely to demonstrate engagement. They are less eager to participate in the classroom and often give up when a difficult task presents itself.

Additionally, Linnenbrink and Pintrich (2002) found that student self-concept is in fact malleable. It is changeable and receptive to student engagement supported by contextual features of the classroom environment. Factors of classroom context include teacher efficacy and curricular choices. This insight also offers hope that students' negative ideas can be affected by their behavioral, emotional, and cognitive engagement.

Martin, Mansour, Anderson, Gibson, and Liem (2013) find that one of the most significant ways to affect behavioral, emotional, and cognitive engagement is through arts integration. They found, "It is the deeper (cognitive, affective and behavioral)
immersion in the arts that has the capacity to impact deeper values and beliefs about oneself and one's place in the world" (p. 721). They also found that significant participation in the arts predicted higher academic engagement and non-academic engagement such as higher self-concept and satisfaction in school.

## Mathematics Anxiety

Again, only seven percent of students have only positive experiences with mathematics in their kindergarten through college academic experience (Jackson \& Leffingwell, 1999). Low self-concept in mathematics has often been linked to a term known as math anxiety. Richardson and Suinn (1972) define mathematics anxiety as involving "feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (p. 551). Students as young as kindergarten experience math anxiety, but most students show initial signs of math anxiety in the third grade (Jackson \& Leffingwell, 1999). According to Jackson and Leffingwell, this is often due to working with fractions or difficulty memorizing multiplication tables. Students who are math anxious not only avoid math, but also perform lower than their peers when exposed to math (Beilock, Gunderson, Ramirez, \& Levine, 2010). Henderson and Landesman (2001) state that children who experience early repeated failures are victims of negative academic self-concept and negative attitudes toward academic subjects.

When students worry about their own abilities, their thinking and reasoning can be affected. Math anxiety prevents these students from using math skills they already have to demonstrate what they know on assessments (Beilock, Gunderson, Ramirez, \& Levine, 2010). Meece, Wigfield, and Eccles (1990) found that math anxiety was most
directly associated to students' math ability perception. Additionally, they concluded that positive perceptions of students' math ability could mediate the effects of math anxiety.

Richardson and Suinn (1972) indicated that mathematics anxiety may inhibit a student from completing essential mathematics courses. A strong mathematics background is now a requirement for many technological jobs (Meece, Wigfield, \& Eccles, 1990). Henderson and Landesman (2001) report that the problem of underachievement in mathematics poses a bigger problem for our nation due to an increasing need of mathematics in the workforce. However, many students are not taking appropriate mathematics courses, thereby restricting their opportunities due to a limited self-concept in mathematics (Meece, Wigfield, \& Eccles, 1990). This challenge can only be combated by instilling a sense of confidence in our underachieving mathematics students.

## Arts Integration

Certain forms of arts-integration education have been linked with improved development of cognitive capacities. These capacitates are thought to be important for academic success (Rinne, Gregory, \& Yarmolinskya, 2011). Arts integration teaches persistence and reflectiveness, hallmarks of success during challenging academic experiences (Rinne, Gregory, \& Yamolinskya, 2011). In an arts-integrated classroom, the role of the student shifts from one who listens to one who constructs meaning (Gullatt, 2008). Visual representations maximize retention of ideas through emotional arousal and kinesthetic movement (Rinne, Gregory, \& Yamolinskya, 2011). This may also be due to some of the processes associated with arts-integrated lessons. The arts encourage students to construct meanings through multiple representations and this same
process can be transferred to other academic subjects (Gullat, 2008). Use of rehearsal, elaboration, generation, and enactment offer repetition and integration of new content, allowing students to retain content longer, and retrieve content more efficiently (Rinne, Gregory, \& Yarmolinskya, 2011). For example, students who are involved in instrumental music in middle and high school demonstrate significantly higher math achievement than their peers by the twelfth grade (Catterall, Chapleau, \& Iwanaga, 1999).

According to Bresler (1995), there are four dominating styles of arts integration. When teachers add both the visual and performing arts into their curriculum as a filler or quick craft activity, this is known as the subservient approach (Gullatt, 2008). Another style, called co-equal cognitive integration, asks students to use higher order thinking skills to integrate the arts into other content areas (Bresler, 1995). For example, a student using this style may be studying paintings and their paralleled historical events (Gullatt, 2008). Bresler's third approach immerses students in the arts while they work on other academic areas. In this affective approach, students listen to music during work time, or respond to visual paintings in the classroom environment (Gullatt, 2008). The final style of arts integration, or social arts integration, is performance-based (Bresler, 1995). Students are only exposed to the arts as they relate to school plays or band concerts (Gullatt, 2008). This suggests that there are a variety of ways that teachers and students can engage with the arts at school.

## Mathematics and Arts Integration

Lockhart (2009) expresses his views that mathematics should be looked upon as an art. As a mathematician he feels, "The difference between math and the other arts
such as music and painting is that our culture does not recognize it as such" (p. 3). He continues that mathematics should be taught in its purest form, as an art form. "If everyone were exposed to mathematics in its natural state..., I think we would see a dramatic change in both the attitude of our students toward mathematics and in our conception of what it means to be 'good at math' "(Lockhart, 2009, p. 7).

Arts integration in mathematics has been shown to increase student achievement. Jones and Pearson (2014) state that the overlap between students who study music and mathematics showed improved academic achievement over students who have not studied music. Recent studies indicate students who take part in the arts tend to overtake their peers on standardized measures of achievement (Rinne, Gregory, \& Yarmolinskya, 2011). In a study done by Walker, Winner, Hetland, Simmons, and Goldsmith (2011), students were asked to take a geometric reasoning test. Students who had formal arts training performed significantly better than their peers who did not have formal arts training.

Additionally, arts integration invites opportunities for students to think divergently. Divergent thinking is defined as the capability to produce various and diverse solutions to a given stimulus or problem (Runco, 1991). Due to the complex nature of our world, students should be encouraged and given multiple opportunities to participate through multiple perspectives (Martin, 1998). The arts can help students understand that there are multiple ways to approach a problem. Many mathematics teachers are adopting an "open-ended" problem solving style methodology allowing their students to practice divergent thinking in the mathematics classroom. This encourages mathematical creativity, or the ability to formulate and recognize relationships and
patterns within a problem (Kwon, Park, \& Park, 2006). Mathematical creativity also asks students to bypass common solutions and provide innovative approaches to solve the problem (Kwon, Park, \& Park, 2006).

Finally, the language component of the visual arts lends itself to integration in the mathematics classroom. The language principles of visual arts design include vocabulary such as balance, repetition, and pattern (Gullatt, 2008). This vocabulary innately connects to mathematical theory as one recognizes these words make up the mathematician's vocabulary as well (Gullatt, 2008). Allowing students to visually experiment with these elements gives them a tangible understanding of mathematic principles. The arts enhances mathematic principles by letting the students authentically participate by asking questions and solving problems through hands-on learning experiences (Gullatt, 2008).

## Methodology

The researcher initiated this study in an attempt to understand how arts integration could influence students' development of self-concept in the mathematics classroom. For this mixed methods study, the researcher observed in classrooms, collected student survey data, and conducted student interviews. According to Creswell (2014), a combination of both quantitative and qualitative data provides the researcher with a more sound understanding of the problem than either methodology alone. Using both types of data allows the researcher to explain quantitative results collected by the survey with the qualitative results by incorporating the perspectives of the individual students (Creswell, 2014).

## Research Question:

While the overall focus of this study was to investigate the ideas of integrating arts into the mathematics curriculum, the primary research question investigated in this study asked: to what extent does the integration of arts into the study of mathematics influence the development of students' learning self-concept? Other questions included: how does integration of the arts into the third grade math curriculum affect the way thirdgrade students perceive their own competence in mathematics? How does the integration of arts into the math curriculum affect student engagement in mathematics? How does integrating arts into the math curriculum affect students' commitment to solving complex problems?

## Research Sample Setting and Demographics

This study targeted a third-grade classroom at CHIME Charter School in Woodland Hills, California. CHIME Charter has a population of 698 students.

Approximately $6 \%$ of students are African American, $31 \%$ are Latino or Hispanic, $61 \%$ are Caucasian, $9 \%$ Asian and $2 \%$ are other. CHIME has an average API score of 833 . Each class has an average class size of 24 students including students who are English language learners, those who need special education, students who need enrichment, and typically developing students.

The researcher offered her research question and an outline of the proposed research project to teachers during a professional development. The researcher requested a third grade class and the volunteer teacher offered a place to conduct the proposed research. The volunteer class contained 22 students of varying academic abilities. The class had fourteen boys and eight girls between the ages of eight and nine years old. Additionally, one student was classified as an EL student, level three. Three students were identified as gifted, and six students in the class have mild to moderate disabilities. During the recruitment process, a substantial effort was made to recruit students of all academic abilities, all ethnicities, and both genders, by encouraging and giving all students the opportunity to participate in the study. Twenty-one students returned consent forms to participate in the study.

## Instruments:

Students were asked to articulate their ideas of self-concept in the Math and Me survey (Appendix A) developed by Adelson and McCoach (2011). This survey is an 18question printed assessment designed for third through sixth graders and is available for public use. It uses a Likert scale and asks students to respond to sentences relating to their comfort levels in mathematics. This survey was chosen for its demonstrated validity in a study conducted by Adelson and McCoach (2011).

Additionally, The William and Mary School of Education Student Engagement Class Observation Guide was used to document behavioral engagement of students during both the school-adopted math curriculum and arts integrated lessons. This protocol uses a coding system to document classroom student behavior to help the researcher cite evidence of students' on and off-task behaviors. It is also available for public use.

The interview protocol consisted of eight questions that address cognitive and non-cognitive engagement in the lessons.

## Data Collection

Following the collection of parent consent forms by the classroom teacher, the researcher arrived at the volunteer class and students were read aloud an assent form prior to the students' involvement in the study or data collection. It was only read after parents consented to their children's participation in the study. For parents who did not consent (one student), arrangements were made for the student to continue the planned math curriculum independently using a computerized math program. This is often used alternatively by the school to track student data and progress. Once the researcher had all parent consent forms and verbal assent from students, the researcher explained the outline of the study. All aspects of data collection were performed in the volunteer students' classroom with their teacher present.

The study began with an in-class pre-survey. The purpose of this survey was to provide quantitative descriptions of attitudes and opinions that can be generalized as to make inferences about the attitudes of this population (Creswell, 2014). Students were asked to articulate their ideas of self-concept in the Math and Me survey developed by

Adelson and McCoach (2011). This survey asked students to respond to a sentence relating to their comfort levels in mathematics using varying degrees of agreement.

The volunteer teacher then taught four lessons from the school-adopted math curriculum, Go Math. These lessons covered introductory aspects of third-grade fractions. The researcher observed the classroom for two sixty-minute observation blocks. As Creswell suggests, qualitative researchers observe their participants in a setting that is familiar and within the context of the study (2014). One hour is the typical length of math instruction at CHIME. The researcher both videotaped and documented student engagement through use of The William and Mary School of Education Student Engagement Class Observation Guide. The researcher monitored student on-task and offtask behavior measuring behavior engagement in increments of five minutes. Initial data was taken on the specific type of on- and off-task behaviors according to the coding provided by the instrument.

After the week-long fractions unit using the school-adopted math curriculum, the students were then asked to rearticulate their ideas of self-concept using the Math and Me survey. The students had previously taken this survey and were familiar with its questions and Likert scale rating.

The volunteer teacher then attended a one hour professional development opportunity that occurred at the school site led by the researcher. The session presented a brief research background regarding the history and importance of STEM education due to the growing number of future career opportunities. The session also presented the framework for best practices in arts and math integrated lessons and specific lesson plans.

Finally, the volunteer teacher was given four specific co-equal cognitive arts integrated math lessons (Bresler, 1995) to teach to the students for purposes of the research study (Appendix B). This professional development is not part of the research, but is described here to ensure that the teacher integrating the arts has been prescriptively instructed how to effectively do so. The volunteer teacher then taught four math and coequal cognitive integrated arts lessons referencing both the third grade Common Core Mathematics Standards on fractions and the California Visual and Performing Arts Standards. According to Bresler, (1995) co-equal cognitive integrated lessons give equal weight to both the content and arts subject matter. This is the preferred method of arts integration when integrating content with higher order thinking skills (Gullatt, 2008). These lessons are not part of a new curriculum, just a change in the delivery method and assessment. The teacher used arts integration as a pedagogical tool, not as a curricular goal or outcome.

Two of these arts-integrated lessons were observed by the researcher. In all observations, the researcher used The William and Mary School of Education Observation Protocol to document student engagement. Again, data was taken every five minutes to articulate the amount of student on-task and off-task behavior during each lesson. After the conclusion of the lessons, the students were then asked to rearticulate their ideas of self-concept using the Math and Me survey to identify any further changes in attitude or self-perception of their abilities in mathematics. Additionally, the researcher interviewed a selection of students who participated in the study, giving them a chance to answer open-ended questions about their self-concept and engagement. These students were randomly selected after being sub-divided into groups by their self-
perceived notions about mathematics as documented by the pre-assessment Math and Me survey results. Randomized selection offers the ability to generalize the results to that of the whole population (Creswell, 2014). The interview protocol consisted of eight questions that address cognitive and non-cognitive engagement in the lessons. The reason for multiple data samples comes from Creswell's opinion that the strongest qualitative researchers collect multiple forms of data, rather than depend on a single data source (2014).

All identifiable information collected about participants such as name, gender, and age was removed and replaced with a numerical code. A list linking the code and the participants' identifiable information was kept separate from the research data in a locked filing cabinet in the researcher's residence. All research data and video recordings were stored on the researcher's laptop computer that is password protected. The recordings were erased after they were transcribed to field notes. These notes and other research data will be retained for seven years in a locked filing cabinet in the researcher's residence. Only the researcher and researcher's faculty advisor had access to the participants' data. Any information derived from this research project that personally identifies any participant was not and will not be voluntarily released or disclosed without separate parental consent, except as specifically required by law. The researcher intends to keep the research data for approximately seven years and then it will be destroyed.

After examining the pre-and post-surveys from the students involved, the researcher looked for any correlated changes between increased self-concept and arts integration. The researcher used a triangulation of the three data sources to determine the
efficacy of integrated math and arts instruction influencing students' self-concept. According to Creswell, a triangulation of data provides for a coherent validation of results and adds legitimacy to the study (Creswell, 2014).

## Conceptual Framework:

This study draws upon work by Fredriks, Blumenfeld, and Paris who find that student engagement can be divided into three constructs: behavioral, emotional, and cognitive (2004). It is through these various constructs that students advance to positive academic outcomes. These forms of student engagement also drive students' willingness and desire to put in the necessary effort to master complex ideas within the classroom (Fredricks, Blumenfeld, \& Paris, 2004).

Additionally, Linnenbrink and Pintrich (2002) found that student self-concept is in fact malleable. It is most receptive to student engagement supported by contextual features of the classroom such as curricular choices. This insight also offers hope that students' negative ideas can be affected by their behavioral, emotional, and cognitive engagement.

Finally, this study draws upon Bresler's (1995) work, defining the four types of arts-integration models. This study focuses on her discussion of the co-equal cognitive model which integrates a specialized arts discipline with an academic content area. Bresler explains this model requires educators to give equal weight to both the art discipline and content area, while teaching skills in each (1995). This style requires students to analyze, synthesize, and evaluate both disciplines, forcing them to practice higher order thinking skills. Most importantly, Bresler (1995) agrees that using this model has implications for changing pedagogical techniques and conceptual knowledge
to better encourage active perception and reflection amongst students. This has the potential to impact and change their attitudes about the content discipline itself (Bresler, 1995).

## Role of the Researcher:

The researcher is aware of all known biases and assumptions that may have impacted the interpretation of data collected in this study. The researcher verifies that all data was collected during interviews and observations without any interpretation and were the observable actions of the students. Analysis and discussion of this data attempted to locate themes and patterns of student engagement and changes in selfconcept due to the integration of the arts into the mathematics curriculum. Additionally, it should be noted that the volunteer students were familiar with the researcher as she works on their school site, and that all attempts were made to complete the study in a timely manner. There was a brief interruption in data collection due to the researcher being asked to serve jury duty.

## Findings

This chapter will contain an analysis of the study's findings, merging theory with practice. Three fundamental goals drove the focus of this analysis. First, did the arts integration delivery method impact student's engagement in the mathematics classroom? Second, following Linnenbrink and Pintrich's (2002) findings that students' self-concept is malleable, can an arts integrated mathematics curriculum change student's selfperceptions? Last, does using Bresler's (1995) model of co-equal arts-integration as a pedagogical tool affect student's engagement and self-perceptions of their own abilities in the mathematics classroom?

## Engagement

The researcher observed four mathematics lessons in the volunteer teacher's classroom. The first two lessons used the typical math curriculum and the second two used Bresler's model of a co-equal arts integration to deliver math instruction. During each of the lessons, the researcher used The William and Mary School of Education Student Engagement Class Observation Guide to document behavioral engagement. Using the coding suggestions provided with the instrument, the researcher documented each student's engagement every five minutes for the complete lesson. The codes provided two subsets: on-task and off-task behavior. The codes also provided specific on- and off-task codes for specific behaviors such as on-task reading, on-task writing, ontask listening, etc. Similarly, it provided similar codes for off-task behaviors such as offtask talking, off-task working for another class, off-task reading, etc. While these specific codes were recorded, for purposes of this study, only on- and off-task generalizations were measured.

The researcher tallied the instances of on- and off-task behavior for each student over the course of all four lessons. Compiling the data from the observation notes, ontask behaviors were given a score of one and off-task behaviors a score of zero. The researcher assembled all scores and determined an individual behavioral engagement score for each student for each lesson. Charting this data, the researcher was able to determine if there was any increase in behavioral engagement between the first two typically delivered math lessons and the second two arts integrated lessons. After analyzing the data in charted form (Figure 4.1), the researcher concludes that $100 \%$ of the class sample showed increased behavioral engagement with arts integrated lessons.


Additionally, the researcher compiled an overall class behavioral engagement score (Figure 4.2) for each lesson. These totals came from adding the totals of student engagement scores by lesson. By averaging the behavioral engagement scores of the two non-arts integrated lessons, the researcher found that these lessons showed an average of 101.5 points of total classroom engagement. The researcher then averaged the classroom scores of the arts integrated lessons showing an average of 134.5 points of total class engagement. This is an increase of $34 \%$ in classroom behavioral engagement. It should be noted that the classroom sample size for observational lessons was nineteen students, rather than the twenty-one students participating in the initial surveys. This is due to the fact that two students were not in the classroom for the entirety of the four math lessons and therefore could not be compared with the rest of the class.


The researcher then used open-ended interview questions to further probe into cognitive and emotional engagement. According to Linnenbrink and Pintrich’s (2002) findings, it is challenging to document students' cognitive engagement, as it takes place within their heads, and is difficult for teachers to assess. Cognitive engagement demonstrates the quality of effort students put into a task, while behavioral engagement is the quantity of effort. Cognitive engagement suggests that students are able to think creatively about a task and critically reflect about the material being learned. They continue by commenting that it is through student response to comments in class discussions and answers to teachers' questions that teachers can reflect upon to evaluate whether students are cognitively engaged.

The researcher used a set of open-ended discussion questions during student interviews conducted after the series of arts-integrated lessons to probe further into students' cognitive engagement during math lessons. When responding to the question, "How did adding art in your lessons make you want to keep trying when you got stuck on a hard problem?" Out of the six students interviewed, all students interviewed mentioned in their responses the ability and freedom to use creative solutions to solve the problems. Five students documented their willingness to be diligent in solving harder problems stemmed from their engagement in the lessons. One student added, "I wanted to keep going, even when I was stuck. I didn't want to miss on the fun." Another said, "I was less in my head during the arts ones. I wasn't as stressed out." Additionally, another student cited the group participation aspect as a motivator for cognitive engagement. "I looked at other people to help me. It made me want to keep going." This is further supported by the student's classmate's response of, "It was much easier to solve problems
because it was more fun. It wasn't because you had to solve problems. It's because you wanted to."

When students were asked a similar question about the typical math curriculum using a non-integrated approach, four of the participants responded that when they encountered a challenge, they raised their hand to ask their teacher for help. Another solution to encountering challenging problems in the Go Math curriculum was to, as one student put it, "Just skip it."

The quality of effort seems to take on a more personal view with arts-integrated lessons. The responses supplied by the students reflect a determination to solve problems and deploy critical thinking skills, rather than raising their hands or skipping a problem. Arts-integrated lessons seem to provide the very definition of cognitive engagement.

When collecting data on emotional engagement, the researcher looked to Fredriks, Blumenfeld, and Paris' (2004) findings that emotional engagement is interpreted in the positive and negative feelings that students have about a school's teachers, academic content, and other students. Through the same open-ended interview process, the researcher asked the question, "How do you prefer to have your math lessons; straight from Go Math or more arts-based, and why?" The researcher wanted to know the students' feelings of the academic content presented to them and the delivery method they preferred. One student answered, "Go Math is boring. All you do is fill out answers. I like arts. You do more fun activities." Most importantly was the way in which the students' faces reacted to the researcher's questions. Five out of six of the students presented traditional physical signs of happiness when responding to this question. The students laughed and smiled during the responses where they chose the arts-integrated
delivery method over the more typical curriculum. According to Skinner and Belmont (1993), emotional engagement can be demonstrated by a student's interest, happiness, sadness, anxiety, or boredom. This led the researcher to conclude that arts-integrated lessons provided high emotional engagement for the students interviewed in this study.

## Malleability of Self-Concept

Building upon Linnenbrink and Pintrich's (2002) findings that student selfconcept is malleable, the researcher used the Math and Me measurement instrument to document the effects of arts-integrated lessons on students' self-perceptions of their abilities in mathematics. The students were given the instrument as a pre-assessment at the beginning of the study. The students were asked to answer a series of questions on their thoughts and understandings of their perceptions of their mathematical abilities. They responded to different questions marking strongly disagree, disagree, agree, or strongly agree. The researcher took the surveys and awarded -2 for each response that demonstrated the lowest self-concept, -1 to those demonstrating low self-concept, +1 to those responses measuring high self-concept and +2 to responses measuring the highest self-concept. The researcher tallied the scores for each student and found a total selfperception score for each student. Recording the results of the pre-assessment and adding each student's self-concept scores also yielded a class self-concept score.

The process was repeated after a week of typical non arts-integrated math lessons. The students responded to the same Math and Me survey questions. The researcher tallied the scores for each student using the same method previously described. Once again, the researcher found a total self-concept score for each student and then added the individual scores for a class self- concept score.

The process was repeated for a third time, after the completion of four arts integrated mathematics lessons. Again, the researcher tallied the scores and found total self-concept scores for each student (Figure 4.3) and a combined classroom self-concept score (Figure 4.4). Charting the individual student self-concept scores over the course of pre-, mid-point, and post-assessments revealed that $76 \%$ of the students showed an increase in their self-concept of their mathematics attitudes and abilities with art integrated lessons. This percentage was found by dividing the number of students who described increased positive self-concept by the total number of students surveyed.

Additionally, looking at the sum of the classroom self-concept scores, one can infer an increasing trend of students reporting higher confidence in their abilities and attitudes after arts integrated math lessons.



## Arts Integration

The researcher used survey data and interview data to support using Bresler's (1995) model of co-equal arts-integration as a pedagogical tool to affect student's engagement and self-perceptions of their own abilities in the mathematics classroom. As previously stated, there was a notable increase in student engagement and self-concept documented by use of the Math and Me survey instrument and The William and Mary School of Education Student Engagement Class Observation Guide after using arts integrated lessons as a pedagogical delivery method for math curriculum. To further triangulate this data, the researcher collected students' open-ended responses to the question: How did adding art into math make you feel better/worse about your ability in math? All students interviewed responded that the arts-integrated lessons made them feel better about themselves. This was additionally supported by the Math and Me survey results for these particular students. One student responded, "I just really like art; you get
to create things and make up stuff. It becomes my own ideas, not what I have to do." Another student replied, "It was just funner [sic] and not boring. We got to do things, move, and make aliens instead of just sitting down and writing." When asked why math with arts-integration made him feel better a third student, responded, "It was better because when we did math in the math book, it wasn't fun. You just look down and write. I like doing art better than the math book." The researcher infers that the students are referring not only to the enjoyment of engagement in the curriculum, but also allowing students to use a variety of intelligences to involve them in the learning process. Integrating the arts into the curriculum allows use of intelligences such as spatial, musical, and kinesthetic, to engage students into learning (Gardner, 1999; see also Gullatt, 2008). These varied intelligences offer multiple entry points for involving students in the learning process.

Finally, the researcher, alluding to Bresler's (1995) co-equal cognitive model, asked the students in a follow-up interview question as to their preference of curricular delivery, "Why did you like art and math together?" One student responded, "I didn't know you could add music notes! It was fun combining the two." Another student responded, "Art just helps me with all my fractions." "Without art" another student responded, "I didn't participate as much. With art, I participated more because I knew more. I understood more." The researcher infers from the response data that using this model of integration not only allowed students to analyze and synthesize math and arts content in tandem, but also encouraged, as Bresler (1995) acknowledged, an active reflection and participation among students about the discipline itself.

## Conclusion and Recommendations

This mixed-methods study was designed to test how integration of the arts curriculum can influence the development of third-grade students' self-concept as related to the study of mathematics. Driven by the disturbing fact that according to Tai, Liu, Maltese, and Fan (2006), America is significantly lacking in qualified graduates to fill the increasing demand of STEM field positions, this study sought to test a pedagogical method of engaging more students in these disciplines. It has already been documented to be a significant challenge to elementary educators to provide appropriately-constructed curriculum and instruction that engages and supports students to develop both confidence and competence in STEM disciplines (Massey, 1989). In this study, the researcher specifically collected data on embedding arts into the mathematics curriculum as an aid to address the critical need for students to develop self-confidence.

Using a sample size of twenty-one third-grade students the researcher collected three different forms of data to support her findings. In the first quantitative phase of the study, survey data on third grade students' attitudes about mathematics were collected using the Math and Me survey. This instrument asked students to document their selfperception of their mathematics abilities and attitudes. The researcher then observed this class twice during typical school-adopted math curricular lessons documenting evidence of behavioral engagement using the The William and Mary School of Education Student Engagement Class Observation Guide. After a week's worth of interaction with their typical school adopted math curriculum, the students took the Math and Me survey again to document if their perceptions about their own abilities and attitudes had changed.

Third-grade teachers at the research school site were given an hour of professional development on integrating arts into mathematics. While the professional development was not part of the research studied, it served to ensure that the teacher integrating the arts lessons for this study has been prescriptively instructed how to effectively do so. The volunteer teacher then taught the four arts-integrated lessons from the professional development to the volunteer class. Again, the researcher observed this class of students during these arts-integrated lessons for evidence of behavioral engagement. An identical post-survey was given to the students to assess whether arts integration has affected students' ideas of self-concept in mathematics. The second qualitative phase of open-ended interview questions was conducted to a randomized sampling of students as a follow-up to help probe deeper in order to explain into the lived experiences of the students.

Three fundamental goals drove the focus of this analysis. Based on examination of the surveys, observation data, and interviews, arts-integrated lessons do impact a student's engagement in the mathematics classroom. Additionally, the same data lends itself to the conclusion that arts-integrated math curriculum can in fact influence and increase students' self-perceptions in the mathematics classroom. This further confirms Linnenbrink and Pintrich's (2002) findings that student self-concept is indeed malleable. Finally, using Bresler's (1995) model of co-equal arts-integration is an effective pedagogical tool in affecting students' engagement and self-perceptions of their own abilities in the mathematics classroom.

It is the intention of the researcher that research gleaned from this study may help other educators to have a greater understanding of how integration of the arts effects
student engagement and improved self-concept in mathematics. This may have wider reaching impacts on student achievement and self-perceived success in mathematics. Furthermore, a change in self-concept in mathematics could encourage more students to take more mathematics coursework. Students may choose to major in more STEMrelated fields, thus making them eligible for STEM positions in our national and global economy.

This study affirms that students can benefit from using multiple modalities through integrated arts lessons. Finally, by finding a correlation between increased engagement and increased self-perception with its foundations in arts-integrated lessons, this can be established as further evidence to support the need to keep the arts as an important aspect of every child's school day.

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## Appendix A

Math and Me Survey Questions

## Math and Me Survey

| Name Age |
| :--- |
|  |

## Appendix B

## Arts Integrated Lessons Plans

## 3rd Grade Mathematics/Dance NASA 5E Lesson Plan

Overview: Students will take part in dance activities while exploring fractions

## Standards:

## Common Core Mathematics:

Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.
a) Recognize and generate simple equivalent fractions, e.g., $1 / 2=2 / 4,4 / 6=2 / 3$. Explain why the fractions are equivalent, e.g., by using a visual fraction model.
b) Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form $3=3 / 1$; recognize that $6 / 1=6$; locate $4 / 4$ and 1 at the same point of a number line diagram.

## California Arts Standard (Dance)

2.8 Create, memorize, and perform original movement sequences with a partner or a small group.
1.2 Demonstrate the ability to start, change, and stop movement.

Duration: 60 minutes

## Materials:

Colored construction paper

## Student Explanation Sheet

Objectives: Students will use $21^{\text {st }}$ century learning skills (collaboration, cooperation, critical thinking and creativity to create original dance pieces representing fractional concepts.

Engage: (10 minutes). Teacher should review numerator and denominator vocabulary with students. Students should improve "numerator dance moves" dance moves that involve movements above the students' belly button. This may include moving arms, shoulders and head in different fashions. Students should then improve "denominator dance moves" dance moves that involve movements below the students' belly button. These movements may include moving hips, legs and feet to the music. Teacher should then call out sequences of denominator and numerator having students change their movement pattern in relation to the vocabulary word called out.

Explore: (20 minutes) Teacher should pass out large construction paper to student. Students should label piece 1 whole in sharpie. Teacher will ask the class if the students know any other fractions that are equal or equivalent to 1 whole. Teacher will model $2 / 2,3 / 3$, and let students write others on their dance paper Teacher will play music and students have only 1 whole piece of construction paper in which to dance on. Teacher should continue to call out numerator and denominator to change the sequence of movement. After one minute of dancing Teacher should call out " $1 / 2$ ". Students should fold their paper into $1 / 2$ of the construction paper. Students should write one half on the paper, surrounded by as many equivalent or equal fractions as they can think of to $1 / 2$. Example $3 / 6,2 / 4$, etc... Teacher should then announce to students that they have $1 / 2$ of their paper to dance on. Teacher should continue process with $1 / 4,1 / 8$, and $1 / 16$.

Extend: (10 minutes) Students should be encouraged to team up with a partner and add their $1 / 16$ of dance space to their partner's $1 / 16$ of dance space. What is the fraction of their new dance space? Have students explain their thinking. Students should then try dancing on their $2 / 16$ of dance space using numerator and denominator moves.

Evaluate: (10 minutes)
Students pairs should look at their one whole and $1 / 2$ fractions they had written on their dance paper. Have students create a rule for finding equivalent or equal fractions.

Explain: ( 10 minutes) Students should then fill out student explanation sheet with responses. If time permits students should share their explanations with peers.

## 3rd Grade Mathematics/Visual Art NASA 5E Lesson Plan

Overview: Students create works of art while exploring fractions and NASA planetary photograph data sets. Students will articulate what fraction of a whole is visible in their piece of art

## Standards:

Common Core Mathematics: 1 . Understand a fraction $1 / b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction $\mathrm{a} / \mathrm{b}$ as the quantity formed by a parts of size $1 / \mathrm{b}$.
California Arts Standard
1.5 Identify and describe elements of art in works of art, emphasizing line, color, shape/form, texture, space, and value.

### 2.0 Creative expression

Creating, Performing, and Participating in the Visual Arts
Students apply artistic processes and skills, using a variety of media to communicate meaning and intent in original works of art.

Duration: 65 minutes

## Materials:

| Black construction paper | NASA Data Set : Planetary Photographs |
| :--- | :--- |
| Scissors | Arts analysis Reflection Sheet |

Objectives: Students will use $21^{\text {st }}$ century learning skills (collaboration, cooperation, critical thinking and creativity to create original works of art representing fractional concepts.

Engage: (5 minutes)Teacher passes out photographic data set and asks students if they recognize the photographs. Students should hypothesize which planet is which based on evidence they have learned in science studies. They should share their evidence with partners to justify their conclusions. Teacher should then reveal names of each planet.

Explore: (20 minutes) Students should then cut out the planets. They should begin folding them into equal pieces and explore what fractions can be created. Students should choose four planets and fold them into equal pieces. Students should label each piece of the fraction. Accommodations can be made by specifying that Jupiter will be folded in halves, Neptune in quarter etc....

Extend: (15 minutes)Students should cut apart their planets forming fractions. (They should already be labeled). They should then create an original art piece of an "extraterrestrial" using their fraction pieces and glue down on the black construction paper.

Explain: (10 minutes) Students use the art reflection template to describe their work of art in terms of artistic vision and mathematical reasoning.

Evaluate: (15 minutes) Students share their piece of art with a colleague, reading their reflection and commenting on their partners artwork. Commentary should be positive in nature and include artistic and mathematic vocabulary.

Resources: Resources: http://voyager.jpl.nasa.gov/mission/index.html

## 3rd Grade Mathematics/Music NASA 5E Lesson Plan

Overview: Students will take part in music activities while exploring fractions

## Standards:

Common Core Mathematics:
Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.
a) Recognize and generate simple equivalent fractions, e.g., $1 / 2=2 / 4,4 / 6=2 / 3$. Explain why the fractions are equivalent, e.g., by using a visual fraction model.
b) Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form $3=3 / 1$; recognize that $6 / 1=6$; locate $4 / 4$ and 1 at the same point of a number line diagram.

## California Arts Standard (Music)

1.1 Read, write, and perform simple rhythmic patterns using eighth notes, quarter notes, half notes, dotted half notes, whole notes, and rests.

Duration: 50 minutes

## Materials:

Donald in Mathemagic Land Clip Musical Fraction Response Sheet Chart Paper for Music Discussion

Objectives: Students will use $21^{\text {st }}$ century learning skills (collaboration, cooperation, critical thinking and creativity to compose original music pieces representing fractional concepts.

Engage: ( 5 minutes) Students will watch Donald in Mathemagic Land video about music \& Fractions https://www.youtube.com/watch?v=iEVGQKwKeCc

Explore: (10 minutes) Teacher will prompt students to discuss what kinds of math they see in music. Students will respond on chart paper in table groups. Groups will share out with the class.

Extend: ( 15 minutes) Teacher will introduce fraction and note values. Students will fill in fractions in the left hand column. Students will then label fractions in the musical notation provided at the bottom of the sheet. Note: the note that is barred together is $21 / 8$ notes.

Evaluate: ( 10 minutes) Using their knowledge from the extend portion, students will solve equivalent fraction note equations. Students may challenge themselves to create their own musical equations.

Explain: ( 10 minutes) Students will write an explanation of how music an fractions are connected. They will cite examples of their activities done in class to support their explanation

## 3rd Grade Mathematics/Theater NASA 5E Lesson Plan

Overview: Students will take part in theater activities while exploring fractions

## Standards:

## Common Core Mathematics:

Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.
a) Recognize and generate simple equivalent fractions, e.g., $1 / 2=2 / 4,4 / 6=2 / 3$. Explain why the fractions are equivalent, e.g., by using a visual fraction model.
b) Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form $3=3 / 1$; recognize that $6 / 1=6$; locate $4 / 4$ and 1 at the same point of a number line diagram.
California Arts Standard (Theater)
Connections and Applications
5.1 Use problem-solving and cooperative skills to dramatize a story or a current event from another content area, with emphasis on the Five Ws.

## Careers and Career-Related Skills

5.2 Develop problem-solving and communication skills by participating collaboratively in theatrical experiences.

Duration: 60 minutes

## Materials:

Readers theater script: Fraction Action
Readers theater script: Fraction Freaks
Student Response Sheet
Objectives: Students will use $21^{\text {st }}$ century learning skills (collaboration, cooperation, critical thinking and creativity to create original theater pieces representing fractional concepts.

Engage: ( 10 minutes). Students will play fraction charades. Tables should come up with a movement and have class describe what fraction of the students are doing that movement. The other tables should guess what the fraction is. The team that guesses correctly gets a point. Kids have to really think out of the box on how to portray their fraction. Example above: $1 / 34$ of the kids at table 4 are jumping.

Explore: (20 minutes) Students will read fractions readers theater script aloud with their teacher
Extend: (10 minutes) Students will break up into smaller groups and read second readers theater
Evaluate: (10 minutes) Students should explain what they have learned about fractions through their readers theater/ charades experience by sharing with a friend orally.

Explain: (10 minutes) Students should explain what they have learned about fractions through their readers theater/ charades experience writing a paragraph. They should cite examples from their experiences in classroom activities to support their thinking.

