ADDING MOVEMENT TO SUBTRACT MONOTONY: THE EFFECTS OF A DANCE-INTEGRATED MATHEMATICS CURRICULUM ON THE ENGAGEMENT OF STUDENTS FROM LOW-INCOME HOMES

by

Lucy Font

A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Honors Bachelor of Science in Elementary Teacher Education with Distinction

Spring 2016

ADDING MOVEMENT TO SUBTRACT MONOTONY:

THE EFFECTS OF A DANCE-INTEGRATED MATHEMATICS

CURRICULUM ON THE ENGAGEMENT OF STUDENTS

FROM LOW-INCOME HOMES

by

Lucy Font

Approved: ____
Dr. Lynnette Young Overby, Ph.D.
Professor in charge of thesis on behalf of the Advisory Committee

Approved: ____
Dr. Elizabeth Pemberton, Ph.D.
Committee member from the Department of Education

Approved: ____
Dr. Barbara Settles, Ph.D.
Committee member from the Board of Senior Thesis Readers

Approved: ____
Michael Arnold, Ph.D.
Director, University Honors Program

ACKNOWLEDGMENTS

I would like to thank Dr. Lynnette Overby, my thesis director and the ArtsBridge Scholars Program director, for introducing me to undergraduate research. Without her professional guidance, endless encouragement, and sustaining support, this project would not have been possible. I would also like to thank Dr. Elizabeth Pemberton and Dr. Barbara Settles, my second and third readers, for dedicating their time and effort throughout the writing process. Their helpful suggestions and constructive feedback have allowed me to grow and learn as a writer. I would like to thank Karen Brady and Kathy Gill for welcoming “Adding Movement to Subtract Monotony” into their classrooms and learning spaces. To my fellow ArtsBridge scholars – namely Amanda Boccardi and Victoria Snare – and ArtsBridge coordinators – Yael Haislip and Meghan Scully – thank you for your constant advice and assisance throughout this project. Finally, to my beloved family and friends, I could never have undertaken this project without your relentless patience and support for my passions. The completion of this thesis was facilitated by each of the individuals mentioned above, and to them I am incredibly grateful.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The objective of this investigation was to determine whether a dance-integrated mathematics curriculum stimulates cognitive, emotional, and behavioral engagement among low-income students in the state of Delaware. Learners within an urban setting were instructed using a researcher-designed dance integrated math curriculum for second-grade students in a summer camp in the state of Delaware. Lessons integrated math concepts (operations and algebraic thinking, numbers and operations in the base ten system, and geometry) and dance concepts (locomotor and non-locomotor movements, levels, shapes, and space). Participants included 13 children, ages 6 to 11, from low-income homes. A concurrent triangulation method was utilized to guide data collection for this mixed methods study. Qualitative data included video recordings and journals. This data was compared with the outcomes of quantitative measures including pre- and post-assessments, pre- and post-surveys, and rubric evaluations of permanent products created by students. Findings from data analyses indicate that a dance-integrated mathematics curriculum was emotionally, cognitively, and behaviorally engaging. These findings suggest that educators can use arts integration to engage their students.

Chapter 1

INTRODUCTION

The elimination of arts programs and high student disengagement, particularly in urban areas, are two issues facing American schools today. Additionally, there is inequity between the quality of arts education offered to low-income students and that available to their middle- or high-income peers. This study seeks to evaluate the role that arts integration plays in mediating these widespread issues. According to The Kennedy Center, arts integration is "An approach to teaching in which students construct and demonstrate learning through an art form. Students engage in a creative process which connects an art form and another subject area and meets evolving objectives in both" (Silverstein & Layne, 2014). This study utilized an original arts-integrated curriculum to evaluate student engagement with dance and math.

The concept of student engagement has been studied for decades, and is most often linked to improving student achievement (Fredricks, Blumenfeld, & Paris, 2004). However, more recent approaches identify student engagement as a multidimensional construct consisting not only of students' cognition, but behavior and emotion as well (Fredricks et. al., 2004). Cognitive engagement is defined as a student's use of "sophisticated learning strategies" in order to demonstrate a deep understanding of academic concepts (O'Donnell, Reeve, & Smith, 2012). Emotional engagement refers to the extent to which a student demonstrates "task-facilitating" emotions. Positive emotional engagement is characterized by enjoyment and enthusiasm, while negative emotional engagement is characterized by evidence of "task-withdrawing" emotions such as nervousness or anger (O'Donnell et. al., 2012). Finally, behavioral engagement refers to a student's attention, effort, and persistence (O'Donnell et. al., 2012). Because students can demonstrate engagement in any combination of these three domains, this multidimensional construct allows for a deeper understanding of student engagement, and has thus been used as an analytical tool in this study.

The 2012 Arts Program Report, conducted by the United States Department of Education, indicates that there has been a decline in arts program availability in the past decade (Parsad & Spiegelman, 2012). This study found that between 2000 and 2010, arts programs in 1,802 schools across the country changed drastically. While music education remained largely unaffected, only 3% of schools offered dance instruction in 2010, which is a marked decrease from the 20% of schools that offered dance in 2000 (Parsad & Spielgelman, 2012). The decrease and reduction of arts programs has been attributed to the need to allocate more money to STEM (science, technology, engineering, and math) programs, "especially in low income schools" (Sousa & Pilecki, 2013).

Additionally, the 2012 Arts Program Report revealed that schools with free and reduced lunch programs suffered the greatest loss of arts programs (Parsad & Spielgelman, 2012). In 2010, 81% of these schools continued to offer music programs, compared to 100% in 2000. Dance programs were also considerably affected, with only 31% of schools in the highest poverty concentration offering dance as part of music class, while 49% of schools in the lowest poverty concentration supplemented music class with dance instruction (Parsad & Spielgelman, 2012). This inequitable distribution of quality arts programs in public schools is another prevalent issue in the educational field.

Culturally relevant, or culturally responsive, pedagogy is a phrase used to describe effective teaching in culturally diverse classrooms (Irvine, 2009). In contrast with “assimilationist” pedagogy, which focuses on teaching the status quo, culturally relevant pedagogy, or CRP, seeks to empower students by using the students’ individual cultures to construct meaning and deepen understandings (Ladson-Billings, 1992). This teaching method is effective because information taught in the context of a familiar culture is more likely to be remembered and easily applied in the student’s daily life (Irvine, 2009). Furthermore, CRP is described as a “dynamic and interactive process” that allows students to “create and construct meaning” through active involvement (Beaudoin, 2013). The teaching method of arts integration shares this feature with CRP, and can therefore be an example of responsive pedagogy.

Additionally, integrating movement into a curriculum can serve to strengthen recall, stimulate social interaction, and deepen understanding. Several studies assert that the construction of new knowledge must occur both cognitively and physically, particularly in mathematics (Larson & Nguyen, 2015). This method of teaching, called embodied pedagogy, teaches students to construct meaning using both their bodies and their minds (Larson & Nguyen, 2015). An embodied curriculum enhances students’ bodily and spatial awareness, engages students in action followed by meaningful reflection, and increases social awareness (Larson & Nguyen, 2015). Embodied pedagogy is easiest to implement with subjects that have “inherent physicality”, such as music, and subjects that are social in nature, such as psychology. However, embodied pedagogy is also effective in those subjects that only have “implied spatial qualities", like mathematics (Larson & Nguyen, 2015). Learning mathematical concepts through physical action allows students to make strong connections between the problem and the solution, thus strengthening recall (Alibali & Nathan, 2012).

This mixed-methods study seeks to determine the effects of a dance-integrated math curriculum on the emotional, cognitive, and behavioral engagement of students from low-income homes. The curriculum, titled "Adding Movement to Subtract Monotony", was a dance-integrated mathematics unit written for second grade students. In order to obtain data on emotional, cognitive, and behavioral engagement, several tools were utilized, including pre- and post-assessments in mathematics and dance, pre- and post-surveys, daily journal entries, permanent products created by students, and videotaped student performances. This curriculum supplement was implemented twice: first as a pilot study, and then for the purposes of this thesis.

As a pilot study, "Adding Movement to Subtract Monotony" was implemented at a public elementary school in Newark, Delaware, in a second-grade classroom of 20 students. The initial implementation of this curriculum informed later pedagogical and management decisions. Students were receptive to the curriculum and qualitative and quantitative data indicated high levels of emotional engagement. Additionally, assessment scores increased between pre- and post-tests in both mathematics and dance. Finally, videotape analysis revealed high levels of behavioral engagement as evidenced by attention, effort, persistence, and conduct. Thus, the initial implementation of "Adding Movement to Subtract Monotony" was emotionally, cognitively, and behaviorally engaging for these students.

This unit was most recently implemented at a summer camp in Wilmington, Delaware, with participants from low-income homes. The investigation implemented in Wilmington serves as the subject of this thesis paper. The analysis of data indicated that “Adding Movement to Subtract Monotony” was emotionally, cognitively, and behaviorally engaging for students from low-income homes. Thus, an arts integrated curriculum can promote student engagement for students from low-income homes.

The following thesis consists of four sections: (a) a literature review, (b) an overview of methodology for creating and implementing a dance-integrated curriculum “Adding Movement to Subtract Monotony”, (c) a presentation of the results of the curriculum on student engagement, and (d) a discussion of the implication of these findings.

Chapter 2

LITERATURE REVIEW

Introduction

This literature review introduces theoretical frameworks that inform teaching practices throughout the United States. Additionally, it discusses the issues faced by students from low-income homes, as well as the nationwide problems of student disengagement and art program inequity. Finally, this literature review examines previous studies in which arts integrated math instruction has impacted student engagement. Topics covered in this literature review are: (a) Theory of Student Engagement, (b) Culturally Relevant Pedagogy, (c) Embodied Pedagogy, (d) using dance to teach mathematics, and (e) Arts Integration as a Solution.

Theory of Student Engagement

Student engagement is a concept that has been studied for decades as a way to remediate student disinterest and growing dropout rates, particularly in urban areas (National Research Council & Institute of Medicine, 2004, p. 1). Defined as the observable embodiment of motivation, a student’s engagement is a strong predictor of his or her academic success in school (O’Donnell, Reeve, & Smith, 2012, p.334). In order for a student to be engaged with material, he or she must demonstrate active involvement with the learning activity and a commitment to the task at hand (Fredricks, Blumenfeld, & Paris, 2004, p. 60). Fredricks et. al. (2004) therefore suggest that engagement is a multifaceted construct that exists across three domains: behavior, emotion, and cognition.

Behavioral engagement refers to a student’s enduring attention, effort, and persistence throughout a learning activity). Attention is defined as the student’s concentration and focus with the task at hand; effort is defined as clear investment of energy in the task; and persistence is defined as the investment of effort over long periods of time (O'Donnell et. al., 2012, p. 335).

Emotional engagement refers to the presence of positive emotions, such as joy and excitement, and the absence of negative emotions, such as anger or frustration. The presence of enjoyment, defined as an affective state of pleasure, and enthusiasm, described as intense enjoyment, indicate emotional engagement. High levels of emotional engagement facilitate task completion, while low levels contribute to task withdrawal. When students are emotionally engaged, they *want* to participate, rather than feeling that they *have* to participate (O'Donnell et. al., 2012, p. 335).

Cognitive engagement refers to a student's use of "sophisticated learning strategies", such as elaboration, as well as his or her demonstration of critical thinking skills (O'Donnell et. al., 2012, p. 336). Students show high levels of cognitive engagement when they paraphrase the material or relate it to prior knowledge (O'Donnell et. al., 2012, p. 336). Relying solely on rote memorization and fact rehearsal indicates low cognitive engagement (O'Donnell et. al., 2012, p. 336).

Students can demonstrate engagement in any combination of these three domains. For instance, a student might demonstrate positive emotional engagement with a task, but exhibit off-task behavior, or may demonstrate on-task behavior but be clearly distressed by the task. Thus, one must define a student's engagement as a multifaceted combination of on-task behavior, positive emotion, and deep cognitive processing in order to provide a holistic and accurate description (Fredricks et. al., 2004, p. 61).

Why is Engagement Important?

High levels of behavioral, emotional, and cognitive engagement yield higher student achievement and lower dropout rates, while simultaneously revealing a student's internal motivation (Fredricks et. al., 2004, p. 70; O'Donnell et. al., 2012, p. 337). Engagement is significant for four reasons. First, students cannot learn without putting forth effort, experiencing positive emotions, and deepening thought processes. Therefore, without engagement, learning is not possible (O'Donnell et. al., 2012, p. 337).

Second, engagement is a predictor of academic achievement (Fredricks et. al., 2004, p. 70; O'Donnell et. al., 2012, p. 337). The correlation between engagement and achievement is strongest with behavioral engagement, but there is also some evidence that positive emotional engagement contributes to higher achievement when combined with a measure of behavioral engagement (Fredricks et. al., 2004, p. 70). Additionally, longitudinal studies have shown a correlation between engagement during the elementary years and later decisions to drop out or stay in school (O'Donnell et. al., 2012, p. 337). Again, these correlations are strongest with behavioral engagement, but negative emotions about school also contribute to the decision to drop out (Fredricks et. al., 2004, p. 70). The issue of dropping out is especially prevalent among low-income populations, as students from disadvantaged backgrounds are less likely to graduate than their wealthier peers once they have become disengaged. The disadvantages that these students face are "lessened by participation in an engaging school community" (National Research Council & Institute of Medicine, 2004, p. 1).

Third, the teacher or school community can influence student engagement. This is important because while a teacher may not be able to change a student's ability level, he or she can implement interventions in order to increase student engagement in any or all of the three domains. Teachers can increase student engagement by (1) relating to their students, (2) encouraging autonomy, (3) designing structured tasks, and (4) providing interesting, challenging, and collaborative learning activities (O'Donnell et. al., 2012, p. 337).

Finally, student engagement is the embodiment of motivation and therefore provides feedback on whether or not students are motivated. Teachers can use student engagement to determine interest in their lessons, effectiveness of interventions, or the changes in student's attitudes, and can modify their lessons in response to this information (O'Donnell et. al., 2012, p. 337).

Barriers to Engagement for Low Income Students

Socioeconomic status, an inclusive term referring to an individual's education, occupational status, and income, is a strong determinant of students' success in schools, as well as an indicator of school engagement (Jensen, 2013, O'Donnell et. al., 2012, Bornstein & Bradley, 2003, Finn & Cox, 1992). Students living in poverty face cognitive, social, emotional, and physical challenges to which middle- or high-income students are not exposed (Jensen, 2013, Bornstein & Bradley, 2003). These challenges create barriers between low-income students and optimal levels of behavioral, cognitive, and/or emotional engagement (Jensen, 2013). Furthermore, there is a distinct and recognized achievement gap between students of low socioeconomic classes and their middle-class peers (Bornstein & Bradley, 2003). As a result, low-income populations have higher dropout rates (Rumberger, 1987, p. 108). This gap is so prevalent that some scholars refer to it as a "debt" rather than a "gap", a distinction that acknowledges the fact that the "gap" is only a fraction of a much larger problem:

the lower quality education that has been provided to students of marginalized groups for hundreds of years (Ladson-Billings, 2006).

One of the leading challenges faced by students living in poverty is a lack of access to adequate medical attention, sufficient amounts of nutritious food, and enough daily exercise (Jensen, 2013, p. 1). The Center for Disease Control and Prevention asserts that socioeconomic status and childhood obesity have an inverse relationship. In a 2011 study, obesity prevalence was described as the highest among preschool children that had household incomes at or below the poverty threshold (Centers for Disease Control and Prevention). A 2004 study of the neurobiology of intelligence found that there is a profound link between health and intelligence. The study additionally states that environmental factors, such as exposure to toxins, are more like to affect the intellectual function of children from impoverished families than non-genetic factors (Gray & Thompson). The health deficits faced by children from low-income homes thus negatively affects attention, reasoning, learning, and memory, and therefore hinders engagement (Jensen, 2013, p. 1).

If one believes that he or she is powerless to change the outcome of negative events, he or she will behave accordingly. This behavior is referred to as “learned helplessness”, and is a mindset that children living in poverty are likely to adopt (Murphy, 1982, p. 27). Symptoms of learned helplessness, which are often misinterpreted as laziness, include a lack of optimism and depression (Jensen, 2013, p. 3). Students living in poverty also have low expectancy of a productive future, which further feeds into a sense of helplessness (Jensen, 2013, p. 4). A learned helplessness mindset manifests itself as disengagement and a lack of effort in school (Jensen, 2013, p. 3). Finn and Rock (1997) assert that school engagement is a key factor in whether or not a student stays in school. Thus, learned helplessness is a phenomenon that can contribute to a student's decision of whether or not to drop out.

Children living in poverty are likely to have cognitive problems, including short attention spans, distractibility, the inability to self-monitor, and difficulty problem solving. Cognitive difficulties often result in one of two behaviors: the student exhibiting problem behavior, or the student shutting down completely (Jensen, 2013, p. 5). Thus, cognitive issues contribute to low levels of both cognitive and behavioral engagement, which further prohibits learning.

Finally, students from low-income homes suffer from stress, both acute and chronic, due to a multitude of external problems. This type of stress is referred to as "distress". Distress has been shown to affect brain development and social competence, in addition to hindering academic success. In addition, it reduces attentional control, heightens impulsivity, and impedes working memory. Each of these challenges, enhanced by distress, negatively influences student engagement (Jensen, 2013, p. 7).

The myriad of problems previously discussed causes lower school engagement among low-income populations. In a 1992 study, Finn & Cox surveyed fourth grade classrooms in 72 different schools in Tennessee (Finn & Cox, 1992, p. 146). 1,388 students were grouped by participation based on questionnaires completed by their homeroom teachers. These questionnaires assessed non-participatory behavior, adequate effort, and initiative-taking behavior. In addition, students were given a motivation inventory at the end of first, second, and third grade (Finn & Cox, 1992, p. 147). Data was used to group students into one of three groups: nonparticipant, passive participant, or active participant, with nonparticipants being the least engaged students and active participants being the most engaged. The results of the study indicated that over half of the students identified as nonparticipants were receiving free lunch, while only 29.7% of active participants had free- or reduced-lunch plans (Finn & Cox, 1992, p. 150). These results show that income level was indicative of level of participation in school. Thus, students living in poverty face a variety of unique challenges that inhibit cognitive, emotional, and behavioral engagement.

Culturally Relevant Pedagogy

The term “culturally relevant pedagogy” refers to a teaching approach that strives to create an empowering and effective learning environment by acknowledging students’ cultural backgrounds, both collectively and as individuals. Culturally relevant pedagogy, also called culturally responsive pedagogy or CRP, has three goals for students: (1) the achievement of academic success, (2) the development of cultural competence, and (3) the ability to think critically about and challenge the status quo (Ladson-Billings, 1995, p.160). It is based on the assertion that learning is a social process, thus new information must be relevant to students’ “frameworks of culture and cognition” in order for it to be memorable (Irvine, 2009, p. 57).

Examples of successfully implemented CRP lessons exist across subject areas. Ladson-Billings (1995) recounts the example of a second grade teacher that encouraged her students to bring in samples of their favorite rap songs. Although rap music is often criticized in the school setting, this educator understood her students’ connection with the genre, and thus used it to teach a poetry unit. Additionally, one educator created an “artist or craftsperson-in-residence program” through which she invited students’ parents to come to the classroom and share their skills and trades. After each presentation, students were required to conduct additional research into the topic about which they'd learned. Students were therefore introduced to the various careers of adults in their communities while simultaneously building research and writing skills. A final example is a classroom in which students were encouraged to speak and write in their native language, as long as they eventually translated their thoughts into English. Each of these curricula exemplifies CRP, as students are constructing new knowledge based on familiar and relevant cultural frameworks (Ladson-Billings, 1995, p. 161).

Why is Cultural Responsiveness Important?

CRP is an especially important approach in culturally diverse classrooms and for minority and low-income students that have been "poorly served" by our education system in the past (Ladson-Billings, 1995, Irvine, 2009). First of all, CRP allows teachers to forge meaningful connections with their students (Irvine, 2009, Reif & Grant, 2010). Through CRP, teachers recognize that that their classrooms are communities of diverse learners rather than homogenous and generic (Irvine, 2009). Furthermore, by celebrating students' personal backgrounds, teachers show that they value and care for each child as a unique individual (Reif & Grant, 2010).

Additionally, CRP has shown to be more effective in educating minority and at-risk students than traditional curricula (Koppelman & Goodhart, 2010, Beaudoin, 2013). Teaching methods that encourage rote memorization, rather than the exploration of cultural connections, have no personal connection to students' lives. These methods therefore have "not proven to meet the intended objectives of No Child Left Behind" (Beaudoin, 2013, p. 641). Furthermore, what Koppelman & Goodhart (2010) refer to as "business-as-usual" teaching results in low achievement in diverse populations, as well as low motivation and engagement. Finally, CRP combats inequities in the education of diverse students. Standardized curricula, by definition, fails to acknowledge the individualism of each student, particularly that of marginalized populations, while CRP takes culture and personal experience into account (Beaudoin, 2013, p. 643).

Finally, culture is invaluable in shaping students' behavior and values. Irvine (2009) writes that culture is not only personally significant, but is "an important survival strategy that is passed down…through enculturalization and socialization, a type of road map that guides and shapes behavior". Therefore, a curriculum that fails to consider the cultural background of its students also fails to meet their most inherent social, behavioral, and moral needs (Irvine, 2009).

Embodied Pedagogy

While traditional pedagogical approaches focus on the mind as the center of cognition, embodied pedagogy acknowledges that both body and mind play a role in knowledge construction (Nguyen & Larson, 2015). Educational philosopher John Dewey first explored the concept of embodied pedagogy in the early 20^{th} century, when he asserted that the body has the ability to internalize knowledge, and that the human senses play an important role in constructing complex meaning (Dewey, 1916). In his work *Democracy and Education* (1916), Dewey likens the human senses to "avenues" through which new information is synthesized (p. 136). Thus, knowledge is not simply "conveyed" to the brain, but is developed through the unification of mind and body (Nguyen & Larson, 2015, p. 332).

It is possible to implement embodied pedagogy across subject areas, although there are some subjects that are more innately physical than others. Content areas that have "inherent physicality" include subjects that focus on the body, such as kinesiology, as well as subjects that teach manual skills, such as performance. These fields are traditionally taught using embodied pedagogy (Nguyen & Larson, 2015, p. 334). Additionally, there are content areas that have “socially-based content”, such as psychology or education. While these fields might not have obvious physicality, they have a social and emotional nature that allows for the implementation of embodied pedagogy. For example, role-playing and performance in the field of history are embodied techniques that allow learners to reconstruct historical events and personalities (Nguyen & Larson, 2015, p. 335).

Those subjects that do not have inherent physical or social qualities can also be taught using embodied pedagogy, although spatial elements may be less apparent. Mathematics is an example of a subject area with “implied spatial qualities” (Nguyen & Larson, 2015, p. 336). While math is typically regarded as a logic-based discipline, it is not only possible, but also beneficial to create an “embodied link” between mathematical problems and solutions, as this link strengthens conceptual understanding (Nguyen & Larson, 2015, p. 336). Embodied pedagogy has been successfully incorporated in mathematics instruction in the past. For example, Goldin-Meadow, Cook, and Mitchell (2009) taught students to solve math problems using appropriate gestures and pointing (p. 267). They found that those students that used gestures had stronger recall, thus demonstrating that the mind and the body work in conjunction with one another. The results also indicate that body movements assist in the synthesis of new knowledge (Goldin-Meadow, Cook, & Mitchell, 2009, p. 270). Furthermore, teachers were able to observe students’ gestures and determine if and where problem-solving misconceptions exist. Thus, embodied pedagogy is possible and effective not only when teaching social subjects, but also in the mathematical field (Nguyen & Larson, 2015, p. 336).

It is important to note that the addition of a physical component alone does not comprise embodied pedagogy. First, true embodied pedagogy requires that the students are made aware of the relationship between their bodies and the surrounding space, instead of disregarding the body as a separate entity (Nguyen & Larson, 2015, p. 337). Teachers can strengthen this awareness by arranging classrooms in formations that facilitate physical interaction and socialization. A classroom that promotes spatial awareness will be open and malleable, offering ample space for collaboration and reflection (Nguyen & Larson, 2015, p. 338).

Additionally, embodied pedagogy strengthens the unification of mind and body through "cyclical modes of knowledge construction", namely "mindful action" and "reflection" (Nguyen & Larson, 2015, p. 338). "Mindful action" refers to lesson content that promotes learning through motion and sensation (Nguyen & Larson, 2015, p. 338). For example, interdisciplinary curricula naturally support mindful action. When learners are confronted with exercises or space arrangements from other disciplines, they are challenged to think critically about the relationships between disciplines. After students engage in mindful action, the "reflection" stage provides opportunities for thoughtful discussion and consideration about the action (Nguyen & Larson, 2015, p. 338). By moving through cycles of mindful action followed by deep reflection, students construct knowledge about the role of the body in learning and develop an internal sense of their physicality (Nguyen & Larson, 2015, p. 338).

Finally, embodied learning advances awareness of the body's role in socialization. An embodied curriculum acknowledges that learning is a social activity.

As such, its success depends on collaboration and reciprocal dissemination of knowledge. Just as students have a relationship to subject matter, they also have a relationship to their peers, educators, and the school community. Performance is an example of a learning activity that heightens students' awareness of the classroom as a socialized space (Nguyen & Larson, 2015, p. 339).

Embodied learning is a teaching method that regards learning as a holistic process that requires physicality, reflection, and collaboration. Knowledge must be constructed with both body and mind in order to engage "the whole learner" (Nguyen & Larson, 2015, p. 342).

Arts Integration

The theoretical frameworks of engagement theory, culturally relevant pedagogy, and embodied pedagogy each informed the creation of the "Adding Movement to Subtract Monotony" curriculum implemented in this study. This curriculum utilized the teaching approach of arts integration to teach creative movement and mathematics concepts to elementary aged students. As defined by the Kennedy Center, arts integration is a pedagogical approach "in which students construct and demonstrate meaning through and art form" by engaging in a "creative process which connects an art form and another subject area and meets evolving objectives in both" (Silverstein & Layne, 2010, p. 1).

Why Math and Dance?

The idea to integrate movement and mathematics was influenced by several studies, each yielding positive results. Pica (2006) argues that movement facilitates learning, particularly in the mathematical field (p. 16). It is developmentally appropriate to integrate academics with physical activity, as children retain the most information when utilizing all of their senses. In the example of geometry, for instance, there is an obvious parallel between the math concept of shape and the dance concept of body shape. Physically experiencing these concepts enhances understanding, retention, and word comprehension (Pica, 2006, p.16).

Alibali and Nathan (2011) assert that mathematical cognition is based in perception, but is “grounded in the physical environment”, and that mathematical knowledge is therefore the result of embodied processes (p. 2). They especially focus on the role of gesturing in revealing embodied aspects of mathematical thinking (Alibali & Nathan, 2011). In a 2009 study on gesturing, third- and fourth-grade students were randomly assigned to one of three groups: “no gesture”, “partially correct gesture”, and “correct gesture”. Each group solved a missing-part addition problem. Children in the “correct gesture” or “partially correct gesture” groups were taught to use both gestures and verbalization when indicating to addends of the problem, either in whole or in part, while those in the “no gesture” group produced no hand movements while verbalizing the strategies used (Goldin-Meadow et. al., 2009, p. 268). Results indicated that the act of gesturing allowed students to regulate their attention, thus facilitating learning. Additionally, adding physicality to problem solving helped students learn the grouping operation, as evidenced by the “correct gesture” group’s use of academic language throughout the study (Goldin-Meadow et. al., 2009, p. 271). These findings suggest that body movements are involved in the creation and synthesis of new math ideas (Goldwin-Meadow et. al., 2009).

A 2001 study analyzed the effects of a three-year dance integration project implemented in a Minnesota elementary school (Werner). Six classroom teachers and three dance professionals created and taught a dance-integrated math curriculum in a collaborative effort to stimulate students' kinesthetic intelligences while encouraging them to make complex connections. Data was collected in a variety of ways. Primarily, a survey was distributed to students in grades 2-5 in the fall and the spring of the 2000/2001 school year. Some of these students were exposed to the dance-integrated curriculum, and others were not. The survey included 13 questions about math practices and consisted of a 3-point Likert scale (Werner, 2001, p. 1). Classroom observations and teacher interviews were also used to collect data. Results showed a significant difference in student attitudes toward math between the experimental group and the control group. In the spring, those students exposed to a dance-integrated curriculum had a more positive attitude toward and enjoyment of mathematics, as indicated by a significantly higher score on the survey (Werner, 2001, p. 3). In general, students in the non-dance class maintained or decreased their survey scores from the fall to the spring (Werner, 2001, p. 5).

In a mixed-methods study on dance integration, Ryan (2014) found that dance-integrated math instruction yielded positive attitudes toward math and dance. In this study, students from two classrooms in Newark, DE, were sampled. 22 students received instruction in a dance-integrated math curriculum, and 16 students were part of a control group that received only math instruction (Ryan, 2014, p. 29). Analysis of both quantitative and qualitative data revealed that the experimental group had increased knowledge of both dance and math concepts (Ryan, 2014, p. 49). Additionally, these students showed positive attitudes toward performance, dance, and math (Ryan, 2014, p. 50). Thus, students exposed to a dance-integrated math curriculum learned more about both the academic content area and the art form, while having a positive experience (Ryan, 2014, p. 52).

Finally, a mixed-methods study of dance, math, and student engagement indicated that dance integration engages students in all three domains: behavior, cognition, and emotion (Boccardi, 2015). 17 students from a second grade classroom in Newark, Delaware, were exposed to a dance-integrated math curriculum over the course of three weeks. Math concepts taught included money and time (Boccardi, 2015, p. 20). Data was collected in the form of a quantitative post-survey, along with videotapes, student-created journal entries, and case studies (Boccardi, 2015, p. 25). Results indicated that a dance-integrated math curriculum was behaviorally, emotionally, and cognitively engaging for students, and also provided a positive learning experience (Boccardi, 2015, p. 95).

Research Problem

The goal of this study was to explore the role that arts integration plays in mitigating several issues facing elementary schools today. These issues include high levels of student disengagement, a national decline in arts programs, and art program inequity in low-income schools.

Student Disengagement and Drop Out Rates

In a national poll for grades 5-12, 50% of students reported that they were engaged in school, 29% reported that they were not engaged, and 21% reported that they were actively disengaged. This survey also indicated that only 28% of students surveyed “strongly agreed” that they “had fun at school”, and only 23% felt that they “strongly agreed” that they “get to do what [they] do best every day”. Disengagement can be blamed in part on curriculum choices, as 50% students indicated that they felt bored in school at least once per day (Gallup, Inc., 2015, p. 2).

Karweit and Slavin (1981) studied the use of instruction time in four schools in Maryland. Results yielded that throughout 18 classrooms, an average of 269 minutes were scheduled for math instruction each week. Only 183 minutes were “engaged”, meaning that for the other 86 minutes, students were losing learning time to interruptions, intrusions, or inattention (Karweit & Slavin, 1981, p. 162). The largest loss of instruction time was due to student inattention, or a lack of behavioral engagement (Karweit & Slavin, 1981, p. 162).

A lack of school engagement can contribute to the choice to drop out (Rumberger, 1987, Finn & Rock, 1997). Rumberger (1987) surveyed American youth and found that school-related factors were highly predictive of whether or not students would drop out. Male students most commonly answered that they dropped out because they “disliked school” (Rumberger, 1987, p. 109). Female students were also likely to drop out due to disinterest in school, a factor that was second only to pregnancy in likelihood of contributing to their decision to drop out (Rumberger, 1987, p. 109).

O’Donnell et. al. (2012) assert that patterns of disengagement, and therefore higher dropout rates, are more prevalent among minority students from low-income homes (p. 340). Disengagement emerges in the elementary grades, and predicts poor behavior and low academic achievement later. In a 1997 longitudinal investigation, Finn and Rock classified low-income students into one of three groups: “resilient students” that were academically successful school completers, “non resilient completers” that showed poor academic performance but still completed school, and “dropouts” that were non-completers (Finn & Rock, 1997, p. 221). These classifications were made after considering achievement test scores, self-esteem and locus of control, and engagement of 1,803 low-income youth (Finn & Rock, 1997, p. 224). Results indicated that 81.6% of students were non-resilient completers or dropouts, meaning only 18.4% of low-income students were considered “resilient completers” (Finn & Rock, 1997, p. 227). One of the largest contributing factors of group placement was student engagement, which yielded “large and significant differences between resilient and non-resilient students” (Finn & Rock, 1997, p. 231). The results of this investigation thus support the correlation between lack of engagement and high dropout rates.

Decline in Arts Programs

In the past decade, public schools in the United States have seen a decrease in arts programs, especially in dance and theatre programs. The United States Department of Education published a report in 2012 that compared arts program availability in over 1,800 elementary schools in the 1999/2000 school year to that of the 2009/2010 school year. Art programs evaluated were music, visual arts, dance, and drama/theatre (Parsad & Spiegelman, 2012). The report revealed a decrease in all art programs except for music over the course of a decade (Parsad & Spiegelman, 2012, p. 5).

The most profound decrease in availability was in dance education. In 1999, 20% of public elementary schools offered dance education as part of the curriculum, compared to just 3% of schools in 2009 (Parsad & Spiegelman, 2012, p. 5). Additionally, the number of schools offering dance as part of the physical education or music curriculum also decreased from 1999 to 2009. 37% of schools integrated dance and music in 2009, and 44% of schools integrated dance and physical education, down from 48% for each subject area in 1999 (Parsad & Spiegelman, 2012, p. 41).

The primary reason for the decline in arts programs is the renewed emphasis placed on subjects in the STEM field, which includes Science, Technology, Engineering, and Math (Sousa & Pilecki, 2013). Sousa & Pilecki (2013) also assert that low-income schools, which already have lower quality arts programs, are more likely to have their arts programs reduced or eliminated (p. 2).

Art Program Inequity

The Arts Education Partnership, a branch of the Education Commission of the United States, asserts that while the benefits of an arts education are greatest for low-income students, these students are "least likely to have access to a high quality arts education" (Arts Education Partnership, 2015). Furthermore, in a 2011 investigation conducted by the President's Committee in Arts and Humanities, it was discovered that schools across the nation address arts education differently. The report claims "Recent analyses revealed that the schools with students who could most benefit from the documented advantages of arts strategies are often those that…do not have the resources to provide it to their students" (PCAH, 2011, p. 11).

The Department of Education Arts Education Report (2012) also addresses discrepancies in art program availability between low-income schools and their high- or middle-income counterparts. Schools with the highest poverty concentration saw a large decline in music program availability, as 100% of these schools offered music instruction in 1999, and only 81% offered music in 1999. It is important to note that on average, schools did not see a decrease in music programs during the ten-year span (Parsad & Spiegelman, 2012, p. 21). With respect to dance programs, only 36% of schools with the highest poverty concentration offered dance as part of the physical education experience, compared to 56% of schools with the lowest poverty concentration. Similarly, 31% of schools with the highest poverty concentration integrated music and dance, while 49% of schools with the lowest poverty concentration integrated the two (Parsad & Spiegelman, 2012, p. 40). Thus, arts education has become a luxury, only to be afforded by some schools, despite its numerous documented benefits.

Arts Integration as a Solution

Student disengagement and a decline in arts program availability are major issues facing K-12 schools in the United States. Additionally, these problems are compounded for schools with high poverty concentrations that also suffer from inequitable art program quality and accessibility. Culturally relevant pedagogy and embodied pedagogy are examples of engaging teaching approaches that offer a multitude of benefits to students and teachers alike. This study examines arts integration, which is a quality example of both culturally relevant and embodied pedagogy, and explores its role as a possible solution for several problems faced by low-income students. It aims to do so by studying the effects that a dance-integrated math curriculum, "Adding Movement to Subtract Monotony", has on the emotional, behavioral, and cognitive engagement of students from low-income homes.

Culturally relevant pedagogy has proved to be effective in teaching math to minority students in the past (Hubert, 2013). A 10-day culturally relevant mathematics curriculum was implemented in a low-income high school in a Southern state. The goal of each lesson was to make mathematics more relatable to 37 high-school students, all of who had been identified as "at-risk" (Hubert, 2013, p. 327). Data was collected from pre- and post-assessments, as well as individual interviews (Hubert, 2013, p. 327). Data analysis indicated that not only were students more interested in mathematics, but they also felt more positively about the subject in general (Hubert, 2013, p. 329). Students stated that CRP made math "more easier", was "pretty fun", and made them feel like they "actually wanted to be there" (Hubert, 2013, p. 330).

Arts integration is an example of culturally relevant pedagogy, according to Grant and Reif (2013), who state that arts integration increases students' sense of cultural identity, as well as their enthusiasm for "questioning, exploring, and creating" (p. 103). Furthermore, according to their respective definitions, arts integration and CRP are teaching approaches with a shared goal: to support learning by encouraging students to "create and construct meaning" (Beaudoin, 2013, Silverstein & Layne, 2010).

Finally, arts integration, and dance integration in particular, allows low-income students to overcome many of the barriers separating them from engaged learning. An arts integration project called Arts for Academic Achievement was implemented across 45 Minneapolis elementary schools in 2003 (Ingram & Seashore, 2003, p. 2). The results of the program were positive for both students and teachers. Researchers reported that the program allowed teachers to better meet the needs of diverse student population. Furthermore, the program "positively impacted the achievement gap" by improving learning in reading and math (Ingram & Seashore, 2003, p. 10).

Students from low-income homes face a variety of health issues that are middle-class peers do not experience (Jensen, 2013). Studies have shown that recess and physical activity, including dance, contribute to healthy oxygen and glucose levels, which contribute to stronger memory and cognitive function (Jensen, 2013, p. 2). Furthermore, innovative teaching strategies can encourage increased student effort. Thus, arts-integrated or culturally relevant curricula can serve to reach those low-income students that are experiencing a lack of motivation due to outside stressors or learned helplessness (Jensen, 2013, p. 4). Finally, physical activity and fun learning tasks can each play a role in reducing chronic stress. Engagement in sensorimotor activities, in particular, has been shown to support behavioral regulation and diffuse distress (Jensen, 2013, p. 7). In sum, the addition of the arts to the traditional curriculum can alleviate some of the unique challenges faced by low-income students.

Conclusion

This literature review outlined several theoretical frameworks on which both arts integration curricula and the "Adding Movement to Subtract Monotony" curriculum are based. Engagement theory, culturally relevant pedagogy, and embodied pedagogy are frameworks that inform best practice teaching in K-12 schools.

Furthermore, this literature review addressed contemporary issues faced by the K-12 schools in the United States. Among these issues are high levels of student disengagement, which in turn contribute to high dropout rates, as well as the elimination of arts programs, particularly for low-income students. Several studies utilized arts integration to successfully promote classroom engagement and achievement. Arts integration was thus presented as a teaching approach that could possibly mitigate these problems. The history of effective arts integration inspired this project, which examines the effects of an arts integrated curriculum in a class of students from low-income homes.

Finally, each theoretical framework emphasized the role of classroom engagement in learning. Similarly, a lack of engagement contributed to, or was the result of, the contemporary educational issues discussed in this literature review. We therefore see that student engagement is a significant facilitator of learning and a positive educational experience.

In the succeeding chapters, this thesis introduces an arts integrated curriculum, "Adding Movement to Subtract Monotony", and seeks to explore its effect, if any, on the behavioral, emotional, and cognitive engagement of students from low-income homes. The following chapter introduces the methodology used in the implementation and analysis of this curriculum.

Chapter 3

METHODOLOGY

Introduction

The purpose of this study was to determine the effects, if any, that a dance-integrated math curriculum supplement titled "Adding Movement to Subtract Monotony" had on the engagement of students from low-income homes. Engagement, as defined by Fredricks et. al. (2004), is a meta-construct that exists across three domains: emotion, behavior, and cognition. Qualitative and quantitative engagement data within each domain were collected and analyzed in two education settings in the state of Delaware. This chapter discusses the methodology for the data collection and analyses of the data.

Research Question

The research question that guided this study was: What are the effects of a dance-integrated mathematics curriculum on the engagement of students from low-income homes in Wilmington, Delaware? This main question was driven by a series of focus questions, one for each domain of student engagement:

(1) What are the effects of a dance-integrated mathematics curriculum on the emotional engagement of students from low-income homes, as indicated by enjoyment and enthusiasm?

(2) What are the effects of a dance-integrated mathematics curriculum on the cognitive engagement of students from low-income homes, as indicated by academic understanding?

(3) What are the effects of a dance-integrated mathematics curriculum on the behavioral engagement of students from low-income homes, as indicated by attention, effort, persistence, and conduct?

Curriculum Development

The original curriculum supplement used in this study is titled “Adding Movement to Subtract Monotony”, and was written by the researcher. It consists of four integrated lesson plans, each based on the Common Core State Standards for second grade math and the National Core Arts Standards for dance. It also includes an introductory lesson that contains instruction on three dance concepts: (a) movement, (b) body, and (c) space. Movement concepts addressed included locomotor and non-locomotor movements. Body concepts addressed included shape, symmetry, and asymmetry. Space concepts addressed included self- and general-space, levels, and pathways. The learning plan additionally consists of four integrated lessons: (1) Shaping Up, (2) Statues, (3) Addition Alive, and (4) Dancing the Difference.

“Adding Movement to Subtract Monotony” was designed using McTighe and Wiggins’s (1998) Understanding By Design template. An Understanding By Design curriculum is created “backwards”; the researcher considers his desired results and his students’ prerequisite understandings before creating the learning plan (McTighe & Wiggins, 1998). During Stage 1 of curriculum development, the researcher thus outlined essential questions, standards, and objectives in math and movement. Math concepts included (a) geometry, including shapes and symmetry, and (b) operations in base ten, including addition and subtraction. Dance concepts included (a) general- and self-space, (b) levels, (c) pathways, (d) body shape, and (e) locomotor and non-locomotor movements. All concepts addressed were aligned to national standards. The big idea linking these concepts was "connections". During Stage 2, performance tasks to demonstrate conceptual understanding, as well as assessments to evaluate conceptual understanding, were designed. In Stage 3, learning plans were created.

Each learning plan begins with a short movement warm-up, as well as a review of both the math and dance concepts taught in the previous lesson. Instruction followed a gradual release of responsibility model, also referred to as an "I do, we do, you do" model (Levy, 2007). Thus, daily instruction began with teacher modeling, and students gradually moved to independent practice through ample observation and practice. Finally, students had the opportunity to create and choreograph their own movement phrases. Each lesson culminated with a group or partner peer performance and reflection period, each of which was videotaped. After each lesson, students were given the opportunity to journal about their experience. The videotaped performances, journals, and student work samples (permanent products) were used as assessments and data collection tools during curriculum implementation.

Participants

The curriculum "Adding Movement to Subtract Monotony" was implemented in two locations in the state of Delaware. First, it was piloted in a second grade classroom at a public school in Newark. The class consisted of 20 students, 9 males and 11 females. All 20 students volunteered to participate in the study, and consent forms were obtained from the parents or guardians of all students. None of the students had IEPs (Individualized Education Plan) or needed additional accommodations. None of the students had experience with arts integrated learning at the time of either curriculum implementation.

In addition, the curriculum was implemented at a summer camp program in Wilmington. 97% of these summer camp participants attend the camp under Purchase of Care, a state subsidy available for children up to 12 years of age living within 200% of the Federal Poverty Level. The number of study participants varied from week to week, but consent was obtained from the guardians of 13 participants, 2 male and 11 female, that attended consistently. All participants volunteered to be in the study. Participants ranged in both age and grade level, as the sample contained students from first grade to sixth grade. IEP data was not available for these students. It is unknown if students had experience with arts-integrated learning at the time of curriculum implementation.

Mixed Methods Rationale

A mixed methods approach to research integrates both quantitative and qualitative data collection methods in a single study (Thomas, Nelson, & Silverman, 2011, p. 21). Specifically, Creswell's (2007) concurrent triangulation approach was the framework used to design this study.

The purpose of a triangulation design is to use both qualitative and quantitative methods to obtain "complementary" data in order to answer a research question. In doing so, the researcher can validate or expand upon findings from one method with the findings of the other (Creswell & Plano Clark, 2007, p. 62). In the concurrent triangulation model, qualitative and quantitative data are collected together (concurrently) but analyzed separately. Data is then interpreted by merging the results of both (Creswell & Plano Clark, 2007, p. 64). In this study, two types of qualitative data were collected: (a) journal responses and (b) observations from videos. In addition, four types of quantitative data were collected: (a) pre- and post-math assessment scores, (b) pre- and post- dance assessment scores, (c) pre- and post-survey responses, and (d) permanent product scores. Each data source provided information on one or more facets of student engagement. Journal responses assessed students' cognitive, emotional, and behavioral engagement. Video observations assessed behavioral engagement. Survey scores assessed both emotional and cognitive engagement, and pre- and post-assessments, along with permanent products, assessed cognitive engagement. Student engagement is a multifaceted construct consisting of cognition, emotion, and behavior. Thus, the analyses of both qualitative and quantitative data were equally important in determining student engagement.

According to Creswell and Plano Clark (2007), the purpose of using a triangulation design is to utilize the strengths and "non-overlapping weaknesses" of qualitative methods and integrate them with those of quantitative methods (Creswell & Plano Clark, 2007, p. 62). Using this design thus served to strengthen the findings of this study, as the strengths of one method compensated for the weaknesses of the other. Additionally, using various data sources allowed the researcher to obtain a holistic interpretation of student engagement.

Duration

The curriculum was taught in two locations. As a pilot study, it was implemented at an elementary school in Newark, Delaware, over a four-week period. Consent forms for these subjects were completed and collected on January 8, 2015. Between January 8, 2015, and February 5, 2015, the learning plans were taught from 12:20 – 1:10pm on Tuesday and Thursday afternoons. During the first session, 2 pre-assessments (one math, one dance) and a survey were administered. The second session consisted of introductory dance instruction. Over the next 6 sessions, students received instruction in the 4 integrated lessons. On February 5, students performed their final movement phrases for the “Dancing the Difference” lesson and then completed 2 post-assessments and a post-survey. Students had already received instruction in all math concepts and none had received instruction in dance concepts.

Next, the curriculum was implemented at a summer camp in Wilmington, Delaware, June 18, 2015, and August 14, 2016. On June 18, consent forms were distributed and pre- assessments and surveys were administered. Signed consent forms were obtained on June 25, 2016. Students that did not have permission to participate were excluded from the data pool and their pre-tests were removed. During the first session, students received introductory dance instruction. There was a two-week break during which students received no instruction due to changes in the researcher’s schedule. The remainder of the unit was taught between July 17 and August 14. On the final day of instruction, post-tests in dance and math, as well as a post-survey, were administered. It is unknown what previous instruction these students had in both dance and math concepts.

Instruments

In order to collect qualitative and quantitative student engagement data, several instruments were used. Two sources of qualitative data included (1) daily journal responses and (2) videotaped student performances. In addition, three sources of quantitative data included (1) pre- and post-assessments, in both dance and math, (2) pre- and post-surveys, and (3) permanent products in the form of movement maps created by students.

Data Collection Procedures

During the second curriculum implementation, qualitative and quantitative data were collected in order to answer the following research question: What are the effects of a dance-integrated mathematics curriculum on the engagement of students from low-income homes in Wilmington, Delaware? To assess cognitive engagement, pre- and post-assessments in both mathematics and dance were administered and scored, pre- and post-surveys were collected, journal entries were collected, and permanent products created by students were collected and scored. To assess emotional engagement, journal entries and pre- and post-surveys were collected. To assess behavioral engagement, videotaped performances were evaluated. Students were always encouraged to provide honest and detailed responses to journal and survey questions.

Emotional Engagement

First, the researcher investigated students' emotional engagement with a dance-integrated unit, guided by the following research question: What are the effects of a dance-integrated mathematics curriculum on the emotional engagement of students from low-income homes, as indicated by enjoyment and enthusiasm? Emotional engagement refers to the presence of positive emotions the absence of negative emotions in a student's involvement with a learning task (O'Donnell et. al., 2012, p. 335). For the purposes of this study, the researcher utilized two indicators of emotional engagement: enjoyment and enthusiasm. Enjoyment is defined as a state of pleasure, and enthusiasm is defined as intense enjoyment (O'Donnell et. al., 2012, p. 335). Emotional engagement was assessed through one quantitative and one qualitative instrument. First, it was assessed quantitatively through student responses on pre- and post-survey questions. Then it was assessed qualitatively through students' daily journal entries.

Pre- and Post-Survey Responses. An 18-question survey was administered to participants before and after implementation of "Adding Movement to Subtract Monotony". 10 of these questions asked students about their feelings toward learning and participating in various school activities. (See Appendix D for survey.) Before survey administration, students were reminded to answer as honestly as possible, and were assured that there was no right or wrong answer.

Daily Journal Responses. After each day of instruction, students were asked to answer two questions: (1) What did you learn today?, and (2) What did you like or dislike about today's lesson? After the final day of instruction, students were simply asked to reflect upon their experience and write down anything they wanted the researcher to know. Prompts were written and displayed for visual reference. The individual determined the length and amount of detail in each response. Again, students were reminded to answer honestly and thoroughly.

Cognitive Engagement

Next, the researcher investigated students' cognitive engagement with a dance-integrated curriculum using several qualitative and quantitative measures. The guiding research question was: What are the effects of a dance-integrated mathematics curriculum on the cognitive engagement of students from low-income homes, as indicated by academic understanding? Cognitive engagement refers to a student's use of "sophisticated learning strategies", as well as his or her demonstration of deep cognitive processing and critical thinking skills (O'Donnell et. al., 2012, p. 336). Cognitive engagement was therefore evaluated by students' use of academic vocabulary terms and demonstration of mastery of learning goals. Quantitative measures of cognitive engagement included pre- and post-survey and pre- and post-assessment scores, as well as scores on permanent products. Qualitative measures of cognitive engagement were students' daily journal responses.

Pre- and Post-Survey Responses. 5 of the questions on the survey inquired about students' learning styles and whether or not they deemed mathematics a useful subject. (See Appendix D for survey.) These questions serve to assess how experiencing a dance-integrated curriculum affected students' cognitive learning styles between the pre- and post-survey administrations.

Pre- and Post-Assessments. Assessments of both mathematics concepts and movement concepts were administered before and after the implementation of the "Adding Movement to Subtract Monotony" curriculum. (See Appendix C for assessments.) The mathematics assessment consisted of 20 items. It addressed the following math concepts: shapes, symmetry, addition, and subtraction. The math assessment was an independent activity. Students were not given outside help, calculators, or other resources.

The dance assessment included 10 items, and addressed the concepts of space, movement, body, and choreography. The dance assessment was an independent activity. Students were not given outside help or other resources. The researcher only provided support if students needed help reading a word, in which case the researcher would read the word to the student.

Additionally, both assessments asked questions in multiple formats; including, but not limited to, short answer, fill-in-the-blank, and multiple choice. Students were allowed 20 minutes to complete each assessment. Questions about assessment items were answered with a short, encouraging phrase, such as “try your best”. Performance on the posttests provides information about whether or not students retained and understood the concepts taught throughout the unit.

Permanent Products (Movement Maps). As part of the addition and subtraction lessons, students created movement maps in pairs. A movement map is an illustration of choreography that uses abstract shapes to represent locomotor and non-locomotor body movements and pathways. Students used these maps for reference during their performances. These maps were collected by the researcher and evaluated based on a rubric. Students were expected to have included an accurate number and type of movement on each map. Scores on movement maps indicated levels of cognitive engagement with both math and dance concepts.

Daily Journal Responses. As described above, students answered 2 journal questions after instruction each day: (1) What did you learn today? and (2) What did you like or dislike about today’s lesson? Responses to these questions, particularly the first question, provided cognitive engagement data.

Behavioral Engagement

A final research question that guided data collection and analysis is as follows: What are the effects of a dance-integrated mathematics curriculum on the behavioral engagement of students from low-income homes, as indicated by attention, effort, persistence, and conduct? Behavioral engagement refers to a student’s enduring attention, effort, and persistence throughout a learning activity (O’Donnell et. al., 2012, p. 335). Attention is defined as the student’s concentration and focus with the task at hand; effort is defined as clear investment of energy in the task; and persistence is defined as the investment of effort over long periods of time (O’Donnell et. al., 2012, p. 335). Additionally, for the purposes of this study, student conduct was used as an indicator of behavioral engagement. Appropriate classroom conduct was evidenced by positive interactions among peers. Disruptive or inappropriate activity indicated poor conduct, and is not exemplary of behavioral engagement. Videotapes of movement phrase performances were used as a qualitative measure of behavioral engagement.

Videotaped Student Performances. Of the 4 lessons in the learning segment, 3 performances were videotaped. These performances were the culminations of lessons in math and dance concepts, and were done in pairs or groups. After being given instructions and having ample time to practice movement concepts and ask questions, students choreographed their own movement phrases. Teacher support was given throughout the creative process. Students chose their partners for each culminating movement phrase. Partners would be reassigned if more than two episodes of disruptive behavior occurred during the creative process as a result of partner choices.

Daily Journal Responses. As described above, students answered 2 journal questions after instruction each day. These responses were analyzed for behavioral engagement based on response content and length.

Data Analysis

Each study participant was arbitrarily assigned a code in order to maintain confidentiality. Only the researcher knows the student codes. Qualitative data were scored using rubrics (See Appendices D and F for qualitative rubrics). A second scorer later coded the same data using the rubrics, and both sets of scores were analyzed for reliability by calculating the inter-observer agreement (also referred to as IOA).

Quantitative data was scored using a combination of rubrics, assigned scores, and a binary scoring system, based on the type of data.

Emotional Engagement

Pre- and Post-Survey Responses. An 18-question survey was administered to participants before and after curriculum implementation. 10 of these questions were used to gather emotional engagement data. (See Appendix D for survey.) Student responses on the survey were assigned a score based on the content of the response. For the first 6 questions, students indicated their feelings toward a variety of learning concepts by circling a smiling face, a neutral face, or a frowning face. Smiling faces were given scores of 3, neutral faces scores of 2, and frowning faces scores of 1. The next 4 survey items asked students to give their opinion on a variety of statements about math and dance by circling “Y” for “yes” or “N” for “no”. On these questions, positive answers received a score of 2, while negative answers received a score of 1.

Individual student scores were totaled. High scores evidenced high positive emotional engagement. Pre- and post-test scores were compared in order to determine the effects, if any, that a dance-integrated curriculum had on emotional engagement. The change in score between pre- and post-survey had to prove to be statistically significant, and not due to outside variables. Tests of statistical significance were conducted by calculating the probability of observing an effect if engagement stayed the same before and after the implementation of the curriculum supplement. This measure is referred to as the p-value (Curran-Everett, 2009). If the p-value was greater than 0.05, then the results were deemed insignificant, as they could have been the result of outside variables rather than the treatment.

Daily Journal Responses. Each student answered two journal questions after each lesson: (1) what did you learn today? and (2) what did you like or dislike about today's lesson? Journal responses were scored based on rubrics designed to evaluate the categories of enjoyment and enthusiasm. These rubrics can be found in Appendix E. In addition, another individual subsequently scored all journal responses in order to ensure reliability. The inter-observer agreement (IOA) was calculated by dividing the number of agreements between scorers by the total number of scores assigned. (Armstrong, Gosling, Weinman, & Marteau, 1997). This value was then converted into a percentage to calculate the IOA. If the IOA was less than 80% agreement, the observers met and discussed their disagreements until they could agree on each score. If the disagreement was due to a misconception about the rubric content, rubrics were modified for clarification. Qualitative results were considered reliable once IOA reached 80%.

Cognitive Engagement

Pre- and Post-Survey Responses. Surveys additionally provided quantitative cognitive engagement data. 5 survey questions were used to gather cognitive engagement data. (see Appendix D for survey.) Students gave their opinions on a variety of statements about their personal learning preferences by circling "Y" for "yes" or "N" for "no". On these questions, positive answers received a score of 2, while negative answers received a score of 1. Individual student scores were totaled. Pre- and post-survey scores were compared in order to determine the effects, if any, that a dance-integrated curriculum had on cognitive engagement with dance and mathematics. Statistical significance was calculated for any change in results.

Pre- and Post-Assessments. Pre- and post-assessments in both dance and mathematics were administered before and after curriculum implementation. Each assessment was scored using a binary system in which the student response was either correct or incorrect. Students could receive up to 24 points on the mathematics assessment and 20 points on the dance assessment. Individual scores were recorded and averaged, and pre- and post-test scores were compared. An increase in score between pre- and post-tests indicates an increase in academic understanding, and thus the cognitive engagement of students with subject matter. Statistical significance was calculated for any changes in results between pre- and post-assessment.

Permanent Products (Movement Maps). Student work samples were scored using a rubric. Students were able to earn up to 4 points on their movement maps: 2 points for demonstration of mathematics understanding and 2 points for demonstration of dance concept understanding. (See Appendix F for movement map rubric). Scores indicated level of academic understanding. A score of 4 out of 4 indicated complete academic understanding, a score of 3 out of 4 indicated partial academic understanding, a score of 2 out of 4 indicated adequate academic understanding, and a score of 1 out of 4 indicated inadequate academic understanding. A score of 0 out of 4 indicated no academic understanding whatsoever.

Daily Journal Responses. Daily journal responses were evaluated for evidence of cognitive engagement using a rubric. (See Appendix E for journal rubrics). Responses showed evidence of cognitive engagement when they included academic vocabulary terms and/or demonstrated knowledge of the lesson content. Inter-observer agreement was also calculated when coding for cognitive engagement.

Behavioral Engagement

Videotaped Student Performances. Videotaped performances were used to evaluate students' behavioral engagement with math and dance. Each student's performance was scored for attention, effort, persistence, and conduct using a rubric. (See Appendix G for video rubrics). Students with high rubric scores showed evidence of behavioral engagement through positive involvement with the performances. In addition, videos were coded by another scorer and IOA was calculated in order to ensure score reliability.

Daily Journal Responses. As described above, students answered 2 journal questions after instruction each day. A rubric was used to score these responses for behavioral engagement, specifically by scoring for the construct of student effort. Evidence of effort was established by the detail and length of student response. Inter-observer agreement was calculated when coding for behavioral engagement.

Conclusion

In summary, both qualitative and quantitative data were collected to determine the effect of a dance-integrated mathematics curriculum on student engagement. Qualitative measures consisted of journal responses and videotaped student performances. Quantitative measures consisted of pre- and post-surveys, pre- and post-assessments, and permanent products created by students. Each source gathered evidence for emotional, cognitive, or behavioral engagement, with some data sources providing evidence for multiple facets of engagement. Analyses were conducted to ensure the reliability and validity of each data source. The results yielded by these methods are discussed in the following chapter.

Chapter 4

RESULTS

Introduction

The purpose of this study was to determine the effects, if any, that a dance-integrated math curriculum, titled “Adding Movement to Subtract Monotony”, had on the engagement of students from low-income homes. Engagement, as defined by Fredricks et. al. (2004), is a meta-construct that exists across three domains: emotion, cognition, and behavior. Results from data analyses are presented as evidence for one or more of the following categories of engagement: emotional engagement, cognitive engagement, and behavioral engagement.

The research question that guided this study was: What are the effects of a dance-integrated mathematics curriculum on the engagement of students from low-income homes in Wilmington, Delaware? In order to answer this question, a series of focus questions were asked, one for each domain of student engagement:

(1) What are the effects of a dance-integrated mathematics curriculum on the emotional engagement of students from low-income homes, as indicated by enjoyment and enthusiasm?

(2) What are the effects of a dance-integrated mathematics curriculum on the cognitive engagement of students from low-income homes, as indicated by academic understanding?

(3) What are the effects of a dance-integrated mathematics curriculum on the behavioral engagement of students from low-income homes, as indicated by attention, effort, persistence, and conduct?

The first focus question guiding this study sought to investigate emotional engagement. *Emotional engagement* refers to the presence of positive emotions, such as enthusiasm and enjoyment, and the absence of negative emotions, such as anger or frustration (O'Donnell et. al., 2012, p. 335). Thus, indicators for emotional engagement included enjoyment and enthusiasm. Enjoyment is defined as an affective state of pleasure. Enthusiasm is defined as intense enjoyment (O'Donnell et. al., 2012, p. 335). Tools used to evaluate emotional engagement were (1) pre- and post-surveys and (2) daily journal responses.

The second focus question guiding this study sought to investigate cognitive engagement. *Cognitive engagement* refers to a student's use of "sophisticated learning strategies", such as elaboration, as well as demonstration of enduring academic understanding (O'Donnell et. al., 2012, p. 336). Student performance on post-assessments and post-surveys, ability to demonstrate correct utilization of new academic vocabulary terms, and demonstration of accurate dance and mathematics knowledge served as indicators for academic understanding, and thus for cognitive engagement. Tools used to evaluate cognitive engagement were (1) pre- and post-surveys, (2) pre- and post-assessments, (3) student-created permanent products, and (4) daily journal responses.

The third and final focus question guiding this study sought to investigate behavioral engagement. *Behavioral engagement* refers to a student's enduring attention, effort, and persistence throughout a learning activity (O'Donnell et. al., 2012, p. 335). The first indicator of behavioral engagement, attention is defined as the student's concentration and focus with the task at hand; the second indicator, effort is defined as clear investment of energy in the task; and the third indicator, persistence is defined as the investment of effort over long periods of time (O’Donnell et. al., 2012, p. 335). Tools used to evaluate behavioral engagement were (1) videotaped performances and (2) daily journal responses.

The results of qualitative and quantitative data collected before, during, and after the implementation of “Adding Movement to Subtract Monotony” are presented below. The results of emotional engagement data collection are presented in terms of pre- and post- survey scores and rubric scores of daily journal entries. The results of cognitive engagement data are presented in terms of pre- and post- survey scores and score changes, pre- and post-assessment scores, rubric scores of permanent products, and rubric scores of daily journal responses. The results of behavioral engagement data are presented in terms of rubric scores from videotaped student performances and daily journal responses. Finally, this chapter addresses limitations that potentially affected the results of the investigation.

Emotional Engagement

During the implementation of a dance-integrated mathematics curriculum, the following research question guided the investigation of emotional engagement: What are the effects of a dance-integrated mathematics curriculum on the emotional engagement of students from low-income homes, as indicated by enjoyment and enthusiasm? “Enjoyment” refers to a state of pleasure, and “enthusiasm” refers to intense enjoyment (O’Donnell et. Al., 2012, p. 335). The results of emotional engagement data collection are presented below in terms of pre- and post- survey scores, as well as rubric scores of daily journal entries.

Pre- and Post-Surveys – Emotional Engagement

Surveys were administered before and after the curriculum supplement implementation and utilized as quantitative data. Ten of 18 survey questions were categorized as assessing Student Enjoyment (See Appendix D for emotional engagement survey questions). The data set consisted of the survey responses of 13 students. On the pre-survey, students scored an average of 22.81 out of a possible 26 points, with a standard deviation of 2.63. On the post-survey, students scored an average of 22.23 out of 26, with a standard deviation of 2.74. This indicates a decrease of 2.2% in the mean emotional engagement score between pre- and post-survey. A paired t-test was utilized to compare the mean emotional engagement pre- and post-survey scores, which calculated a p-value of 0.54. A p-value greater than 0.05 indicates a lack of statistical significance (Curran-Everett, 2009). Thus, the change in score between the pre- and post-survey was not a result of the implementation of the curriculum supplement, as it is not statistically significant. The following table shows the emotional engagement scores of each participant, along with the percent change between pre- and post-surveys.

Table 1 Survey Scores: Emotional Engagement

Participant	Pre-Score	Post-Score	% Change
1	21	21	0
2	20	22	10
3	22	22	0
4	16	19	18.75
5	23	23	0
6	22	26	18.18
7	25	25	0
8	24	21	-12.5
9	25.5	20	-21.57
10	25	25	0
11	24	17	-29.17
12	23	22	-4.35
13	25	26	4
Mean	*22.73*	*22.23*	*-2.2*
SD	*2.63*	*2.74*	

Common themes existed in pre- and post-survey responses for emotional engagement. Average student scores increased from pre- to post-test only on survey item 17, in which students were asked to indicate whether dancing in front of their peers made them feel nervous. On the pre-test, 7 students answered that dancing in front of their peers made them feel nervous, while only 4 students indicated that they felt nervous on the post-test.

In addition, mean emotional engagement scores decreased the most on survey items 3 and 4. Mean scores on these two items decreased by approximately a quarter of a point. On pre-survey item 3, which asked students to indicate their feelings about addition, 12 students associated addition with positive emotions. However, 8 students associated addition with positive emotions on the post-survey, with the majority of students changing their responses from positive to neutral. A similar pattern is seen on survey item 4, which asks students to indicate their feelings about subtraction. On the pre-survey, 7 students indicated that they felt positively about subtraction, and 5 students indicated that they were neutral. Only 1 student indicated having negative feelings. However, on the post-survey, 3 students indicated negative emotion with subtraction, with 6 reporting positive emotions.

Daily Journal Responses – Emotional Engagement

Student journal responses evaluated for emotional engagement were scored in two categories: Student Enjoyment and Student Enthusiasm. Students answered two journal questions after instruction each day: (1) What did you learn today? and (2) What did you like or dislike about today's lesson? For qualitative emotional engagement data, student responses to the question "What did you like or dislike about today's lesson?" were scored for evaluation using a rubric, the descriptors for which can be found in Appendix E. In order to ensure reliability in the scoring of the journals, inter-observer agreement was calculated for 10 of 13 student responses after two different sessions, both selected at random. Both observers scored the journals, and inter-observer agreement reached 0.95 for both Student Enjoyment and Student Enthusiasm. This is greater than 0.8, or 80% agreement, meaning that results are reliable. The data set consisted of 79 total responses.

In the "Student Enjoyment" category, 58 out of 79 total responses (73.4%) received a score of 3, 6 out of 79 responses (7.6%) received a score of 2, 12 out of 79 responses (15.2%) received a score of 1, and 1 out of 79 responses (1.2%) received a score of 0. The following table shows how many journal entries earned each rubric score.

Table 2 Overall Student Enjoyment in Journal Entries

Score	Number of Entries	Approximate Percentage of Entries
3	58	73.4%
2	6	7.7%
1	12	15.2%
0	1	1.2%

Note: N = 79 responses

For the "Student Enjoyment" category, an example of a student response that received a score of 3 was "I like when we did running" (Participant 7, Journal, 6/30/15). An example of a student response that received a score of 2 was "I did not like the space. I liked moving" (Participant 5, Journal, 6/30/15). An example of a response that received a score of 1 was "I disliked how me and [name of peer] kept falling" (Participant 13, Journal, 7/17/15). Students that were present for the session but failed to record a response to the question "What is one thing you liked or disliked today?" were given Student Enjoyment scores of 0.

In the "Student Enthusiasm" category, 25 out of 79 total responses (31.6%) received a score of 3, 34 out of 79 responses (43%) received a score of 2.5, 6 out of 79 responses (7.6%) received a score of 2, 10 out of 79 responses (12.7%) received a score of 1.5, 3 out of 79 responses (3.8%) received a score of 1, and 1 out of 79 responses (1.2%) received a score of 0.

Table 3 Overall Student Enthusiasm in Journal Entries

Score	Number of Entries	Approximate Percentage of Entries
3	25	31.6%
2.5	34	43%
2	6	7.6%
1.5	10	12.7%
1	3	3.8%
0	1	1.2%

Note: N = 79 responses

For the "Student Enthusiasm" category, an example of a response that received a score of 3 was "I liked everything and it was fun. Have a good day Mrs. Lucy!" (Participant 12, Journal, 7/24/15). An example of a response that received a score of 2.5 was "What I like was we were allowed to dance with a partner" (Participant 10, Journal, 7/31/15). An example of a response that received a score of 2 was "One thing I like was when we were allowed to skip around the room. One thing I disliked was when we had to bend" (Participant 10, Journal, 6/30/15). An example of a response that received a score of 1.5 was "I did not like freeze dance" (Participant 4, Journal, 8/7/15). An example of a response that received a score of 1 was "I did no like everything" (Participant 1, Journal, 7/17/15). Students that were present for the session but failed to record a response to the question "What is one thing you liked or disliked today?" were given Student Enthusiasm scores of 0.

Common themes existed across emotional engagement data gathered from journal responses recorded after each day of dance-integrated mathematics instruction. In the "Student Enjoyment" category, 81% of responses scored a 2 or higher, indicating at least some level of pleasure. Similarly, in the "Student Enthusiasm" category, 82.3% of responses scored a 2 or higher. 81.6% of responses scored a 2 or higher across both indicators of emotional engagement.

Cognitive Engagement

During the implementation of a dance-integrated mathematics curriculum, the following research question guided the investigation of cognitive engagement: What are the effects of a dance-integrated mathematics curriculum on the cognitive engagement of students from low-income homes, as indicated by academic understanding? The results of cognitive engagement data collection are presented below in terms of pre- and post- survey scores, pre- and post-assessment scores, student-created permanent products, and daily journal responses.

Pre- and Post-Surveys – Cognitive Engagement

Surveys were administered before and after the curriculum supplement implementation and utilized as quantitative data. An increase in survey score indicated increased cognitive engagement with dance concepts, mathematics concepts, or both. Five of 18 survey questions were categorized as assessing cognitive engagement (See Appendix D for cognitive engagement survey questions). The data set consisted of the survey responses of 13 students. On the pre-survey, students scored an average of 8.58 out of a possible 10 points, with a standard deviation of 0.61. On the post-survey, students scored an average of 8.5 out of 10, with a standard deviation of 1.25. This indicates a decrease of 0.93% in the mean cognitive engagement score between pre- and post-survey. A paired t-test was utilized to compare the mean emotional engagement pre- and post-survey scores, which calculated a p-value of 0.79, which is larger than 0.05. Thus, the change in score between the pre- and post-survey is not statistically significant. The following table shows the pre- and post-survey cognitive engagement scores of each participant, along with the percent change between pre- and post-survey. The following table shows the cognitive engagement scores of each participant, along with the percent change between pre- and post-survey.

Table 4 Survey Scores: Cognitive Engagement

Participant	Pre-Score	Post-Score	% Change
1	8	8.5	6.25
2	8	6	-25
3	9	9	0
4	8	9	12.5
5	9	9	0
6	8.5	10	17.65
7	8.5	9	5.88
8	8	7	-12.5
9	8.5	8	6.25
10	9	10	11.11
11	10	10	0
12	9	7	-22.22
13	8	8	0
Mean	*8.58*	*8.5*	*-0.93*
SD	*0.61*	*1.25*	

The only survey item for which the mean cognitive engagement score increased was Item 13, which asked students if they learned best when working collaboratively. On the pre-survey, 5 students reported that they learned best when working with others, while 7 students reported that they learned best with others on the post-survey.

The survey item for which response scores decreased the most was Item 11, which asked students whether or not they learned best through movement. On the pre-survey, 9 students answered yes, they did learn the best when moving. On the post-survey, scores decreased by 0.2 points, as 7 students reported learning best through movement. The remainder of the cognitive engagement survey question score averages either stayed the same or decreased by less than a tenth of a point.

Pre- and Post-Assessments

Students took two assessments, one consisting of dance concepts and one consisting of mathematics concepts. Both assessments were administered before and after curriculum supplement implementation and utilized as quantitative data. An increase in assessment score indicated enduring academic understanding of the mathematics or dance concept taught. Each assessment item was scored using a binary system in which the student's response was scored right or wrong. See Appendix C for dance and mathematics assessment items.

The data set for the dance assessment consisted of the scores of 13 students. On the dance pre-assessment, students scored an average of 4.46 out of 22 possible points with a standard deviation of 2.93. On the post-assessment, students scored an average of 10.62 out of 22 possible points, with a standard deviation of 7.82 points. There was a mean score increase of approximately 138.12%. A two-tailed t-test was conducted to determine the presence of statistical significance between mean pre- and post-test scores. This test calculated a p-value of 0.0014, which is less than .05, and therefore indicates that the change in mean score between pre- and post-assessment is statistically significant. The following table shows the dance assessment scores of each participant, along with the percent change between pre- and post-assessment.

Table 5 Dance Test Scores

Student	Pre-Score	Post-Score	% Change
1	0	0	0
2	0	0	0
3	5	17	240
4	9	20	122.22
5	3	14	366.67
6	0	0	0
7	6	6	0
8	6	8	33.33
9	5	19	280
10	7	19	171.43
11	4	7	75
12	6	19	216.67
13	7	9	28.57
Mean	*4.46*	*10.62*	*138.12*
SD	*2.93*	*7.82*	

The data set for the mathematics assessment consisted of the scores of 12 students. On the mathematics pre-assessment, students scored an average of 17.75 out of 24 possible points with a standard deviation of 4.45. On the post-assessment, students scored an average of 16.83 out of 24 possible points, with a standard deviation of 7.11 points. There was a mean score decrease of approximately 5.16%. A two-tailed t-test was conducted to determine the presence of statistical significance between mean pre- and post-test scores. This test calculated a p-value of 0.88, which is greater than .05, and therefore indicates that the change in mean score between pre- and post-assessment is not statistically significant. The following table shows the mathematics assessment scores of each participant, along with the percent change between pre- and post-assessment.

Table 6 Math Test Scores

Student	Pre-Score	Post-Score	% Change
1	8	3	62.5
2	12	20	66.67
3	22	23	4.55
4	18	18	0
5	21	21	0
6	20	4	-80
7	18	14	-22.22
8	20	16	-20
9	24	24	0
10	16	23	43.75
11	15	14	-6.67
12	19	22	15.79
Mean	*17.75*	*16.833*	*-5.16*
SD	*4.454313538*	*7.107401179*	

Permanent Products – Cognitive Engagement

Students created choreography tools, called movement maps, which were scored and used as quantitative data. The data set consisted of 12 students. One student did not complete a movement map, and therefore was not included in the set. Each student was expected to include certain dance and mathematics components on their movement maps. In order to demonstrate complete mathematics understanding, students needed to show a correct addition or subtraction sentence, as well as illustrate a corresponding number of movements. In order to demonstrate complete dance understanding, students needed to include illustrations or identification of locomotor and non-locomotor movements, as well as pathways. Maps were scored using a rubric, the descriptors for which can be found in Appendix F. The following figure is an example of a movement map that received a perfect rubric score for both mathematics and movement concepts, thus evidencing complete academic understanding.

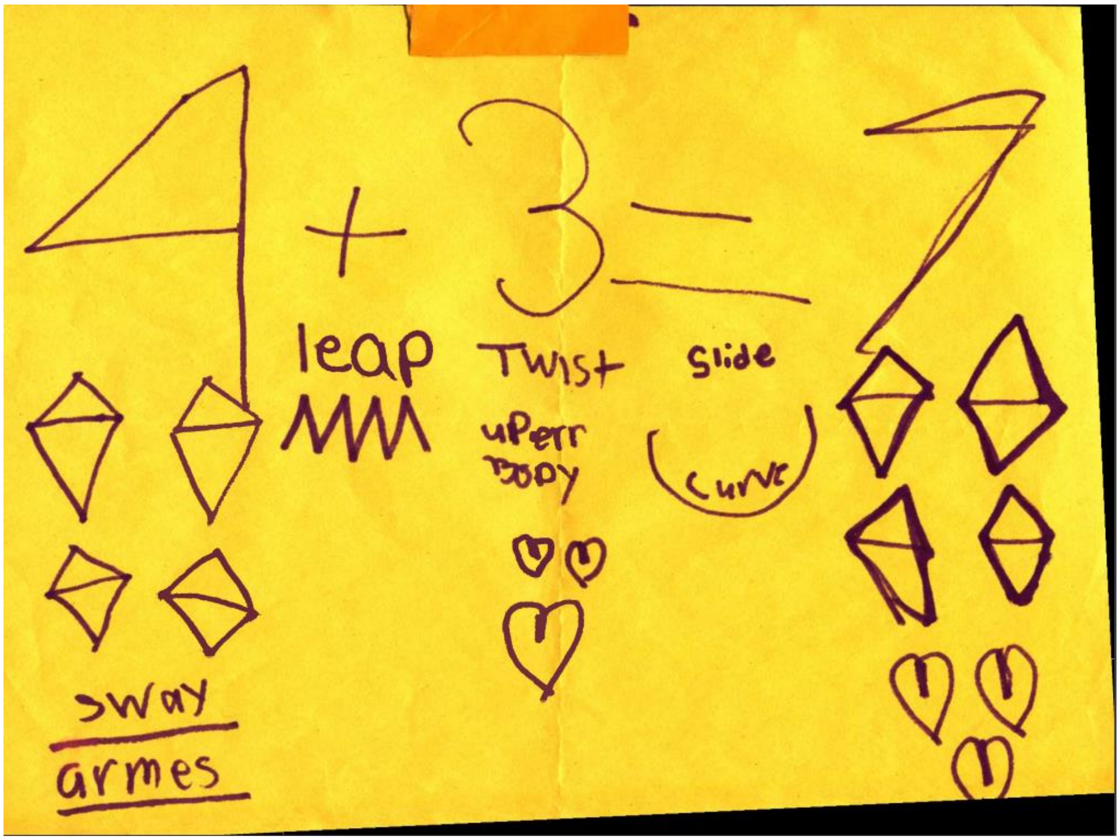


Figure 1	Movement Map Example (Participant 4)

The following table shows student permanent product rubric scores.

Table 7 Student Permanent Product Scores

Participant	Score (out of 4)
1	4
2	4
3	4
4	4
5	4
6	[no available score]
7	4
8	4
9	4
10	3
11	4
12	4
13	4
Mean	*3.92*
SD	*.29*

Based on these scores, each student was assigned to a level of academic understanding. A score of 4 out of 4 indicated complete academic understanding, a score of 3 out of 4 indicated partial academic understanding, a score of 2 out of 4 indicated adequate academic understanding, and a score of 1 out of 4 indicated inadequate academic understanding. A score of 0 out of 4 indicated no academic understanding whatsoever. The following table shows the distribution of movement map scores.

Table 8 Movement Map Score Distribution

Score	Level of Academic Understanding	Number of Students	Approximate Percentage of Class
4	Complete	11	91.67%
3	Partial	1	8.33%
2	Little	0	0%
1	Inadequate	0	0%
0	None	0	0%

N = 12 students

11 out of 12 (91.67%) students scored 4 out of 4 possible points, 1 out of 12 (8.33%) scored 3 out of 4 possible points, and no students scored 1 out of 4 or 0 out of 4 possible points. 100% of student movement maps evidenced at least partial academic understanding, and 91.67% of student movement maps demonstrated complete academic understanding.

Daily Journal Responses – Cognitive Engagement

Student journal responses evaluated for cognitive engagement were scored in a single category, “Academic Understanding”. A rubric was used, the descriptors for which can be found in Appendix E. Students answered two journal questions after instruction each day: (1) What did you learn today? and (2) What did you like or dislike about today’s lesson? For qualitative cognitive engagement data, student responses to the question “What did you learn today?” were scored for evaluation. In order to ensure reliability in the scoring of the journals, inter-observer agreement (IOA) was calculated for 10 of 13 student responses after two different sessions, both selected at random. Both observers scored the journals, and then mitigated disagreements until inter-observer agreement reached 0.8, or 80% of scores. For cognitive engagement in daily journal entries, IOA reached 100%. The data set consisted of 70 total responses.

18 out of 70 total responses (25.7%) received a score of 3, 46 out of 70 responses (65.7%) received a score of 2, 4 out of 70 responses (5.7%) received a score of 1, and 2 out of 70 responses (2%) received a score of 0. The following table shows how many journal entries earned each rubric score.

Table 9 Overall Academic Understanding in Journal Entries

Score	Number of Entries	Approximate Percentage of Entries
3	18	25.7%
2	46	65.7%
1	4	5.7%
0	2	2.9%

Note: N = 70 responses

In order to receive a score of 3, students needed to include the use of academic vocabulary terms, such as “locomotor movement”, “geometry”, or “addition”, as well as define these academic vocabulary terms accurately. Scores of 3 were also given to those students that made a written connection between dance and mathematics concepts. For the category of academic understanding, an example of a response that received a score of 3 was “I learned how to subtract non-locomotors” (Participant 4, Journal, 8/7/15). An example of a response that received a score of 2 was “I learned subtrahend” (Participant 12, Journal, 8/11/15). An example of a response that received a score of 1 was “Today I learned nothing” (Participant 9, Journal, 8/11/15). Students that were present for the session but failed to record a response to the question "What is one thing you learned today?" were given scores of 0.

Common themes existed across cognitive engagement data gathered from journal responses recorded after each day of dance-integrated mathematics instruction. 91.4% of responses scored a 2 or higher, indicating at least some level of academic understanding. The remaining 8.6% of responses reflected no academic understanding. This corroborates permanent product data that show that 91.6% of students demonstrated complete academic understanding of math and dance concepts.

In addition, cognitive engagement data from daily journal entries shows evidence of academic understanding of both dance and mathematical concepts, with some understanding of the connection between dance and math. Responses were classified to each category (dance, mathematics, or both) based on word or phrase indicators. The following table shows each indicator, followed by the number of times the word or phrase was used. Some students used more than one indicator in their response.

Table 10 Word/Phrase Indicator Coding in Journal Entries

	Mathematics	Movement	Integration (Mathematics and Movement)	Unrelated/ General
Indicator	"math" (1) "symmetrical" (2) "asymmetrical" (2) "shapes" (3) "heart" (1) "addition" (1) "addend" (1) "subtraction" (1) "minuend" (3) "subtrahend" (4) "difference" (3) "number sentence" (1)	"dance" (10) "dance partner" (5) "movement" (1) "leap" (1) "non-locomotor" (6) "space" (4) "steps" (1) "locomotor" (7) "movement map" (5) "high level" (1) "middle level" (1) "low level" (1) "clap when somebody is done" (1)	"shapes with our body" or "body shapes" (4) "to make symmetric and asymmetric shapes" (3) "I learned addition dance" (1) "how to dance with addition" (1) "how to hop on a map" (1) "I learned math and dance together" (1) "I learned how to subtract non-locomotors" (1)	"we learned to make" (1) "I learned nothing" (3) "I learn to today" (1) "I learned a lot" (2) "I learned everything" (1)

		"freeze dance" (2) "sway" (1) "stretch" (1) "bend" (1)		

The following table shows the breakdown of responses to the question "What is one thing you learned today?" Each response was classified based on whether it referenced math topics, dance topics, or the connection between the two. Some responses were unrelated to either dance or math, or were general, such as "I learned everything" (Participant 8, Journal, 8/4/15).

Table 11 Academic Understanding in Journal Entries by Topic

	Mathematics	**Movement**	**Integration (Mathematics and Movement)**	**Unrelated/General**
Number of Responses	12	37	12	9
Percentage of Responses	17.1%	52.9%	17.1%	12.9%

Note: N = 70 responses

Twelve out of 70 responses (17.1%) demonstrated academic understanding of mathematics concepts, 37 out of 70 responses (52.9%) demonstrated academic understanding of movement concepts, and 12 out of 70 responses (17.1%) demonstrated academic understanding of the integration of mathematics and movement concepts. Nine out of 70 responses (12.9%) were unrelated or general.

Patterns exist across cognitive engagement data collected from daily journal entries. The majority of journal entries (52.9%) demonstrate academic understanding of dance concepts, based on the usage of indicative words and phrases. In addition, 17.1% of journal entries reflect academic understanding of the connection between mathematics and dance concepts. These results corroborate the results of the pre- and post-dance assessments, on which students demonstrated academic understanding of dance concepts with increased mean scores (see Table 5).

Behavioral Engagement

During the implementation of a dance-integrated mathematics curriculum, the following research question guided the investigation of behavioral engagement: What are the effects of a dance-integrated mathematics curriculum on the behavioral engagement of students from low-income homes, as indicated by attention, effort, persistence, and conduct? The results of behavioral engagement data collection are presented below in terms of videotaped performances and daily journal responses.

Videotaped Performances

Videotaped performance data consisted of two performances. The first, which was performed after the implementation of the third lesson plan, “Addition Alive”, had a data set of 12 students. The second, performed after the implementation of “Dancing the Difference”, had a data set of 10 students. Students performed in groups but were scored individually using rubrics. Four rubrics were used for four different categories: (1) Student Attention, evaluated by whether or not the student stayed focused throughout the performance; (2) Student Effort, evaluated by whether or not the student exerted physical energy and an apparent desire to succeed; (3) Student

Persistence, evaluated by whether or not students exerted consistent effort throughout the performance; and (4) Student Conduct, evaluated by whether or not the students were demonstrating appropriate classroom behavior with no disruptive episodes. The descriptors for each rubric can be found in Appendix G. In order to ensure reliability in the scoring of the videos, inter-observer agreement was calculated for 5 of 13 participants, selected at random. Both observers scored the videos, and then mitigated disagreements until inter-observer agreement reached 0.8, or 80% of scores. For behavioral engagement in videotaped performances, IOA reached 90%. The following table shows the overall mean scores in each category for both performances.

Table 12 Overall Student Scores in Videotaped Performances

	Average (%)	Addition Alive (%)	Dancing the Difference (%)
Attention			
3	90.8	91.7	90.0
2	0.0	0.0	0.0
1	0.0	0.0	0.0
0	9.15	8.3	10.0
Effort			
3	67.5	75.0	60.0
2	18.3	16.6	20.0
1	5.0	0.0	10.0
0	9.15	8.3	10.0
Persistence			
3	80.9	91.7	70.0
2	10.0	0.0	20.0
1	0.0	0.0	0.0
0	9.15	8.3	10.0
Conduct			
3	85.9	91.7	80.0
2	9.15	8.3	10.0
1	0.0	0.0	0.0
0	5.0	0.0	10.0

Note: N = 12 for Addition Alive, N = 10 for Dancing the Difference

In the category of “Student Attention”, 90.8% of students received a score of 3; no students scored a 2 or 1, and 9.15% of students received scores of 0. In the category of “Student Effort”, 67.5% of students earned a score of 3; 18.3% earned a score of 2; 5% earned a score of 1; and 9.15% received a score of 0. In the category of “Student Persistence”, 80.9% of students scored a 3; 10% of students earned a score of 2; no students received a score of 1; and 9.15% of students received a score of 0. Finally, in the category of “Student Conduct”, 85.9% of students received a score of 3; 9.15% received a score of 2; no students received a score of 1; and 5% of students received a score of 0.

For the purpose of the "Addition Alive" lesson, students worked with a partner to create a movement phrase based on an addition problem with one-digit addends. Students were asked to demonstrate knowledge of movement concepts by using non-locomotor and locomotor movements, as well as pathways. Students were asked to demonstrate knowledge of mathematics concepts by adding their movements to create the correct sum of movements. The following chart shows the mean scores for each category in the "Addition Alive" performance, based on scores shown in Table 12.

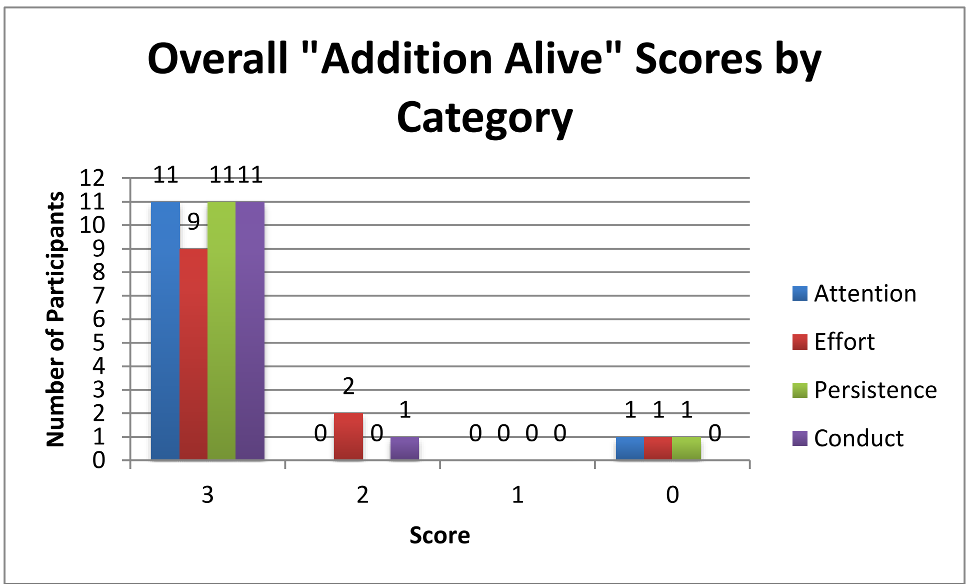


Figure 2 Overall "Addition Alive" Scores by Category

Table 11 and Figure 1 show that 11 out of 12 students (91.7%) received a score of 3 for the Student Attention category, no students received a score of 2 or 1, and 1 out of 12 students received a score of 0 in the Student Attention category. In the Student Effort category, 9 out of 12 students (75.0%) scored a 3, 2 out of 12 (16.7%)

scored a 2, no students scored a 1, and 1 out of 12 students (8.3%) scored a 0. The Student Persistence category scores resemble the Student Attention category, in that 11 out of 12 students scored a 3, no students scored a 2 or 1, and 1 out of 12 students scored a 0. Finally, in the Student Conduct category, 11 out of 12 (91.7%) scored a 3, 1 student (8.3%) scored a 2, and no students scored a 1 or a 0.

For the purposes of the "Dancing the Difference" lesson, students again worked with a partner to create a movement phrase, this time for a subtraction sentence with one-digit addends. Students were asked to demonstrate knowledge of movement concepts by using non-locomotor and locomotor movements, as well as pathways. Students were asked to demonstrate knowledge of mathematics concepts by subtracting their movements to create the correct difference between movements. The following chart shows the mean scores for each category in the "Dancing the Difference" performance, based on scores shown in Table 12.

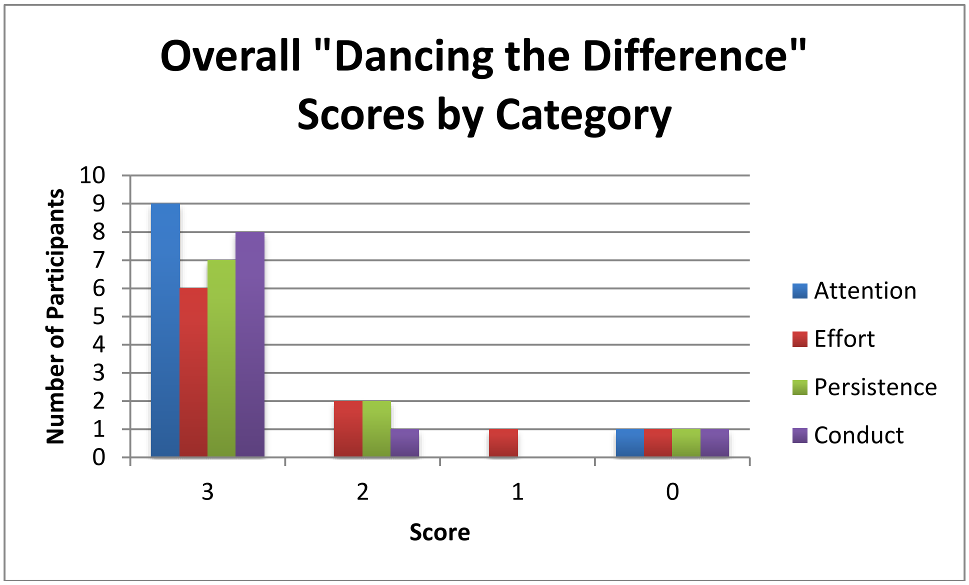


Figure 3 Overall “Dancing the Difference” Scores by Category

Table 11 and Figure 2 show that 9 out of 10 students (90%) received a score of 3 for the Student Attention category, 2 out of 10 students (20%) received a score of 2, no students received a score of 1, and 1 out of 10 students received a score of 0 in the Student Attention category. In the Student Effort category, 6 out of 10 students (60%) scored a 3, 2 out of 10 (20%) scored a 2, 1 out of 10 (10%) scored a 1, and 1 out of 10 students (10%) scored a 0. In the Student Persistence category, 7 out of 10 students (70%) scored a 3, 2 out of 10 students (20%) scored a 2, no students scored a 1, and 1 out of 10 students (10%) scored a 0. Finally, in the Student Conduct category, 8 out of 10 (80%) scored a 3, 1 student (10%) scored a 2, and 1 student (10%) scored a 0.

Daily Journal Responses – Behavioral Engagement

Student journal responses evaluated for behavioral engagement were scored in a single category, “Student Effort”. A rubric was used, the descriptors for which can be found in Appendix E. Students answered two journal questions after instruction each day: (1) What did you learn today? and (2) What did you like or dislike about today's lesson? All responses were taken into consideration for scoring for behavioral engagement, as the completion of both questions was necessary to prove effort. In order to ensure reliability in the scoring of the journals, inter-observer agreement was calculated for 10 of 13 student responses after two different sessions, both selected at random. Both observers scored the journals, and then mitigated disagreements until inter-observer agreement reached 0.8, or 80% of scores. For behavioral engagement in daily journal entries, IOA reached 100%. The data set consisted of 84 total responses.

67 out of 84 total responses (79.8%) received a score of 3, 16 out of 84 responses (19%) received a score of 2, 1 out of 84 responses (1.2%) received a score of 1, and 0 out of 84 responses (0%) received a score of 0. The following table shows how many journal entries earned each rubric score.

Table 13 Overall Student Effort in Journal Entries

Score	Number of Entries	Approximate Percentage of Entries
3	67	79.8%
2	16	19.0%
1	1	1.2%
0	0	0

Note: N = 84 responses

An example of a journal entry that earned a score of 3 for effort was "I learned symmetrical and asymmetrical and locomotor and non-locomotor" and "I did not like when we had to go over locomotor" (Participant 12, Journal, 6/30/15). An example of a journal response that earned a score of 2 for effort was "I learn to today" and "I dot know" (Participant 2, Journal, 7/20/15). An example of a journal response that received a score of 1 was “We learned to make” (Participant 1, Journal, 7/20/15). Students that were present for the session but failed to record a response to the questions were given scores of 0.

A behavioral engagement pattern that exists in journal entries is that 98.9% of students scored a 2 or a 3 in the Student Effort category. This means that almost all journal entries demonstrated consistent effort in length and detail of response. However, it must be noted that the data set does not reflect the scores of those students that were consistently absent or did not complete their daily journal entry. This will be discussed further in the following section.

Limitations

There are several limitations that have the potential to affect the results of this investigation. First, the sample size of participants was quite small, with few male students. Additionally, this study did not have a control group of students, which limits the quality of quantitative data, as scores could not be compared to those of students that did not receive instruction in the curriculum. Finally, the group of students could not be randomized, as participants in the summer camp are pre-determined.

Many limitations rose from the fact that this project was implemented in a summer camp setting rather than a school setting. First, the campers came from a variety of schools and educational backgrounds, and were not all in the same grade. “Adding Movement to Subtract Monotony” was written using standards for second grade students. While the sample size certainly consisted of second graders, it also included students in grades 3 through 6, and ages 6 to 11.

The most profound limitation of this study was the variation in attendance. A characteristic of urban populations is transience, and this was exacerbated by the fact that the setting was a summer camp without compulsory attendance. Because not all students were present on every day of unit implementation, journal entries and test scores were affected. It was difficult to keep track of which students had been present and did not write in their journals, which students had been present and wrote minimally in their journals, and which students had simply been absent. In fact, the original sample size of about 20 students had to be reduced to 13 due to a lack of data. These absences also affected test scores. Students that were not present for either the pre- or post-test could not have their results counted. This further limited the sample size.

Finally, both the administration and the content of pre- and post-surveys served to limit the results of the study. Pre-survey scores were higher than post-survey scores, despite journal and assessment evidence that engagement occurred (see Table 1, Table 4). This can be attributed to one of two causes: first, a ceiling effect might have occurred. A ceiling effect is "score limitation at the top of a scale" (Wang, Zhang, McArdle, & Salthouse, 2009). It is possible that students falsely inflated their feelings toward dance and mathematics content in an effort to win the approval of the researcher, who was presented to the students as an authority figure before survey administration. As a result, pre-survey scores were already at the "top of the scale". Second, the surveys might not have properly assessed integrated learning. "Adding Movement to Subtract Monotony" is a dance-integrated curriculum in which students learn dance concepts in conjunction with math concepts. However, survey questions separated mathematics and dance concepts. For example, one survey question asked students how they felt about mathematics, and then a different question asked students to identify their feelings about dance. No survey items asked students to share their feelings about dance-integrated mathematics, nor did they make any connection between the two subject areas.

It is important to note that the change in survey scores was not statistically significant. The benefit of utilizing a concurrent triangulation approach when analyzing data is that different types of data may substantiate one another, or the strengths of one type may account for weaknesses in another. While survey content and administration limited reliable results, data derived from journals and permanent products indicated the existence of both emotional and cognitive engagement (See Table 2, Table 8, and Table 9).

Conclusion

Both qualitative and quantitative data were collected and evaluated to determine the effects of a dance-integrated math curriculum on the emotional, cognitive, and behavioral engagement of low-income students. Data were collected through a combination of several tools, including pre- and post-surveys, pre- and post-assessments, daily journal entries, permanent products, and videotaped performances. Results were derived from survey score changes (enjoyment and academic understanding), assessment score changes (academic understanding), rubric scores for videotapes (attention, effort, persistence, and conduct), rubric scores for journal entries (enjoyment, enthusiasm, academic understanding, and effort), and rubric scores on permanent products (academic understanding).

Despite the limitations discussed above, patterns can be seen in the results of this investigation. First, patterns that exist in emotional engagement data derived from journal entries included that 81% of responses scored a 2 or higher for the category of "Student Enjoyment" and 82.3% of responses scored a 2 or higher for the category of "Student Enthusiasm". An average 81.6% of responses scored a 2 or higher across both indicators of emotional engagement. These results signify the presence of emotional engagement with the curriculum, as indicated by high enjoyment and enthusiasm.

Patterns also exist in regard to cognitive engagement. On the pre- and post-dance assessment, there was a mean score increase of 138.1%, which was deemed to be statistically significant. While no statistically significant increase or decrease existed in mathematics assessment data, data derived from permanent products and journal entries have implications for academic understanding with mathematics. 17.1% of journal responses to the question "What is one thing you learned today?" demonstrate knowledge of mathematics concepts, with another 17.1% demonstrating the connection between dance and math concepts. Finally, in regards to permanent product scores, 11 out of 12 students scored 4 out of 4 possible points, indicating complete academic understanding of dance and mathematics concepts. Only one student scored 3 out of 4 possible points, meaning that every student demonstrated at least partial academic understanding through permanent products.

Finally, patterns exist in behavioral engagement data, derived from videotaped performances, as well as daily journal entries. In the videotaped performances of the addition and subtraction lessons, an average of 90.8% of students scored a 3 for attention, 67.5% of students scored a 3 for effort, 80.9% scored a 3 for persistence, and 85.9% of students scored a 3 for conduct. Across all four indicators of behavioral engagement, an average of 81.23% of students scored a 3, and an average of 90.6% of students scored at least a 2. These results indicate that students were behaviorally engaged, as demonstrated by high levels of attention, effort, persistence, and positive conduct. Additionally, 98.9% of student journal responses scored at least a 2 in the "Student Effort" category. Again, this indicates a high level of effort, and therefore contributes to behavioral engagement.

A thorough discussion of these results in relation to the research questions, as well as future and prior research, will be included in the following chapter. Results hold implications for arts-integration and its effects on students from low-income homes.

Chapter 5

DISCUSSION

Summary of Results

In Relation to the Research Questions

This investigation into the effects of a dance-integrated mathematics curriculum on the engagement of students from low-income homes was driven by several research questions. The research question that guided this study is: What are the effects of a dance-integrated mathematics curriculum on the engagement of students from low-income homes in Wilmington, Delaware? To investigate this question, three focus questions were asked:

(4) What are the effects of a dance-integrated mathematics curriculum on the emotional engagement of students from low-income homes, as indicated by enjoyment and enthusiasm?

(5) What are the effects of a dance-integrated mathematics curriculum on the cognitive engagement of students from low-income homes, as indicated by academic understanding?

(6) What are the effects of a dance-integrated mathematics curriculum on the behavioral engagement of students from low-income homes, as indicated by attention, effort, persistence, and conduct?

In order to answer these questions, qualitative and quantitative data were collected for emotional, cognitive, and behavioral engagement. The effects of the curriculum implementation were positive in all three domains of engagement. High levels of enjoyment and enthusiasm were observed in journal responses, indicating the presence of emotional engagement. High levels of academic understanding and the use of academic vocabulary terms were observed in assessments, journals, and permanent products, indicating the presence of cognitive engagement. Finally, high levels of attention, effort, persistence, and conduct were observed in videotaped student performances, with additional effort demonstrated in student journal responses, indicating the presence of behavioral engagement. Thus, there is ample evidence that this dance-integrated mathematics curriculum was emotionally, cognitively, and behaviorally engaging for students.

In Relation to the Literature

Theory of Student Engagement. The theory of student engagement asserts that engagement is a metaconstruct that exists across three domains: emotion, cognition, and behavior. Engagement is the external embodiment of internal motivation, as well as a predictor of academic achievement. Learning is impossible without putting forth effort, experiencing positive emotions with school, and sustaining academic understandings. Thus, engagement is essential for learning to occur (O'Donnell et. al., 2012).

The results of this study indicate that students were emotionally, cognitively, and behaviorally engaged throughout the "Adding Movement to Subtract Monotony" curriculum. Students showed their internal motivation through their journal entries and in their videotaped performances. Additionally, students showed that they were cognitively engaged through their improved scores on the dance assessment, and through the accurate completion of permanent products. Thus, learning was occurring as a result of an arts-integrated curriculum.

Implications for Low-Income Students. Students from low-income homes face several barriers to engagement that can be mitigated by the addition of the arts into the traditional school curriculum. Arts for Academic Achievement, an arts integration project implemented across 45 Minneapolis schools, resulted in positive effects for both students and teachers. Teachers reported that they felt that they were better meeting the needs of their low-income student population. In addition, the program had a positive effect on the achievement gap, as participants saw increased scores in reading and mathematics (Ingram & Seashore, 2003).

Cognitive engagement results of the current study showed that students were cognitively engaged with both mathematics and dance concepts. Additionally, behavioral engagement results indicated that students were demonstrating high levels of effort with the curriculum. Thus, as the Arts for Academic Achievement study indicated, students demonstrated academic understanding of mathematics while putting forth an effort to achieve.

Additionally, students from economically disadvantaged homes are more likely to terminate their education before graduating high school, and less likely to graduate than their wealthier peers once they have become disengaged (Yazzie-Mintz, 2007). The disadvantages that these students face are "lessened by participation in an engaging school community" (National Research Council & Institute of Medicine, 2004, p. 1). Furthermore, several longitudinal studies have shown a correlation between engagement in the elementary years and later decisions to drop out. Behavioral engagement has the strongest relationship with dropout rates; however, negative emotional engagement with school can also contribute to a student's decision to drop out (Fredricks et. al., 2004, p. 70).

Of course, this was not a longitudinal study, and it is impossible to say what the effects of consistent arts-integrated pedagogy will have on this group of students over the course of their entire educational career. However, these students showed that they had positive emotions and put forth effort with an arts-integrated curriculum. Thus, arts integration promotes engagement, which is a significant contributor to a student's decision to drop out.

Culturally Relevant Pedagogy. Culturally relevant pedagogy, also referred to as "CRP", creates an empowering learning environment by acknowledging student culture (Ladson-Billings, 1995). CRP has shown to be more effective in educating minority and at-risk student populations, including students from low socioeconomic backgrounds, than traditional curricula that focuses on rote memorization (Koppleman & Goodhart, 2010, Beaudoin, 2013). Arts integration is an example of CRP. Both teaching approaches encourage "questioning, exploring, and creating" (Grant & Reif, 2013, p. 103). "Adding Movement to Subtract Monotony" supported students in the shared goal of "creating and constructing meaning" with lessons that encouraged creativity and reflection. Students created dances, constructed meaning from abstract concepts, explored the intersection between two disciplines, and reflected on their experiences (see Appendix B for lesson plans).

According to Hubert (2013), CRP has been effective in teaching math to minority students from low-income homes. After the implementation of a 10-day CRP mathematics program at a low-income high school, students reported that they were more interested in mathematics, as well as indicated feeling positively about the subject. According to daily journal response data analyzed in the current study, low-income students not only reported positive emotions, but also indicated enthusiasm toward both dance and mathematics components of the curriculum. Thus, "Adding

Movement to Subtract Monotony", and arts-integrated curricula in general, effectively enhanced engagement through the use of culturally relevant pedagogy.

Embodied Pedagogy. The theory of embodied pedagogy asserts that both body and mind play a role in the synthesis of new information. In subject areas such as mathematics, which has "implied spatial qualities", it is especially beneficial to create an embodied link between mathematical problems and solutions (Nguyen & Larson, 2015, p. 336). Thus, a dance-integrated math curriculum exemplifies embodied pedagogy. Goldin-Meadow, Cook, and Mitchell (2009) taught students to solve math problems using appropriate gestures and pointing (p. 267). Findings indicated that adding a physical component, such as gesturing, enhanced recall and aided in the synthesis of new knowledge (Goldin-Meadow et. al., 2009, p.270).

The findings of the current study also indicate strengthened cognitive processes. Through journal entries, assessments, and permanent products, participants in the "Adding Movement to Subtract Monotony" curriculum demonstrated academic understanding. The inclusion of academic vocabulary in journal responses indicated the synthesis of new knowledge. Thus, "Adding Movement to Subtract Monotony" effectively utilized embodied pedagogy to enhance cognitive engagement.

Arts Integration. Arts integrated curricula, including movement-integrated curricula, have proven to enhance learning experiences, as discussed in the literature review. In a 2001 study analyzing the effects of a three-year dance integration program at a Minnesota elementary school, students exposed to the dance curriculum had a more positive attitude toward, as well as heightened enjoyment of, mathematics (Werner, 2001). Similarly, Ryan (2014) also found that dance-integrated math instruction yielded positive attitudes toward both mathematics content and dance content. Finally, Boccardi (2015) conducted a study on the engagement of students exposed to a music and dance-integrated mathematics curriculum. Findings were increased engagement in emotion, cognition, and behavior.

The findings of this study indicate that "Adding Movement to Subtract Monotony" enhanced emotional engagement with dance and mathematics, as indicated by enjoyment and enthusiasm. Additionally, students showed positive attitudes toward content area by being behaviorally engaged, as evidenced by their attention, effort, persistence, and conduct. There are also significant parallels with the work of Boccardi, which found that music- and dance-integrated math curricula cognitively engaged students. These results are consistent with the findings of this study, in which students demonstrated their cognitive engagement through assessments, journal entries, and permanent products. Thus, the results of the current investigation corroborate the findings of Werner (2001), Ryan (2014), and Boccardi (2015), showing that the arts are engaging.

Implications for Future Research

The results of this investigation, as well as "Adding Movement to Subtract Monotony" curriculum itself, hold implications for future research. First, future investigations would benefit from using a larger sample size of students, with an equal number of male and female participants. Additionally, utilizing an experimental design in future studies will allow for comparison of student engagement data between an experimental group and a control group. The control group would receive traditional mathematics instruction, without the presence of dance instruction, and their engagement would be evaluated using the same qualitative and quantitative tools as the experimental group. Analyses of data from both groups would allow the researcher to compare levels of engagement between traditional curricula and arts-integrated curricula.

Additionally, future investigations on arts integration could greatly benefit from utilizing longitudinal studies. While the current study discovered the effects of arts integration on short-term engagement, teachers and education systems would profit immensely from learning the effects of arts integration over several years. Furthermore, one could utilize longitudinal data to discover the effects of arts-integrated learning on student resilience and decision whether or not to terminate their education before graduating high school. Arts integration during the elementary years could potentially affect student engagement for the remainder of their school careers.

Next steps in the implementation of the “Adding Movement to Subtract Monotony” curriculum include teaching the unit in an elementary school classroom, rather than at a summer camp. In the classroom setting, students would be more likely to be consistently present. Furthermore, the researcher could ensure that all participants were in the same grade with the same level of mathematics experience. Finally, investigating engagement in the classroom setting would result in direct implications for school environments.

In future studies, some of the data collection tools used to discover the effects of “Adding Movement to Subtract Monotony” could be improved. First, the administration and content of the pre- and post-surveys need to be changed. As discussed in the limitations section, survey questions assessed mathematics and dance separately, and would more effectively assess engagement if items assessed integrated learning. Additionally, although no changes in survey scores were deemed statistically significant, surveys would best be administered before the principal investigator was introduced to students as an authority figure, in order to ensure that students are recording candid answers.

Finally, future studies on arts integration and engagement could benefit from studying the relationship between the three different domains of engagement, both with one another and with academic achievement. An exploration of the correlation between emotional, behavioral, and/or cognitive engagement could reveal links between constructs. Additionally, an investigation of the relationship between engagement and achievement could further reveal the extent to which engaged learning promotes deep cognitive processing.

In order to sustain a project such as “Adding Movement to Subtract Monotony”, schools can begin by providing resources to help teachers bring their arts into their classrooms. By making this curriculum, and other arts-integrated curricula, available to schools and communities, one can promote teaching approaches that engage students in body, mind, and behavior.

Conclusion

The investigation on the effects of the “Adding Movement to Subtract Monotony” on the engagement of students from low-income homes has implications for the current issues of disengagement in school, the elimination of arts programs, and the inequitable access to quality arts programs for under-resourced schools. Additionally, based on the results of this study, it is clear that arts integration is emotionally, cognitively, and behaviorally engaging for students from low-income homes. Arts integration is a teaching approach that not only makes learning possible, but also truly “subtracts” the monotony of a traditional curriculum, thus making learning fun.

REFERENCES

Alibali, M. & Nathan, M. (2012). Embodiment in mathematics teaching and learning: Evidence from learners' and teachers' gestures. *Journal of the Learning Sciences*, *21*(2), 247-286.

Armstrong, D., Gosling, A., Weinman, J., & Marteau, T. (1997). The place of inter-rater reliability in qualitative research: An empirical study. *Sociology, 31*(3), 597-606.

Arts Education Partnership. (2016). *About AEP.* Retrieved 02/29, 2016, from http://www.aep-arts.org/about-aep/missionoverview/

Beaudoin, B. B. (2013). Culturally responsive Pedagogy/Culturally relevant teaching. In C. E. Cortes (Ed.), *Multicultural America: A multimedia encyclopedia* (1st ed., pp. 640-641, 642, 643) SAGE Publications, Inc.

Boccardi, A. (2015). Math is music to our ears: The effects of a music and movement integrated mathematics curriculum on second grade students' engagement with learning. (Honors Bachelor of Science, Elementary Teacher Education, University of Delaware).

Bornstein, M., & Bradley, R. (2003). *Socioeconomic status, parenting, and child development*. Mahwah, N.J.: Lawrence Erlbaum Associates.

Creswell, J. & Plano Clark, V. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, California: Sage Publications, Inc.

Curran-Everett, D. (2009). Explorations in statistics: Hypothesis tests and P values. *Advances in Physiology Education*, *33*(2), 81-86.

Dewey, J. (1966). *Democracy and education : An introduction to the philosophy of education.* New York; London: The Free Press ; Collier-Macmillan.

Engaged today - ready for tomorrow (2015). Gallup, Inc.

Finn J. & Rock, D., (1997). Academic success among students at risk for school failure. *The Journal of Applied Psychology, 82*(2), 221-34.

Finn, J. & Cox, D. (1992). Participation and withdrawal among fourth-grade pupils. *American Educational Research Journal,29*(1), 141-62.

Fredricks, J., Blumenfeld, P., & Paris, A. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109.

Goldin-Meadow S.W., Cook S., & Mitchell Z.A. (2009). Gesturing gives children new ideas about math. *Psychological Science, 20*(3), 267-72.

Gray J.R. & Thompson, P. (2004). Neurobiology of intelligence: Science and ethics. *Nature Reviews. Neuroscience, 5*(6), 471-82.

Hubert, T. & Capraro, R. Texas A & M University. (2014). *Empowering and facilitating student learning : An investigation of culturally relevant pedagogy for high-school mathematics instruction.*

Ingram, D. & Seashore, K. (2003). *Arts for academic achievement: Summative evaluation report*. Minneapolis, MN: Center for Applied Research and Educational Improvement, College of Education and Human Development, University of Minnesota.

Irvine, J. (2010). Culturally relevant pedagogy. *Education Digest: Essential Readings Condensed for Quick Review, 75*(8), 57-61.

Jensen, E. (2013). How poverty affects classroom engagement. *Educational Leadership, 70*(8), 24-30.

Karweit, N. & Slavin, R. (1981). Measurement and modeling choices in studies of time and learning. *American Educational Research Journal, 18*(2), 157-171.

Koppelman, K. & Goodhart, L. (2011). *Understanding human differences : Multicultural education for a diverse America*. Boston, MA: Pearson/Allyn & Bacon.

Ladson-Billings, G. (1995). But that's just good teaching! the case for culturally relevant pedagogy. *Theory into Practice, 34*(3), 159-65.

Ladson-Billings, G. (2006). From the achievement gap to the education debt: Understanding achievement in U.S. schools. *Educational Researcher, 35*(7), 3-12.

Levy, E. (2007). *Gradual release of responsibility: I do, We do, you do.* Unpublished manuscript.

Murphy, S. (1982). Learned helplessness: From concept to comprehension. *PPC Perspectives in Psychiatric Care, 20*(1), 27-32.

National Research Council (U.S.). Committee on Increasing High School Students' Engagement and Motivation to Learn. Institute of Medicine (U.S.) (2004). *Engaging schools fostering high school students' motivation to learn.*

Nguyen, D. & Larson, J. (2015). Don't forget about the body: Exploring the curricular possibilities of embodied pedagogy. *Innovative Higher Education, 40*(4), 331-344.

Parsad, B. & Spiegelman, M. (2012). *Arts education in public elementary and secondary schools 1999-2000 and 2009-2010*. Alexandria, VA: U.S. Department of Education.

Pica, R. (2006). Physical fitness and the early childhood curriculum. *Young Children, 61*(3), 12-19.

The prevalence of obesity among low-income children aged 2 through 4 years, by state and income, 2011(2011). Atlanta, GA: Centers for Disease Control and Prevention.

Reif, N. & Grant, L. (2010). Culturally responsive classrooms through art integration. *Journal of Praxis in Multicultural Education Journal of Praxis in Multicultural Education, 5*(1)

Reinvesting in arts education (2011). . Washington, DC: President's Committee on Arts and the Humanities.

Rumberger, R. W. (1987). High school dropouts: A review of issues and evidence. *Review of Educational Research, 57*(2), 101-121.

Ryan, J. (2014). Math that moves you: A study of the effect of a dance integrated mathematics curriculum supplement on the knowledge and attitudes of second grade students. (Honors Bachelor of Science, Elementary Teacher Education, University of Delaware).

Silverstein, L., & Layne, S. (2010). Defining arts integration.

Sousa, D. & Pilecki, T. (2013). *From STEM to STEAM : Using brain-compatible strategies to integrate the arts*

Thomas, J., Nelson, J., & Silverman, S. (2011). *Research methods in physical activity* (6th ed.). Champaign, IL: Human Kinetics.

Wang, L., Zhang, Z., McArdle, J. J., & Salthouse, T. A. (2009). Investigating Ceiling Effects in Longitudinal Data Analysis. *Multivariate Behavioral Research,43*(3), 476–496. http://doi.org/10.1080/00273170802285941

Werner, L. (2001). *Arts for academic achievement. changing student attitudes toward math: Using dance to teach math.*

Wiggins, G. & McTighe, J. (1998). *Understanding by design*. Alexandria, Va.: Association for Supervision and Curriculum Development.

Appendix A

DANCE ELEMENTS

Teaching the Elements of Dance is… B. (m) E. S. T.

Any movement can be described in terms of ENERGY, SPACE, and TIME; also in terms of how the body is involved in doing the movement. These elements should be taught as conceptual ideas that weave through a complete class from the warm-up to the skill building to the creative components. They can be joined and rejoined to create movement problems for exploration and composition. Use this chart and the simplified student chart (attached) to build your students' dance language and movement literacy.

The **BODY** … is capable of **MOTION** … which requires **ENERGY** … uses **SPACE** … and takes **TIME**! (B.E.S.T.)

I. Physical Skill and Body Awareness (warm up and skill building) A. Posture B. Balance C. Flexibility D. Strength E. Coordination **II** Bartinieff's **Developmental Patterns** (mind/body connections) *Gilbert's **BrainDance** -breath *tactile -core-distal -head-tail -upper-lower -body half -cross-lateral *vestibular **II. Body Parts Alone** (isolation) - head, shoulder, back, arm, leg, foot, hand, torso etc. **III. Joint Action**-neck, wrist, elbow, knee, hip etc. **IV.. Total Body Involvement –** Whole body awareness and movement	**I. Locomotor** (moves thru space) - The 8 Basic Steps A. Walk B. Run C. Leap D. Jump E. Hop F. Gallop G. Skip H. Slide – Chasse - Traditional Folk Steps J. Two-step K. Grapevine L. Paddle M. Chug N. Schottische etc. - Non-pedal locomotor O. Roll P. Crawl etc. **II. Axial** (stays in one place) A. Stretching B. Sinking C. Pushing D. Bouncing E. Twisting F. Bending, G. Slashing H. Kicking etc. **III. Combining** (movement sequences) A. Run, freeze, stretch, sink, roll, explode, jump B. Twist, untwist and twist again, spin into gallop, etc.	**I. Qualities of Movement** A. Sustain (smooth) B. Suspend (light) C. Swing (under-curve) Sway (over-curve) D. Collapse (loose) E. Vibrate (shudder) F. Percussive (sharp) 1. Explosive 2. Staccato **II. Degrees of Energy** A. Strong/weak B. Heavy/light C. Bound flow/free flow	**A. Design of Body-Shape** 1. Straight 2. Bent/angular/crooked 3. Twisted 4. Curved 5. Symmetrical 6. Asymmetrical 7. Use of positive/negative **B. Direction** 1. up 7. around 2. down 8. toward 3. side 9. away 4. forward 10.out 5. backward 11. in, etc. 6. diagonal **C. Level** 1. high 3. low 2. medium **D. Range - amount of space,** 1. big/little 2. narrow/wide **E. Pathways** 1. Floor Pattern (feet on floor) straight, curved, zigzag, etc. 2. Air pattern-straight, angular, twisting, etc. **F. Focus** -gaze &/or movement (constantly changing toward or away)	**I. Metric Rhythm** (countable) A. Beat - even, uneven B. Meter C. Accent D. Tempo (speed) E. Note Value (duration) F. Rhythm, etc. (pattern) G. Syncopation **II. Rhapsodic Rhythms** (non metric) A. Breath B. Wind C. Water, etc.

Dance is B.E.S.T. Marilyn Berrett

Marilyn Berrett

Appendix B

LESSON PLANS

"Shaping Up"

Name: Lucy Font
Title: Creative Movement and Geometry
Grade or Age Group: Second Grade

Materials Needed: Small drum, chalkboard or display board

Standards for each Objective (Content Area and Arts Area):
Common Core Standard 2.G.A.1 – reason with shapes and their attributes

1. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces; identify triangles, quadrilaterals, pentagons, hexagons, and cubes

DA:Cr1.1.2

a. Explore movement inspired by a variety of stimuli (for example, music/sound, text, **objects**, images, **symbols**, observed dance, experiences) and suggest additional sources for movement ideas.
b. Combine a variety of movements while manipulating the elements of dance.

DA:Pr4.1.2

a. Demonstrate clear directionality and intent when performing locomotor and non-locomotor movements that change body shapes, facings, and pathways in space. Identify symmetrical and asymmetrical body shapes and examine relationships between body parts.

DA:Pr5.1.2

b. Move safely in a variety of spatial relationships and formations with other dancers, sharing and maintaining personal space.
c. Repeat movements, with an awareness of self and others in space. Self-adjust and modify movements or placement upon request.

DA:Pr6.1.2

a. Dance for and with others in a space where audience and performers occupy different areas.

DA:Re8.1.2

a. Use context cues from movement to identify meaning and intent in a dance using simple dance terminology.

Learning Objectives
Cognitive: Students will recall dance concepts of levels and shapes. Students will be able to design a movement phrase that meets specific criteria. Students will be able to identify three different basic shapes. Students will be able to evaluate the performance of their peers.
Affective: Students will work well with a partner. Students will demonstrate knowledge of self-space. Students will listen to and follow directions.
Psychomotor: Students will be able to physically represent three different basic shapes. Students will be able to design a movement phrase.

Assessment Criteria
Cognitive: Teacher will refer to the rubric to evaluate students' understanding of dance concepts as well as their mathematical understanding.
Affective: Teacher will watch videotape to ensure students are paying attention and are cooperating with their partners. Teacher will refer to the rubric to correct students during the lesson.

Psychomotor: Teacher will refer to the rubric during and after the lesson to determine students' ability to use their bodies and self-space correctly.

Introduce Lesson's Target Learning
I will introduce the lesson's concept with a review of shapes and dance elements. I will ask them to stand up and do a basic warm-up during which we will review dance elements. I will then ask students to identify shapes they know and find them around the room (ex.: A desk is a rectangle, a clock is a circle, etc). I will ask them how they identify each shape using their math language (angles, corners, sides, etc). I will draw several shapes on the board for them.

Integrated Arts Activity:

1. Ask students to stand up. Do a basic body warm up (stretching, jumping, jogging in place).
2. Ask students to make levels (high, middle, low).
3. Ask students to try and create the following shapes: circle, rectangle, square, heart, triangle with their bodies. Give examples. Suggest that they make three different body formations per each shape. Ask them to make high shapes, middle shapes, and low shapes. Suggest that they face different directions or use different body parts.
4. Ask a student to join you at the front of the classroom as you make a shape with a partner. Make two or three different shapes.
5. Ask the students to pair up (look at the person next to you and if they are looking at you then they are your partner). Ask them to make the following shapes: circle, rectangle, square, heart, triangle, this time with the help of a partner.
6. Put the movement to music. Ask the students to make different shapes after 8 counts, and to slowly switch to a different shape for another 8 counts.

Culminating Activity:
Students will be asked to design a 24-count movement phrase with their partner that shows 3 different shapes and demonstrates knowledge of levels and shape. Teacher will discuss the behavior of polite audience members and good performers before the groups begin to present. Teacher will then divide the class in half for the performance.

Assessment (*your actual assessment tool, i.e. rubric, journal, etc.*)
Teacher will evaluate based on:

1. Demonstration of 3 different shapes.
2. Use of 3 different levels (low, medium, high).
3. Students will then be asked to identify which shapes they showed and which levels they used.
4. Students will be asked to observe their peers and identify the shapes that they observed and how they know which shapes were which using math language.
5. Students will be evaluated on their ability to keep time, their ability to demonstrate and identify 3 shapes, their ability to demonstrate and identify 3 levels, and their ability to perform and be a good audience member.

Rubric:

3	Student will identify the shapes and levels in their choreography. Student will identify a shape or level performed by a peer. When identifying, student uses math terminology (angle, side, straight, curved, corner)	Student will cooperate with his/her partner. Student will show qualities of an attentive audience member. Student will follow directions.	Student will show 3 different shapes and/or show 3 different levels.
2	Student will identify at least 2 of the shapes and/or at least 2 of the levels in their choreography. Student will identify a shape or level performed by a peer. Student does not use math terminology or uses math terminology incorrectly.	Student will cooperate with his/her partner. Student may struggle to pay attention or follow directions.	Student will show at least 2 different shapes and/or at least 2 different levels.
1	Student will identify at least 1 of the shapes and/or at least 1 of the levels in their choreography. Student is unable to identify a shape or level performed by a peer. Student does not use math terminology or uses terminology incorrectly.	Student is unable or unwilling to work well with a partner. Student fails to pay attention. Student does not follow most instructions.	Student will show at least 1 different shape and/or at least 1 different level.
0	Student is unable to identify any shapes or levels in their choreography or the choreography of their peers, or student does not participate.	Student is completely off-task or does not participate.	Student will not show any shapes or levels or does not participate.

"Statues"

Name: Lucy Font
Title: Creative Movement and Geometry
Grade or Age Group: Second Grade

Materials Needed: Small drum, chalkboard or display board

Standards for each Objective (Content Area and Arts Area):
Common Core Standard 4.G.A.3 – Draw and identify lines and angles

2. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

DA:Cr1.1.2

c. Explore movement inspired by a variety of stimuli (for example, music/sound, text, **objects**, images, **symbols**, observed dance, experiences) and suggest additional sources for movement ideas.
d. Combine a variety of movements while manipulating the elements of dance.

DA:Pr4.1.2

d. Demonstrate clear directionality and intent when performing locomotor and non-locomotor movements that change body shapes, facings, and pathways in space. Identify symmetrical and asymmetrical body shapes and examine relationships between body parts.

DA:Pr5.1.2

e. Move safely in a variety of spatial relationships and formations with other dancers, sharing and maintaining personal space.
f. Repeat movements, with an awareness of self and others in space. Self-adjust and modify movements or placement upon request.

DA:Pr6.1.2

b. Dance for and with others in a space where audience and performers occupy different areas.

DA:Re8.1.2

b. Use context cues from movement to identify meaning and intent in a dance using simple dance terminology.

Learning Objectives
Cognitive: Students will recall dance concepts of levels and shapes. Students will be able to design a movement phrase that meets specific criteria. Students will be able to differentiate between symmetrical and asymmetrical shapes. Students will be able to evaluate the performance of their peers.
Affective: Students will work well with a partner. Students will demonstrate knowledge of self-space. Students will listen to and follow directions.
Psychomotor: Students will be able to physically represent symmetrical and asymmetrical shapes. Students will be able to design a movement phrase.

Assessment Criteria
Cognitive: Teacher will refer to the rubric to evaluate students' understanding of dance concepts as well as their mathematical understanding.

Affective: Teacher will watch videotape to ensure students are paying attention and are cooperating with their partners. Teacher will refer to the rubric to correct students during the lesson.
Psychomotor: Teacher will refer to the rubric during and after the lesson to determine students' ability to use their bodies and self-space correctly.

Introduce Lesson's Target Learning
I will introduce the lesson's concept with a review of shapes and dance elements. I will ask them to stand up and do a basic warm-up during which we will review dance elements. I will then show students a series of photographs and drawings of shapes with pre-drawn lines of symmetry as examples. I will also explain that shapes can have more than one line of symmetry, and show students examples. Finally, I will ask students to come to the front of the room and draw lines of symmetry on shapes on the board.
I will then introduce the concept of asymmetrical shapes. I will show examples on the board of asymmetrical shapes, and explain that we see asymmetrical shapes more often than we see symmetrical shapes.

Integrated Arts Activity:

7. Ask students to stand up. Do a basic body warm up (stretching, jumping, jogging in place).
8. Ask students to make levels (high, middle, low).
9. Review shapes with students. Ask them to make shapes (triangles, circles, rectangles, hearts) with different body parts and facing different directions.
10. Ask the students to make symmetrical body shapes.
11. Ask the students to make asymmetrical body shapes.
12. Ask a student to join you at the front of the classroom and ask them to help you make a middle-level triangle using arms. Ask the class to identify where the line of symmetry would be.
13. Ask the students to pair up (look at the person next to you and if they are looking at you then they are your partner). Ask them to make the following symmetrical shapes: circle, rectangle, square, heart, triangle, this time with the help of a partner.
14. Ask the students to repeat the above activity but to make asymmetrical shapes.
15. Ask the students to think of two different symmetrical and two different asymmetrical shapes.
16. Put the movement to a beat. Ask the students to make a symmetrical shape and switch to their second symmetrical shape after 8 counts. Repeat with asymmetrical.

Culminating Activity:
Students will be asked to design two 24-count movement phrases with their partner that shows 3 different symmetrical and asymmetrical shapes and demonstrates knowledge of levels and shape. Students will begin in a neutral position, and then make 3 symmetrical shapes, each on a different level, with their partners. They will then repeat with asymmetrical shapes. Teacher will discuss the behavior of polite audience members and good performers before the groups begin to present. Teacher will then divide the class in half for the performance.

Assessment (*your actual assessment tool, i.e. rubric, journal, etc.*)
Teacher will evaluate based on:

6. Demonstration of 3 different symmetrical shapes.

7. Demonstration of 3 different asymmetrical shapes.
8. Use of 3 different levels (low, medium, high).
9. Students will then be asked to identify which types of shapes they showed and which levels they used. They will be expected to know how to describe the difference between a symmetrical and asymmetrical shape.
10. Students will be asked to observe their peers and identify the types of shapes that they observed and how they know if the shapes were symmetrical or asymmetrical using math language.
11. Students will be evaluated on their ability to keep time, their ability to demonstrate and identify symmetrical and asymmetrical shapes, their ability to demonstrate and identify 3 levels, and their ability to perform and be a good audience member.

Rubric:

3	Student will identify the types of shapes (as symmetrical or asymmetrical) and levels in their choreography. Student will identify a shape or level performed by a peer. When identifying, student uses math terminology (angle, side, straight, curved, corner, symmetrical, asymmetrical)	Student will cooperate with his/her partner. Student will show qualities of an attentive audience member. Student will follow directions.	Student will show 3 different symmetrical and 3 different asymmetrical shapes and/or show 3 different levels.
2	Student will identify at least 2 of the shapes (as symmetrical or asymmetrical) and/or at least 2 of the levels in their choreography. Student will identify a shape or level performed by a peer. Student does not use math terminology or uses math terminology incorrectly.	Student will cooperate with his/her partner. Student may struggle to pay attention or follow directions.	Student will show at least 2 different symmetrical and at least 2 different asymmetrical shapes and/or at least 2 different levels.
1	Student will identify at least 1 of the shapes (as symmetrical or asymmetrical) and/or at least 1 of the levels in their	Student is unable or unwilling to work well with a partner. Student fails to pay attention. Student does not follow most instructions.	Student will show at least 1 symmetrical shape and at least 1 asymmetrical shapes and/or at least 1 different level.

	choreography. Student is unable to identify a shape or level performed by a peer. Student does not use math terminology or uses terminology incorrectly.		
0	Student is unable to identify any shapes or levels in their choreography or the choreography of their peers, or student does not participate.	Student is completely off-task or does not participate.	Student will not show any shapes or levels or does not participate.

"Addition Alive"

Name: Lucy Font
Title: Creative Movement and Addition
Grade or Age Group: Second Grade

Materials Needed: Small drum, chalkboard or display board, construction paper, markers

Standards for each Objective (Content Area and Arts Area):
Common Core Standard 2.OA.A.1 – represent and solve problems involving addition and subtraction

1. Use addition and subtraction to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing
2. Fluently add and subtract within 20.

DA:Cr1.1.2

a. Explore movement inspired by a variety of stimuli (for example, music/sound, text, objects, images, symbols, observed dance, experiences) and suggest additional sources for movement ideas
b. Combine a variety of movements while manipulating the elements of dance.

DA:Pr4.1.2

a. Demonstrate clear directionality and intent when performing locomotor and non-locomotor movements that change body shapes, facings, and pathways in space. Identify symmetrical and asymmetrical body shapes and examine relationships between body parts. Differentiate between circling and turning as two separate ways of continuous directional change.

DA:Pr5.1.2

a. Demonstrate a range of locomotor and non-locomotor movements, body patterning, and dance sequences that require moving through space using a variety of pathways.
b. Move safely in a variety of spatial relationships and formations with other dancers, sharing and maintaining personal space.
c. Repeat movements, with an awareness of self and others in space. Self-adjust and modify movements or placement upon request.

DA:Pr6.1.2

a. Dance for and with others in a space where audience and performers occupy different areas.

Learning Objectives
Cognitive: Students will recall dance concepts of locomotor movements, non-locomotor movements, and pathways. Students will be able to create a movement phrase that meets certain criteria. Students will be able to add and subtract one-digit numbers.
Affective: Students will work well with a partner. Students will demonstrate knowledge of self-space. Students will listen to and follow directions.
Psychomotor: Students will perform several locomotor and non-locomotor movements by following a movement map. Students will coordinate movements with a partner.

Assessment Criteria

Cognitive: Teacher will evaluate students' ability to create a movement phrase that accurately shows a number sentence. Teacher will evaluate students' ability to meet the dance concept criteria assigned in the culminating activity.
Affective: Teacher will watch videotape to ensure that children are following directions and are working well with their peers. Teacher will observe students' audience skills.
Psychomotor: Teacher will observe students' performance of locomotor and non-locomotor movements. Teacher will observe students' ability to perform a movement phrase with a partner.

Introduce Lesson's Target Learning
I will introduce the lesson with a review of locomotor and non-locomotor movements. We will identify and define locomotor and non-locomotor movements as a class. The children will then do an across-the-floor warm-up to practice locomotor movements, and a warm-up in place to practice non-locomotor movements.

Warm-Up:
We will warm up with a counting down activity. Teacher will first remind students about the concept of space bubbles and personal space. We will start by shaking our right arm 8 times, then our left arm, then our right leg and then our right leg. We will continue this pattern doing one less shake per limb per round until we get to 0.

Integrated Arts Activity:
DAY ONE

1. Review locomotor movements and the 3 types of pathways. Write them on the board.
2. Review non-locomotor movements, writing them on the board.
3. Ask students to perform different locomotor movements in groups across the floor. Give specifics (ex.: "gallop, then run"). Review pathways and give specific pathways. Review each locomotor movement as a class before students go across the floor.
4. Ask students to perform two different non-locomotor movements in place. Give specifics (ex.: "twist, then swing"). Clarify as a class before students begin.
5. Pass out pieces of construction paper and markers.
6. Instruct students how to make a movement map, using symbols for non-locomotor movements and lines for each pathway. Reflect back to shapes knowledge and use math terminology. Draw an example movement map on the board, asking the class to suggest non-locomotor movements, pathways, and locomotor movements.
7. Dance the sample movement map as a class.

DAY TWO

1. Do the same movement review as Day 1, including identifying the types of movement/pathways and the across-the-floor warm-up.
2. Write an addition sentence on the board, for instance, 2+2. Label the parts of the sentence as addends and sum.
3. Ask students to suggest a non-locomotor movement, and then demonstrate how to model the number sentence, asking them to repeat after you. For example, doing two twists and two more twists is four twists. Each twist represents an addend and the combination of twists represents the sum.

4. Ask students to suggest different non-locomotor movements to use. Repeat the above step with several different number sentences until students grasp the concept. (Assess by asking students to give a thumbs up if they understand, a sideways thumb if they still need to practice, and a thumbs down if they do not understand).
5. Create a movement map as a class to model an addition problem. Non-locomotor movements will represent each added and the combination of non-locomotor movements will be the sum. In order to add the addends, the first addend must use a locomotor movement and pathway to get to the second addend, and then both must use a locomotor movement and pathway to get to the sum.
6. Ask students to pair up ("look at the person next to you. If they are looking at you, that is your partner"). Tell them that each student is an addend and that when they dance together they are the sum. Dance the example map as a class.

DAY THREE:

Culminating Activity:

Students will be asked to pair up and make a movement map with their partners to show a number sentence for the following word problem:

Ms. Font has 5 pencils. If Ms. Brady gives Ms. Font 7 pencils, how many pencils will Ms. Font have in total?

The students will begin by making a body shape. The students must choose one non-locomotor movement for each addend and combine their non-locomotor movements to make the sum. In order to add the addends, the first addend must do a locomotor movement with a pathway to the second addend, and then the two must repeat the locomotor movement and pathway to dance to the sum, or the ending pose.

The class will all perform together two times. Then, half of the class will perform while the other half watches, and vice versa.

See last page for example movement map.

Assessment

Teacher will evaluate based on:

12. Accurate demonstration of a number sentence.
13. Use of non-locomotor movements.
14. Students will then be asked to explain which locomotor movement they chose and how their movements represented a number sentence.
15. Students will be evaluated on their ability to keep time, their ability to demonstrate a number sentence, their ability to demonstrate and identify non-locomotor movements, and their ability to perform and be a good audience member.

“Dancing the Difference”

Name: Lucy Font
Title: Creative Movement and Subtraction
Grade or Age Group: Second Grade

Materials Needed: Small drum, chalkboard or display board

Standards for each Objective (Content Area and Arts Area):
Common Core Standard 2.OA.A.1 – represent and solve problems involving addition and subtraction

3. Use addition and subtraction to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing
4. Fluently add and subtract within 20.

DA:Cr1.1.2

c. Explore movement inspired by a variety of stimuli (for example, music/sound, text, objects, images, symbols, observed dance, experiences) and suggest additional sources for movement ideas
d. Combine a variety of movements while manipulating the elements of dance.

DA:Pr4.1.2

b. Demonstrate clear directionality and intent when performing locomotor and non-locomotor movements that change body shapes, facings, and pathways in space. Identify symmetrical and asymmetrical body shapes and examine relationships between body parts. Differentiate between circling and turning as two separate ways of continuous directional change.

DA:Pr5.1.2

d. Demonstrate a range of locomotor and non-locomotor movements, body patterning, and dance sequences that require moving through space using a variety of pathways.
e. Move safely in a variety of spatial relationships and formations with other dancers, sharing and maintaining personal space.
f. Repeat movements, with an awareness of self and others in space. Self-adjust and modify movements or placement upon request.

DA:Pr6.1.2

b. Dance for and with others in a space where audience and performers occupy different areas.

Learning Objectives
Cognitive: Students will recall dance concepts of locomotor movements, non-locomotor movements, and pathways. Students will be able to create a movement phrase that meets certain criteria. Students will be able to subtract one-digit numbers.
Affective: Students will work well with a partner. Students will demonstrate knowledge of self-space. Students will listen to and follow directions.
Psychomotor: Students will perform several locomotor and non-locomotor movements by following a movement map. Students will coordinate movements with a partner.

Assessment Criteria

Cognitive: Teacher will evaluate students' ability to create a movement phrase that accurately shows a number sentence. Teacher will evaluate students' ability to meet the dance concept criteria assigned in the culminating activity.
Affective: Teacher will watch videotape to ensure that children are following directions and are working well with their peers. Teacher will observe students' audience skills.
Psychomotor: Teacher will observe students' performance of locomotor and non-locomotor movements. Teacher will observe students' ability to perform a movement phrase with a partner.

Introduce Lesson's Target Learning
I will introduce the lesson with a review of the previous addition lesson. We will dance through a few addition problems as a class.

Warm-Up:
We will warm up with a counting down activity. Teacher will first remind students about the concept of space bubbles and personal space. We will start by shaking our right arm 8 times, then our left arm, then our right leg and then our right leg. We will continue this pattern doing one less shake per limb per round until we get to 0.

Integrated Arts Activity:
Outline the steps/instructions that will take place for this activity from beginning to end.
<u>DAY ONE</u>

8. Review locomotor movements and the 3 types of pathways. Write them on the board.
9. Review non-locomotor movements, writing them on the board.
7. Write a subtraction sentence on the board, for instance, 4 – 2 = 2. Label the parts of the sentence as minuend, subtrahend, and difference.
8. Ask students to suggest a non-locomotor movement, and then demonstrate how to model the number sentence, asking them to repeat after you. For example, doing 4 twists and then taking away 2 twists leaves you with 2 twists.
9. Ask students to suggest different non-locomotor movements to use. Repeat the above step with several different number sentences until students grasp the concept. (Assess by asking students to give a thumbs up if they understand, a sideways thumb if they still need to practice, and a thumbs down if they do not understand).
10. Pass out construction paper and markers.
11. Create a movement map as a class to model a subtraction problem. Non-locomotor movements will represent the minuend and subtrahend, and the final number of locomotor movements will be the difference. In order to subtract the movements, both students will dance as the minuend, and then one student will use a locomotor movement to dance away from the first student and perform a non-locomotor movement. The first student will then perform the final number of non-locomotor movements minus the subtrahend.
12. Dance the sample movement map as a class.
13. Ask students to pair up ("look at the person next to you. If they are looking at you, that is your partner").

Culminating Activity:

Students will be asked to pair up and make a movement map with their partners to show a number sentence. The students will begin by making a body shape. The students must choose one non-locomotor movement for both the minuend and the subtrahend. In order to subtract the movements, both students will dance as the minuend, and then one student will use a locomotor movement to dance away from the first student and perform a non-locomotor movement. The first student will then perform the final number of non-locomotor movements minus the subtrahend.

The class will all perform together two times. Then, half of the class will perform while the other half watches, and vice versa.

See last page for example movement map.

Assessment (*your actual assessment tool, i.e. rubric, journal, etc.*)

Teacher will evaluate based on:

16. Accurate demonstration of a number sentence.
17. Use of non-locomotor movements.
18. Students will then be asked to explain which locomotor movement they chose and how their movements represented a number sentence.
19. Students will be evaluated on their ability to keep time, their ability to demonstrate a number sentence, their ability to demonstrate and identify non-locomotor movements, and their ability to perform and be a good audience member.

Appendix C

ASSESSMENTS

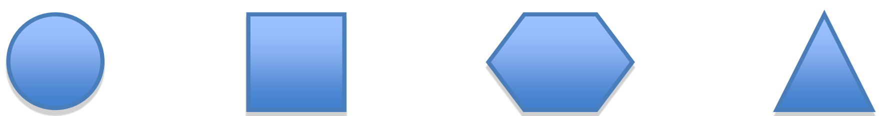
Mathematics Assessment

Please answer the following questions about shapes. It is okay if you do not know the answer. Try to do your very best work!

1. How many sides does a triangle have?

   ____

2. Please circle the shape that is a square:



3. How many sides does a rectangle have?

   ____

4. How many angles does a triangle have?

   ____

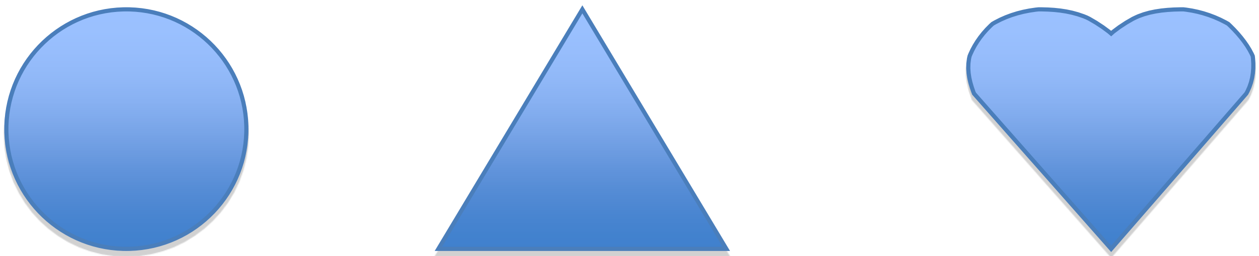
5. Circle the shape that has only 4 angles:

6. How many angles does a circle have?

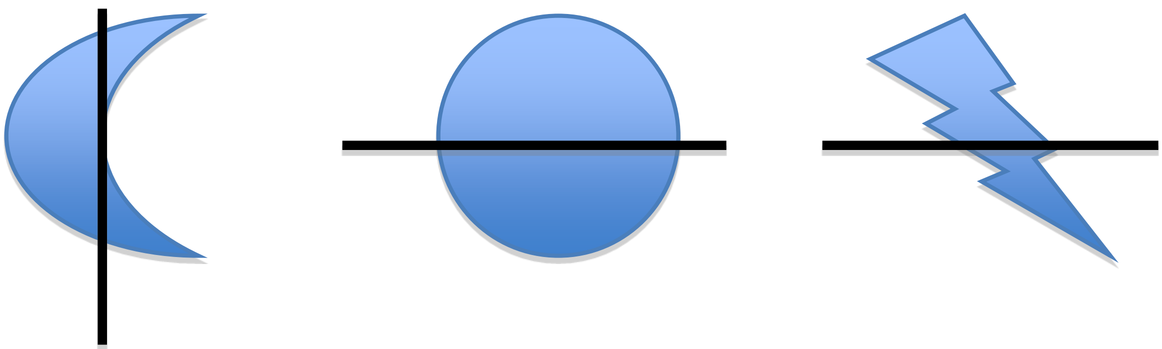
   ____

   ____

7. Please draw a line of symmetry for the following shapes:



8. Please circle the shapes that are asymmetrical.



Please answer the following addition and subtraction problems. It is okay if you do not know the answer. Try to do your best work!

1. 2 + 4 = ______
2. 7 + 3 = ______
3. 10 + 4 = ______
4. 5 + 7 = ______
5. 12 + 6 = ______

6. Linda and Dave are going apple picking. If Linda picks 14 apples, and Dave picks 6 apples, how many apples did they pick in total?
7. 6 - 4 = ______
8. 9 - 5 = ______
9. 10 - 7 = ______
10. 16 - 4 = ______
11. 18 - 9 = ______
12. Linda and her sister are picking apples. They pick 17 apples. If Linda's sister eats 13 apples, how many apples will Linda have left?

Dance Assessment

Please answer the following questions about movement. It is okay if you do not know the answer. Try to do your very best work!

I. Space

1. Is the classroom an example of self-space or general space? Circle one.
   a. Self-space
   b. General space
2. Is your desk an example of self-space or general space? Circle one.
   a. Self-space
   b. General space
3. Which level is your teacher showing when he or she is standing at the board?

   ____
4. Which level are you showing when you are lying on the floor?

   ____
5. Which level are you showing when you are sitting at your desk?

   ____
6. Please write down or draw the 3 different kinds of pathways:
   1) _____________________
   2) _____________________
   3) ______________________

II. Movement

1. Write an L next to the locomotor movements and a N next to the non-locomotor movements:

   Gallop _____ Leap _____

   Turn _____ Skip _____

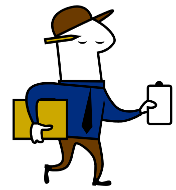
   Swing _____ Hop _____

   Slide _____ Twist _____

Run _____ Walk _____

III. Body

1. Write an A under the asymmetrical body shape and an S under the symmetrical body shape:



IV. Choreography

1. Please write down one way you can show that you are a polite audience member:

____

____

2. How might you use a movement map?

____

____

Appendix D

SURVEY ITEMS

Emotional Engagement Items

Circle the face that shows the best answer to the question! There are no right or wrong answers.

1. Learning about math makes me feel…

   ☺ 😐 ☹

2. Learning about shapes makes me feel…

   ☺ 😐 ☹

3. Learning about addition makes me feel…

   ☺ 😐 ☹

4. Learning about subtraction makes me feel…

   ☺ 😐 ☹

5. Learning about dance makes me feel…

   ☺ 😐 ☹

6. Working with a partner makes me feel…

   ☺ 😐 ☹

Circle yes (Y) or no (N) to the following questions. There are no right or wrong answers:

7. I like math class. Y N

9. I am good at math. Y N

16. I like to dance. Y N

17. Dancing in front of my friends makes me nervous. Y N

Cognitive Engagement Items

8. I think math is useful. Y N

10. I learn best by writing things down. Y N

11. I learn best when I am moving around. Y N

13. I learn best when I work with others. Y N

14. I learn best when I can see pictures. Y N

Appendix E

RUBRICS: JOURNALS

RUBRICS FOR JOURNAL QUESTIONS
Cognitive Engagement: Student Category Rubric

Score	Descriptor
3	The response indicates a high level of academic understanding, includes academic vocabulary terms or illustrations, and/or refers to the lesson content accurately (I learned that a locomotor movement is a movement that travels)
2	The response includes some academic understanding but does not demonstrate use of academic vocabulary terms OR the response is inaccurate (I learned about locomotor movements) (I learned that a locomotor movement stays in one place) (I learned dance)
1	The response lacks any indication that learning occurred (I learned nothing)
0	The participant did not respond

Emotional Engagement: Student Enjoyment Category Rubric

Score	Descriptor
3	The response indicates a state of pleasure (I liked, I loved)
2	The response is neutral (It was ok) OR reflects both pleasure & displeasure
1	The response indicates a state of displeasure or anxiety (I didn't like, I hated)
0	The participant did not respond

Emotional Engagement: Student Enthusiasm Category Rubric

Score	Descriptor
3	The response indicates intense enjoyment (I loved/ I liked everything)
2.5	The response indicates fairly intense enjoyment (I liked, My favorite thing was...)
2	The response is neutral/indicates both pleasure and displeasure
1.5	The response indicates fairly intense displeasure or discomfort (I disliked)
1	The response indicates intense displeasure or discomfort (I hated/ disliked everything)
0	The participant did not respond

Behavioral Engagement: Student Effort Category Rubric

Score	Descriptor
3	The response reflects exceptional effort (answered all questions with detail)

2	The response reflects good effort (answered at least 2 questions, with or without detail)
1	The response reflects some effort (answered at least 1 question, with or without detail)
0	The response reflects no effort (answered 0 questions)

Rubrics adapted from Boccardi, 2015.

Appendix F

RUBRICS: PERMANENT PRODUCTS

RUBRICS FOR MOVEMENT MAPS: COGNITIVE ENGAGEMENT

Score	Math Criteria	Movement Criteria
2	Movement map shows a correct addition or subtraction sentence AND Number of movements drawn corresponds to addition or subtraction sentence.	Movement map includes illustrations or identification of non-locomotor movements, locomotor movements, AND pathways.
1	Movement map shows an incorrect addition or subtraction sentence OR Number of movements drawn does not correspond to addition or subtraction sentence.	Movement map includes illustrations or identification of non-locomotor movements OR locomotor movements OR pathways.
0	Movement map shows an incorrect addition or subtraction sentence AND Number of movements drawn does not correspond to addition or subtraction sentence OR there is no number sentence.	Movement map does not include dance elements.

Appendix G

RUBRICS: VIDEOTAPES

RUBRICS FOR VIDEO FOOTAGE: BEHAVIORAL ENGAGEMENT

Behavioral Engagement: Student Attention Category Rubric

Score	Descriptor
3	The student is constantly on-task, as indicated by movement and/or focus throughout the entire performance.
2	The student is mostly on-task, as indicated by movement and/or focus throughout most of the performance.
1	The student is mostly off-task, as indicated by movement and/or focus for less than half of the performance.
0	The student is completely off-task, as indicated by no movement or focus for the whole performance

Behavioral Engagement: Student Effort Category Rubric

Score	Descriptor
3	The student exerts physical energy, as indicated by strong movements and an apparent desire to succeed (regardless of whether or not he or she follows directions)
2	The student exerts some physical energy, as indicated by fairly strong movements and a somewhat apparent desire to succeed (regardless of whether or not he or she follows directions)
1	The student exerts little physical energy, as indicated by weak movements and an apparent careless attitude (regardless of whether or not he or she follows directions)
0	The student exerts no physical energy, as indicated by the student not moving or seeming to care

Behavioral Engagement: Student Persistence Category Rubric

Score	Descriptor
3	The student demonstrates consistent effort throughout the dance
2	The student demonstrates inconsistent effort throughout the dance
1	The student dances some of the time with inconsistent effort
0	The student demonstrates no effort and/or failed to dance throughout the performance

Behavioral Engagement: Student Conduct Category Rubric

Score	Descriptor

3	The student demonstrates appropriate classroom conduct with his/her peers throughout the performance
2	The student demonstrates no more than 1 episode of disruptive behavior or inappropriate classroom conduct with his/her peers throughout the performance
1	The student demonstrates no more than 2 episodes of disruptive behavior or inappropriate classroom conduct with his/her peers throughout the performance
0	The student demonstrates consistent disruptive behavior and fails to demonstrate appropriate classroom conduct with his/her peers

Rubrics adapted from Boccardi, 2015.