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The Effects of Art Integration on Math Achievement of 6th Grade Male Students

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Abstract

The United States educational system continues to cut back on art programming; however, international statistics report countries with a stronger art presence continuously perform at higher academic levels. Art integration provides multiple pathways through curriculums and enables engaging learning environment. Art integration refers to three forms of art collaboration: learning in core subjects with and through the arts, creating interdisciplinary connections throughout curriculums and collaboration engagement. When all three of these forms are combined, casual relationships with increased student achievement and higher levels of engagement are formed. This study examined the effects of art integration on math achievement on male middle school students. The control and experimental group completed a pre- and post-test to assess academic achievement. The control group received math instruction from the math teacher using textbooks, teacher created problems, and only math content, while the experimental group received math instruction with art integration. Student engagement was also measured for both groups. It was hypothesized that art integration would increase academic achievement and student engagement in math for 6th grade boys. Results from four independent sample t-tests supported the hypothesis.

Keywords: art integration, male students, academic achievement, student engagement

Art integration is an undervalued tool in the current education system and has been linked to heightened student engagement and academic achievement when correctly integrated into core classes (Carney, Weltsek, Hall & Brinn, 2016; Maguire, Donovan, Mishook, Gaillande & Garcia, 2012; Melnick, Witmer & Strickland, 2011; Robinson, 2013). Melnick, Witmer and Strickland (2011) found that students who attend schools with art instruction have higher levels of academic achievement than students who attend schools with no art instruction, most notably in reading competencies and mathematics. Additionally, art education is believed to benefit school-wide curriculum and school attendance, and can even lead to lower drop-out rates (Fehr, 2008; Melnick et al., 2011). Despite these positive correlations, art education programs have been cut nationally as educational budgets have decreased over the years, and more money is allocated to programs with higher levels of need (Shaw, 2018; Spohn, 2008). Cities such as Buffalo, Milwaukee, New York City and Los Angeles have faced budget deficiencies and executed extreme program cuts directly affecting art programs in recent years (Shaw, 2018). The high stakes test climate that has been created for the educational system through legislature such as No Child Left Behind (NCLB) has demanded that more money and time be allocated to the testing subjects and taken away from non-testing subjects (Shaw, 2018; Spohn, 2008). Many districts are looking to cut back on art programs when districts and administrators should be

looking more closely at the benefits of academic achievement and school culture from art integration.

Art Integration

Art integration encompasses learning in core subjects with and through the arts, creating interdisciplinary connections throughout curriculums and collaboration engagement (Robinson, 2013). There are four main approaches to art integration: subservient, coequal integration, affective integration and social integration. While there are four approaches to art integration, coequal integration provides cohesive integration along with the best learning opportunities for students (Robinson, 2013). Art integration requires art standards be combined with the common core standards, but also requires both teachers to have multiple subject knowledge, which is rare. Concepts and standards that work together and mutually build on one another will best encompass coequal integration (Smilan, 2016). Coequal integration requires students to use high level thinking strategies and twenty-first century skills.

Art integration, in the form of coequal integration, provides access to curriculum through multiple pathways and supports whole brain learning (Carney et al., 2016). Successful integration facilitates the discovery of cross-curricular connections, providing students skills across multiple disciplines that can then be built upon independently (Carney et al., 2016). This type of classroom and learn is closely

linked to Vygotsky's concept of the zone of proximal development. Carney et al. (2016) define the zone of proximal development as the type of learning that occurs when a student transitions from learning through teacher assistance to learning on their own. This zone is reached through art integration by allowing students to channel both concrete and abstract thought processes. Lev Vygotsky developed the concept of the zone of proximal development which is still widely used in scaffolding techniques in education (Wass & Golding, 2014). Vygotsky believed that a key process in learning was to facilitate and provide skills to help transition learners into performing new skills independently (Wass & Golding, 2014). Reaching the zone of proximal development allows students to interact with concepts and tools they normally would not be able to handle in order to develop understanding or master a skill (Danish, Saleh, Andrade and Bryan, 2017). As stated by Carney et al. (2016), art fosters the ability for students to learn new techniques and skills through teacher guidance which easily transfers into individual and independent studio practices.

Similar to Vygotsky's Zone of Proximal Development theory, John Dewey developed the constructivism theory. Dewey believed that learning was obtained through experiences and ideas built upon foundational and prior knowledge (Krahenbuhl, 2016). Krahenbuhl (2016) defines constructivism as the ideology that acquiring knowledge is not an act of discovery but a construction of the mind. Constructivism supports the need for art integration through the use and explanation of student agency. Learning through art integration is a process of growth and innovation (Selkrig, 2017). Within the theory of constructivism, children not only absorb the knowledge, but also build upon that knowledge and through experience and recreate it in a new perspective. Art integration provides that channel to recreate different content knowledge and re-examine what was learned through a new lens (Thompson, 2015). Providing student choice is a common feature of constructivist classrooms, which is ingrained within art integration (Krahenbugl, 2016; Thompson, 2015). Art integration will provide students the means to explore content and connections through numerous different skills and materials or to present their knowledge and understanding of a subject in a variety of ways. Currently in education, the focus is on measuring student learning through narrow parameters of standardized tests and procedures, but many students need more than that to learn and express their knowledge. The inclusion of constructivism practices

through art integration create a positive learning environment for both student and teacher.

The model of Bloom's Taxonomy can help support the constructivism learning theory. Bloom's Taxonomy creates a hierarchy of cognitive models that helps to lead instruction through a ladder of learning processes and mastery (Ellis, 2016). In Bloom's Taxonomy, creating is held as the highest level of mastery and regarded as a highly cognitive process (Ellis, 2016). Art integration fosters creativity, which promotes connections throughout different subjects (Ellis, 2016). Creating, the top tier of the revised taxonomy, can include a variety of skills and forces students to recall the five previous steps mastered while constructing new and authentic products. Bloom's Taxonomy has thematic commonalities with art integration in that it strives to break the boundaries of traditional learning and provide a range of educational possibilities across curriculums (Krahtwohl, 2002).

Art Integration and Academic Achievement

Art integration has many benefits that affect academic achievement and school culture. Art classrooms typically promote acceptance, exploration, discovery and diversity in opinions through self-expression and collaboration (Maguire et al., 2012). Creating an environment in which students feel respected and able to take risks has also been linked to academic achievement (Maguire et al., 2012; Mikami, Ruzek, Hafen, Gregory & Allen, 2017; Rapp-Paglicci, Stewart & Rowe, 2011). Students who have had negative interactions with peers in the classroom show decreased levels of participation, engagement and confidence, which directly lead to underachievement (Mikami et al., 2017). This environment of acceptance and the ability to take risks inspires self-efficacy with students, which generates problem-solving skills (Claymier, 2014). These characteristics establish respectful and interactive relationships between students, spurring student engagement, and leading to higher academic achievement (Hentges, 2016).

Several studies have found casual relationships between arts integration and academic achievement. Melnick et al., (2011) addressed the prevalence of art instruction as well as additional exposure to art programs outside of school. According to Melnick et al. (2011), neuroscience has recently delved into the cognitive connections that art integration can ignite in the learning process. Most deep learning requires a continual flow of sensory information, making art the perfect catalyst (Melnick

et al., 2011). Melnick et al. (2011) conducted a study that examined the data from the Early Childhood Longitudinal Study K of approximately 8,000 children. Melnick et al. (2011) aimed to examine the academic impact that both school and home-based art programs had on student achievement. Teachers evaluated fifth grade students on reading and math skills using a scale of 1 to 5, excluding students with special needs. Students who participated in art programs both in school and at home scored significantly higher on teacher evaluations of reading and math competencies. Melnick et al. (2011) concluded that family involvement in the arts in addition to school art instruction yielded the highest levels of student achievement but noted that much of the data regarding student performance came from teacher reports, which could present bias.

Maguire et al. (2012) studied four urban high schools to examine the effects of art education. These high schools work with art non-profits to provide art instruction and experience. Maguire et al. (2012) looked into the types of art instruction provided by the schools, and if the instruction was providing positive academic outcomes and engagement, as reported by the students. Maguire et al. (2012) collected data using student surveys, pre- and post-surveys from focus groups and additional information provided by the art program and school district. The focus groups consisted of small groups of secondary students randomly picked to discuss their interpretation of the art instruction provided by the school. The surveys conducted after the focus groups asked questions in regards to practical reasoning, resilience, disposition, integrity, and social awareness. These responses were compared across the participating schools and used to assist in creating follow up focus groups to further understand the students' interpretation of the art instruction received. The results showed that the students with the highest grades had the most exposure to art programs within their schools. The high school with the highest number of students reporting participation in art programs, 57%, also reported having a higher mean of GPAs (Maguire et al., 2012). This data relates to the finding from Robinson (2013) that students with more years of art class experience had consistently higher scores on the SATs. In addition, all five schools in the study reported higher graduation rates than surrounding neighborhood schools which average a 56% graduation rate (Maguire et al., 2012). Maguire et al. (2012) concluded that increased exposure to art instruction provided enhanced overall learning experiences.

Internationally, the inclusion of art classes has increased test scores as well. Countries that typically outscore the U.S. on the international assessments Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS) provide their students with more exposure and class time within the arts (Robinson, 2013). Countries considered top-performers, such as Finland, Hong Kong and Singapore, value the importance of supplying their students with a well-rounded education and increased time studying the arts (Robinson, 2013). Art education in Finland occurs in 80% of total instructional hours because art is integrated into all subjects and taught as an individual class as well (Robinson, 2013). Asian countries such as Japan, South Korea, China and Singapore report increasing art education through organizations, resources, professional development, and mandating time within the curriculum for art education (Robinson, 2013). Of the previously mentioned countries, in 2011 Singapore, Japan, Korea, and Finland all performed better on the fourth and eighth grade TIMSS and PIRLS assessments (Robinson, 2013). The inclusion of art education and its connection to higher academic performance of many international education systems should raise awareness that the inclusion of art integration within the United States educational system would be beneficial.

Art and Engagement

High levels of student engagement increase academic achievement and student interest levels (Waggett et al., 2017). Developing an artistic understanding in students can produce several types of engagement (Lekue, 2015). Artistic understanding is defined by Lekue (2015, p.2) as "the ability to think and act flexibly" within different subjects and contents. Once students have developed artistic understanding, students can exhibit cognitive engagement through the natural process and steps of creating art (Lekue, 2015). Cognitive engagement is defined as a method of processing knowledge, typically blending new knowledge with current knowledge (Lekue, 2015). In addition, art integration allows culture and student interests to be woven into different subjects, creating greater connections for students to lead to higher levels of engagement (Melnick et al., 2011).

Teachers have begun to assess their method and ability to increase student engagement in order to promote increased student interest and academic achievement. Student engagement is commonly

perceived to encompass good behavior, participation and answering questions; however, Waggett et al. (2017) claim that this common assessment of engagement is incorrect. “True engagement” contains intrinsic connections to self-motivation and realized purpose and value (Waggett et al., 2017). Students need to believe that the learning experience is important and be confident in completing the work (Hentges, 2016). Waggett et al. (2017) created a checklist based on five levels of engagement, which address the student’s intrinsic engagement. The five levels of engagement are true engagement, strategic compliance, ritual compliance, retreatism and rebellion (Waggett et al., 2017). Waggett et al. (2017) tested the checklist at a professional development workshop on secondary math and science teachers using a test re-test method. Preceding two model lessons, the educators completed the engagement survey immediately after the lesson and again 18 hours later. There was little variance between the individual answers indicating that the survey accurately recorded the levels of engagement (Waggett et al., 2017).

Having discussed how student engagement is closely linked to academic achievement, there are engagement and motivation differences between boys and girls. Many engagement and learning differences can be attributed to the developmental differences between boys and girls (James, 2015). The brain develops differently for girls and boys, causing an initial imbalance in cognitive development, specifically in mathematics (James, 2015). The hippocampus, which is connected to mathematical calculation and arithmetic, among other skills, develops sooner for girls than for boys (James, 2015). In addition, boys’ brains go into a rest state more than girls during instruction (King, Gurian, & Stevens, 2010). The rest state is comparable to a state of boredom or “zoning out” and occurs when there are not enough stimuli throughout the classroom or instruction to keep them focused (King et al., 2010). A significant area of difficulty in the classroom for boys is having low motivation to learn and the belief that the curriculum content is relevant for them which can be partially explained by the higher frequency of “zoning out” (King et al., 2010). The combination of these developmental factors creates the need for curriculum that provides stimulating instructions in multiple ways.

Gender relevant curriculum is a response to the underachievement and disengagement displayed by males in a school setting (Bristol, 2015). Bristol

(2015) states that providing experiential learning opportunities and nontraditional academic experiences helps to re-engage boys in the learning process. Boys are often described as graphic thinkers and excel in kinetic settings (King et al., 2010). Male students thrive in environments with stimulating and engaging instruction, which art integration can supply through kinetic learning opportunities (Robinson, 2013). Rawle (2017) states kinetic learning is a highly engaging tactic for motivating students. Kinetic learning often best demonstrated through art instruction, and can provide non-traditional methods in the classroom, fostering student engagement and academic achievement. A shift in learning environments to blend multiple subjects will provide relevant and meaningful instruction that reaches more students and provides heightened engagement and academic achievement.

Art Integration Limitations

Art integration is often unsuccessful because full integration is not met. For art to be fully integrated into a subject the art teacher and classroom teacher must be invested in the collaboration and the content (Smilan, 2016). Typically, an art class is a mix of academic standards and studio practices, but art integration needs to be a collaboration between the classroom teacher, art teacher and if available, teaching artist. True art integration has had positive results with student achievement and engagement; however, those who attempt it without proper training, time or resources usually fall short (Hallmark, 2012).

Even though research on art integration is still in its infancy, lack of time and resources, as described by Hallmark (2012) are the cause of unclear outcomes. Rapp-Paglicci et al. (2011) conducted a quasi-experimental study that centered on a pre- and post-test given to 108 at-risk youths and their parents to determine the effects of self-regulation skills and art programs on academic achievement. Self-regulation skills are defined as a set of skills balancing on both the emotional and functional controls to achieve goals. Many times, these skills are supported within art programs with the addition of life and social skills (Rapp-Paglicci et al., 2011). Rapp-Paglicci et al. (2011) collected data through surveys completed by students and parents monitoring the student’s perception of self-efficacy and “school performance variables.” The students participated in an art instruction program for two months with teaching artists trained to incorporate self-regulation skills into the curriculum (Rapp-Paglicci et al., 2011). The results indicated no significant improvements overall

in academic achievement with minor improvements scattered throughout math, reading, English and attendance (Rapp-Paglicci et al., 2011). Rapp-Paglicci et al. (2011) consider previous similar studies with a longer timeline and conclude that the amount of time, eight weeks, was not enough to generate the results desired.

Hallmark (2012) sheds light on the lack of consistency in art education among educators regarding ideology and implementation which causes unsuccessful attempts of art integration to often occur. The definition of art integration differs from school to school and even from teacher to teacher in some cases creating uneven results. Hallmark (2012) names the inconsistencies as lack of resources, lack of time and lack of training within both art and classroom educators. Art educators are continuously trained in traditional teaching pedagogy. To have educators ready to initiate the shift to art integration, the training and professional development need to provide that support. Through a study based on a district with high levels of art collaboration, Hallmark (2012) created three frameworks for art integration: arts as craftsmanship, arts as play and arts as inquiry. Within each of these frameworks, the arts collectively blend content and inquiry with other subjects (Hallmark, 2012). Hallmark's (2012) study provides insight into how art integration could be included within high-level training and teacher preparation programs.

Along with a lack of time and resources allocated to art integration, there is currently a lack of research on the art integration and its effects. Robinson (2013) analyzed at seven meta-analyses and out of those seven, only one addressed full art integration. Additionally, Robinson (2012) searched sixteen databases using specific criteria to uncover studies based on art integration with disadvantaged students. Robinson (2013) analyzed forty-four studies on the effects of art integration within one or more subjects. Of these forty-four studies only five of them focused on visual art integration, with one reporting positive effects (Robinson, 2013). In this wide-ranging survey, Robinson (2013) exposes the lack of research, specifically in visual art integration effects.

Purpose Statement

The purpose of the proposed research is to determine whether art integration can raise student achievement and engagement, specifically for male students. Art programs are being cut due to budget constraints, even though art integration can be a tool used within core classes (Carney, Weltsek, Hall &

Brinn, 2016; Maguire, Donovan, Mishook, Gaillande & Garcia, 2012; Melnick, Witmer & Strickland, 2011; Robinson, 2013). Results from past research suggest casual relationships of art integration to student engagement and academic achievement (Hallmark, 2012; Maguire et al., 2012; Melnick et al., 2011; Rapp-Paglicci et al., 2011; Robinson, 2012). International education systems with high percentages of art integration continue to outperform the United States on international assessments (Robinson, 2013). The awareness of art integration benefits is slowly rising; however, research regarding true art integration is in its infancy due to lack of time and resources (Hallmark, 2012). Single content specific research focused on art integration with specific populations is necessary to provide accurate information about art integration. This author will focus on art integration paired with math instruction with adolescent males to measure the effect it has on academic achievement and engagement. This author's hypothesis is that art integration in math instruction will increase student achievement and engagement for sixth grade boys.

Methods

Participants

Thirty-one students from a private middle school in the Northeast United States were assigned to two equal classes through randomization (one class was the control group and one class was the experimental group). The participants range from ten to eleven years old and are all in sixth grade. Due to the school being an all-boys middle school, the participants are all males. Seventy percent of the participants receive free and reduced lunch. The demographics of the participants are as follows: thirty-seven percent African American, twenty-nine percent Hispanic, twenty-two percent biracial and twelve percent Asian. There were no incentives given to the participants.

Materials

Daily instruction. Throughout math instruction the control group used a textbook provided by the math teacher. Students provided themselves with an individual notebook, calculator, pen and pencil. Throughout math instruction and art integration the experimental group used a textbook, individual notebook, calculator, pencil, pens, colored pencils, acrylic paint, paint brushes and white paper. The art supplies were provided by the art teacher. The math teacher used a whiteboard to demonstrate problems on with whiteboard markers as well as a projector and iPad. The iPad is an iPad Pro, with a

12.9-inch display screen and 64 GB. The projector is Epson VS250 SVGA 3LCD projector, positioned on a table, projecting onto the whiteboard.

Math achievement. The control and experimental groups both used the same exam for measuring math achievement. The pre- and post-test was the math achievement portion of the Education Records Bureau (ERB) Independent School Entrance Exam (ISEE) practice test. This is a paper and pencil test consisting of twenty-five multiple-choice questions. Each participant was given an answer sheet, which was numbered one to twenty-five with the letters A, B, C and D next to each number. Participants are not permitted to use scratch paper or calculators but can write on the test if necessary. The math achievement practice exam covers number operations, algebra, geometry, measurement, data analysis and probability and problem solving. A sample question would be: Which whole number is divisible by 9 without a remainder? A) 2,001 B) 2,003 C) 2,005 D) 2,007. This exam was given prior to the treatment phase to collect baseline data and after the eight-week treatment phase to assess academic achievement. This material was selected because the school uses the actual ERB ISEE exam to assess student learning at the end of each school year.

The ERB ISEE provides an exam that evaluates a student's content knowledge as aligned with the national standards (ERB, 2016). The school in which the participants attend does not participate in the state exams, so the ISEE serves as a credible assessment tool to assess academic achievement. The scoring of the math achievement exam was conducted through the ERB scoring method. A raw score, which is the number of correctly answered questions, was recorded for each participant. Participants do not lose points for incorrect or unanswered questions. When typically taking the ERB exams, students receive a raw score, scaled score and quartile score to compare their score to other students nationwide. Since the experiment compared the control and experimental groups, only the raw score was used. Once a raw score was obtained for all participants, the mean score was compared for both the pre- and post-test. The ISEE provides the answer key for the multiple-choice questions. Since there is only one possible answer and no points are given for amount of work shown, this provides a high level of reliability in scoring and accuracy. The tests produced by the ERB are aligned with best practices for assessment and the National Common Core Standards, which provides validity within the content assessed (ERB, 2016). Since 1927,

the ERB has been developing tests for the Northeast region (ERB, 2016). Questions on the ISEE are created by ERB faculty that represent independent schools nationwide and work in collaboration with specialists at measurement incorporated (ERB, 2016).

Student engagement. Student engagement levels were monitored throughout the research study to help support the academic achievement data. The participants in both groups completed a survey (see Appendix A) created by Waggett et al. (2017) to evaluate student engagement after each unit in the eight-week treatment phase. This survey was composed to address the five levels of engagement; true engagement, strategic compliance, ritual compliance, retreatism and rebellion. An example statement from the survey is: I saw this assignment as meaningful and believe something of worth may be accomplished by doing this task. This survey was on a half sheet of paper and completed with pencil or pen.

The student engagement survey (see Appendix A), consisting of five statements, was collected three times for both the control and experimental group. Both groups completed the engagement survey during the first, fifth and last week of the research study. The survey results were tallied up by the number of responses received for each statement on the survey. The statements are labeled with letters A, B, C, D and E; with the highest level of engagement statement being labeled A and the lowest level of engagement statement being labeled E. The number of responses for each statement was recorded in both groups. More responses recorded for statements A and B signify higher levels of student achievement. The student engagement data is an informal assessment tool, used to supplement the academic achievement data. Waggett et al. (2017), the developers of this survey, proved the reliability of this tool through a test-retest method. After giving the initial engagement survey, the same survey was given again eighteen hours later and the results revealed a high degree of correlation between the responses (Waggett et al., 2017). High levels of student engagement are a reliable tool to predict the effectiveness on academic achievement, as student engagement has been positively linked to academic achievement (Hao, Yunhuo & Wenye, 2018). Hao et al. (2018) report a positive correlation between behavioral, cognitive, and emotional engagement and academic achievement. This coincides with the Waggett et al. (2017) assessment and survey basis that engagement goes deeper than just behavioral observation data.

Procedures

Math achievement. The study conducted followed an A versus no A research design. Initially baseline data was collected through a pre-test prior to any art infusion. For the pre-test measure, the participants completed the ERB ISEE practice test. Both groups completed the test in the classroom designated for math instruction. The ISEE test was administered by the math teacher. During administration, scripted directions provided by the ERB were provided orally and in writing on the first page of the test. The administration of directions occurred before the twenty-five minutes allotted for the exam. Additionally, the administrator provided time updates in five-minute increments orally and visually. The post-test was conducted in the same way as the pre-test after eight weeks of art infusion with math instruction for the experimental group and math instruction as it currently exists for the control group.

Student engagement. Student engagement data was collected through a survey as the two groups progress through their units. The survey consisted of five statements on a half sheet of paper (see Appendix A), which was administered by the math teacher at the end of a unit. The survey was the same for both the control and experimental group. Each participant circled the statement they felt best aligned with their thoughts on the most recently completed unit.

Experimental procedure. Once the pre-test was given, the treatment began. Participants in the control group received math instruction as it currently exists. A typical lesson starts out with a warm up question that lasted for five minutes. Students worked independently on the warm up problem. Next, the teacher began reviewing previous concepts or introducing a new concept, which took approximately fifteen minutes. Concepts are gone over verbally by the math teacher using a projector connected to an iPad or a whiteboard. The rest of the class period, which was approximately twenty minutes, classwork instruction was carried out in several ways depending on the lesson. Examples of classwork instructional methods includes: independent work, small group work, teacher assigned pair work, worksheets, textbook problems, use of the whiteboard, and/or problems created by the teacher.

One example of classwork with art integration combined studying ratios and fractions with color theory. To begin the lesson, participants began a warm up, which lasted for approximately five minutes. In the warm up, participants identified

different fractions and ratios using shaded shapes and images, by writing the correct fraction and ratio next to the images. The math teacher then introduced the concept of adding fractions, which took approximately fifteen minutes. This concept was taught using the projector or whiteboard and students took notes in their individual notebooks. The classwork portion used art integration to reinforce the student's knowledge of adding fractions and provided additional practice. The participants applied their knowledge of ratios and fractions to color theory, learning about how to properly mix colors using ratios of different colors. Each participant created a new color recording the ratio of colors mixed. The classwork portion was facilitated by both this author and the math teacher. This author discussed color theory and the combination of colors to create new colors through modeling an example in front of the class of mixing the color green. Adding different ratios of yellow and blue produce different shades and tints of green. Participants used the color theory worksheet (see Appendix B) to complete their classwork activity. At the end of the class period the students work was collected.

Data Analysis

The dependent variables, academic achievement in math and student engagement, were assessed using four independent sample t-tests. The scores for the pre-test on math achievement were compared between the control and experimental groups along with comparing the student engagement survey responses. The post-test scores on math achievement were compared between the control and experimental groups along with the student engagement responses. The Education Records Bureau Independent School Entrance Exam mathematic achievement practice test assessed the academic achievement. The student engagement was assessed using a survey connected to the five levels of engagement, developed by Wagget et al. (2017). The mean scores from both the control and experimental group were compared and analyzed via the four independent samples t-test to determine which group had higher levels of academic achievement. Additionally, student engagement data was collected and the number of responses recorded for each statement was compared between the experimental and control groups using an independent samples t-test.

Results

The purpose of this study was to measure the effectiveness of art integration on academic achievement and student engagement in math for sixth grade male students. The students were assigned to two classes through randomization. The control group received traditional math instruction while the experimental group received math instruction with art integration. This researcher was interested to know whether academic achievement and student engagement would be higher with the addition of art integration. Both groups were assessed on academic achievement with the same pre- and post-test using the math achievement portion of the Independent School Entrance Exam practice test. Additionally, both groups completed a student engagement survey created by Waggett et al. (2017) after each unit. Independent sample t-tests were used to compare both groups in academic achievement and student engagement. An alpha level of .05 was used for all statistical tests. The results supported the hypothesis that art integration can create higher levels of academic achievement in math instruction and student engagement.

The independent samples t-test showed that the control group ($M = 79.50$, $SD = 12.97$) had a mean score that was 5 points higher than the experimental group ($M = 72.80$, $SD = 13.46$) on the ERB ISEE pre-test, $t(29) = 1.412$, $p = 0.169$.

The post-test did not show there was a significance difference between scores on the ERB ISEE mathematics achievement test, $t(29) = -0.381$, $p = 0.706$. The experimental group ($M = 83.60$, $SD = 8.68$) scored approximately one percentage point higher on the mean score than the control group ($M = 82.25$, $SD = 10.83$). However, the experimental group increased eleven percentages on their mean score, while the control group only raised their mean score by three percentage points. See Table 2 and Figure 2 for t-test results on academic achievement pre- and post-test.

Results also show that the experimental group ($M = 2.19$, $SD = 0.83$) and the control group ($M = 2.07$, $SD = 0.88$) scored similarly on the initial student engagement survey with no statistical significance, $t(29) = 0.392$, $p = 0.698$. The experimental group recorded higher scores on the student engagement survey after the third unit with art integration, $t(29) = -8.807$, $p < .001$. The experimental groups mean score on the final student engagement survey ($M = 4.53$, $SD = 0.64$) was twice that of the control group's

mean score ($M = 2.38$, $SD = 0.72$). See Table 1 and Figure 1 for t-test results on student engagement.

Overall findings confirmed an increase in performance for the experimental group over the control group for both academic achievement in math and student engagement. Findings suggest that the inclusion of art integration increased academic achievement in math as well as student engagement. The results for mathematic achievement were not statistically significant, however, the experimental group increased their mean score more than the control group. Therefore, the hypothesis that art integration will increase academic achievement and student engagement in math for sixth grade boys is supported.

Discussion

When employed correctly, art education is a tool that can help raise student engagement and academic achievement for middle school students (Hentges, 2016). Art education can provide multiple access points to curriculums, therefore allowing more points of understanding for students (Carney et al., 2016). Art integration provides students the opportunities to present their learned knowledge through alternative materials and approaches (Thompson, 2015). The results of this study demonstrated a positive increase in academic achievement in math for the experimental group. After receiving eight weeks of art integration, the experimental group made larger gains than the control group, by increasing their mean score by eleven percentage points. Both groups reported similarly low scores on the first measurement of student engagement; however the experimental group surpassed the control group by almost doubling the student engagement scores, showing that art integration has a substantial impact on student engagement. The results confirmed the hypothesis that art integration can be used as a tool to increase academic achievement in math for sixth grade male students. Additionally, the results confirmed that art integration can increase student engagement for sixth grade male students.

Art Integration Embodies Constructivism

The results of this study support the constructivist theory that providing more autonomy and choice within the classroom has a positive outcome (Krahenbugl, 2016; Thompson, 2015). Providing math instruction within an art studio setting opens up the possibilities for students to explore new concepts in different ways. Art instruction is often a

mix of lecturing and modeling, followed by student experimentation and exploration. Allowing students to independently work through techniques and skills provides a constructivist classroom experience (Carney et al., 2016). Fostering gradual independence is a key ideology within the constructivist theory as Vygotsky strongly believed in facilitation in the classroom (Wass & Golding, 2014). Facilitation allows the teacher to create an environment that promotes student independence and agency, which is a key characteristic of studio practice (Maguire et al., 2012). The control groups participated in an environment where student independence and choice was not a common factor within their math instruction. The experimental group was able to explore math concepts infused into art lessons during art class along with additional art inspired activities during their math instruction. Learning through art integration is a process of growth and innovation, which allowed the experimental group to take foundational math skills they had learned and recreate them and build upon it (Selkrig, 2017). Participants were able to reexamine content they had already been taught through a different lens, providing a deeper learning experience. Due to this experiential learning the experimental group was able to show more growth than the control group in math academic achievement.

Student engagement has shown positive casual relationships to higher academic achievement, when assessed correctly (Waggett et al., 2017). Most often educators look for physical signs of positive behavior and participation, mistaking it for engagement (Waggett et al., 2017). Initial responses to the engagement survey can be seen in *Figure 1*, showing that the control and experimental group reported similar engagement responses. After connecting math and art, the engagement responses began to increase for the experimental group. Providing clear pathways and connections across contents allows the students to visualize real life connections for both content areas. Participants began to point out other content areas that were prevalent in the projects such as biology, chemistry and history. As participants worked through watercolor techniques they pointed out many connections with science, specifically chemistry. Participants were eager to point out that the movement of water molecules due to temperature had a direct effect on the way their watercolor techniques turned out or that evaporation plays a part in how quickly the paint will dry. These independent connections that were made further reinforce the constructivist ideology that once a

student is guided through skills they can begin to expand on them independently (Krahenbuhl, 2016). This study supports the fact that art integration can raise student engagement.

Study Limitations

The two groups that participated in the research study were comprised of only male students due to the fact that the participants attend an all-boys middle school. This allowed the researcher to focus on one specific gender for the duration of the study; however it limits the results to only describing the effects of art integration on males. A replica study with only female participants of the same age would provide comparison data on the effects of art integration between genders and would give a clearer set of data points. Additionally, providing data for a participant sample of mixed gender would round out the results. Although the sample size was limited to only males, the participants were diverse in both ethnicity and socioeconomic status. While the two classes were divided through randomization, the experimental group scored significantly lower on the pre-test than the control group. These results created an uneven starting point to begin the research and raised the question of whether or not the outcome would have been affected and still support the hypothesis once other skills were covered throughout the remainder of the year.

The art integration in this experiment heavily relied on the cooperation of the math teachers. Administration helped to create collaboration time at the request of this researcher, but the math teacher was often absent, leaving no lesson plans which caused delays or gaps within the research study. If the math teacher was absent the class was given a study hall, which meant no concepts were reviewed or learned. This made it difficult to maintain a steady timeline with art projects and also took away class periods that the art teacher could be involved in the math class instruction. True art integration is noted to have the strongest results, and that is only achieved when both educators have been trained appropriately and carry the same investment (Smilan, 2016). The math teacher involved in this researcher's experiment did not have the art knowledge and background required to cohesively collaborate with the art teacher. The art teacher did the planning in its entirety and executed the activities. Art was integrated into the math classroom as much as possible, but was emphasized more with the art lessons that involve math.

The amount of time put aside for solely art education within the school is only two class periods a week out of 38. This means that art education is only present for approximately five percent of instructional time within each regular school week. With the addition of art integration within the four weekly math classes, art is present for 21% of instructional time, which still is not enough in comparison with the international education community. In other countries such as Finland that outperform the United States on international tests, art is present in approximately 80% of instructional time (Robinson, 2013). Data from the study done by Robinson (2013), supported by international testing data suggests a casual relationship between art integration and academic achievement.

Suggestions for Future Research

A continuation on the study of the effect of art integration would be beneficial to provide a stronger set of data. Several factors could be changed in order to further investigate art integration. A larger sample size of both males and females would give crucial data that helps define the role gender plays in learning in relation to art integration. Different grade levels would provide a series of data on whether or not art integration is more effective in different stages of development for students. Art integration with different contents such as reading, science and history could provide additional knowledge on whether specific content areas provided stronger relationships and connections with art integration. Studies on art integration are in their infancy (Hallmark, 2012), so providing data on a variety of variables will only continue to help further understanding on the subject.

In the case of this research study, it would be beneficial to carry out art integration with eighth grade and measure the academic achievement within one content area such as math, because the students would all have been attending the same school for the entirety of their middle school career. This would provide a sample group of students coming from the same teaching styles for the previous three years and would eliminate the element of surprise of having brand new students from a variety of school cultures and curriculum. The participants within the study were approximately half new students to the school and half previously enrolled students, recruiting from private, charter and public schools. Sixth grade is the last year to accept new students into the school which created a sample from a multitude of academic backgrounds. This could have had an impact on the mathematic achievement imbalance on the pre-test.

Choosing the academic content based on the teacher and their background would incite a stronger collaboration bond and participation for the additional teacher working with the art educator. Working with a teacher who has a crafts or arts background would have created stronger collaboration and provided more background knowledge, producing a truer form of art integration. Full art integration requires positive collaboration and investment (Smilan, 2016) and improper collaboration is often cited as the biggest cause for unclear results (Hallmark, 2012).

Implications

The main implication of this study for participants is the fact that art integration can help create clear pathways of understanding and provide meaningful engagement in both art curriculum and additional content areas. Following art integration in math instruction, student engagement scores approximately doubled for the experimental group. Participants transitioned from being provided and guided through the cross curricular connections to independently identifying them and expanding beyond math. The academic achievement intervention also showed a high level of growth for participants after receiving art integration. Although the results were not statistically significant, the experimental group had more growth in their mean score on the post-test.

An additional implication for educators is that art integration training and knowledge should be provided by administrators. When given the necessary tools and time, art integration has the possibility to increase academic achievement and student engagement. More collaboration time built into the academic year and professional development targeting art integration to provide quality training to both art educators and other content areas would be beneficial. This training would need to begin for art educators by creating common terminology and pedagogy nationally. Many art educators have different interpretations of processes such as art integration causing a lot of confusion and inconsistent data regarding the positive effects of art education (Hallmark, 2012). Once art educators create a common pedagogy, professional development can begin to help create positive collaboration opportunities to begin effectively and correctly creating art integration. The current study suggests that incorporating art integration will provide students the tools to independently make cross curricular connections and perform higher academically.

Implications exist at a national level as well for legislators. Many countries consistently outperform the United States on international tests and report higher levels of art education by increased instructional time, additional art programs in schools and professional development (Robinson, 2013).

Providing higher quality art education and introducing more minutes of art integration into the total instructional teaching times will help the United States to perform equally if not better than other countries internationally within education.

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