

Learning Form and Function by Dance-Dramatizing Cultural Legends to Drum Rhythms Wearing Student-Made Animal Masks

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Abstract

This study examined the self-efficacy in science, art, dance, and music; attitudes concerning contributions of people of various ethnic/cultural groups; and science learning of students involved in an after-school arts-integrated science enrichment project. Students dramatized three traditional animal legends from African, Native American, and Mexican cultures to drum beats while wearing student-made papier-mâché helmet crest masks of the animal characters. They learned the structure and functions of the featured animals through slide shows, embedded explanations in the play scripts, and hands-on form and function analogy materials that related the form and function of animal body parts to manufactured items. Although at least 40 students participated at times in the after-school program, matching pretest and posttest data were only available for 13 students. Results showed positive changes in students' art self-efficacy with a medium effect size, improvements in knowledge of animal form and function with a large effect size, and a trend toward greater appreciation of the cultural contributions of different ethnic groups. Photographs of student-made masks and the animal legend scripts with added form-and-function content are provided.

Key Words

Arts-integration, shadow puppets, science methods, preservice teachers, minority scientists, culture, STEM education, STEAM education

Introduction

The arts-integrated science and social studies afterschool enrichment program described in this article was designed for several purposes: 1) to make a positive difference in the community by providing a motivating, enriching, academic, and social program to students from a local underserved school district; 2) to introduce racially and /or economically diverse students to the campus to encourage them to envision attending college in general and the local university in particular; and 3) to increase collaboration between the School of Music and the Department of Curriculum and Instruction in the College of Education through a joint project. The first purpose of this afterschool enrichment project, providing an interesting, educational arts-integrated science and social studies program, will be explored in this article. The second purpose of the project was long-range and has not yet been evaluated, although data are being collected on the overarching program (of which the program described here

was a small one-year part) of bringing students from this local school district to the college campus for enrichment programs over many years. The last purpose was accomplished with an on-going relationship established between faculty in the School of Music and faculty and doctoral students in Curriculum and Instruction who collaborate each summer concerning a one-week music-and-arts- integrated science enrichment day camp for kindergarten through eighth grade students.

The current study examined student perceptions of science, art, dance, and music abilities, student science learning of animal form and function, and student attitudes toward different cultural groups before and after participation in an after school arts-integrated enrichment project. The special project opportunity focused on dramatizing Native American, African, and Mexican animal legends, papier-mâché mask making, drumming, and wearing the animal masks to act out animal stories through dance moves. The enrichment lessons also included hands-on science lessons concerning form and function of animal body parts.

Elementary and middle school students from a local school district participated. These students were part of an afterschool enrichment program held at the university once a week over the school year. In general, science has not been emphasized in these students' education, a situation shared by many American elementary schools in response to No Child Left Behind Legislation (Au, 2007). The schools that students from the current study attended focused more on reading and mathematics because these schools had been identified as schools in need of assistance according to No Child Left Behind legislation, and reading and math were considered to be high stakes testing subjects. Elementary students from the current study told the researchers that science was only addressed through reading books that have a science topic and that there were no formal science lessons. Women and individuals of color are underrepresented in the science professions; the authors hoped that they might inspire the students in this project to pursue more science involvement in the future, although this was not formally assessed here.

Literature Review

The following literature review addresses the main components of this project: academic benefits of arts participation, positive self-concepts enhanced by the arts, motivation through the arts, and the theoretical framework of the study based on constructionism.

Academic Benefits of Arts Participation

Evidence for the positive academic effects of arts participation has been accumulating. Research (Rose-Krasnor, Busseri, Willoughby, & Chalmers, 2006) has indicated that student participation in theater and music is associated with academic engagement. These investigators' study (Rose-Krasnor et al., 2006) was based on a sample of 7430 mostly White Canadian youth, with equal male and female participants who averaged 16 years and who responded to a two-hour survey during school hours. In a study (Marsh & Kleitman, 2002) that included a more diverse population from the National Center for Education Statistics (NCES) for the U.S. Department of Education, extracurricular participation in the arts was found to foster school commitment benefiting diverse academic outcomes, particularly for socioeconomically disadvantaged students. A compilation of four longitudinal studies (Catterall, Dumais, & Hampden-Thompson, 2012) showed that youth of low socioeconomic status who have prolonged in-depth arts involvement evidenced better academic outcomes than peers. These arts-involved students also earned better grades, enrolled in more-competitive colleges than peers, and achieved in college at higher rates. In addition to higher grade point averages, slightly-elevated mathematics performance and enrollment in calculus classes was shown by students involved with the arts (Catterall et al., 2012). A meta-analysis of ten arts-based studies (Hattie, 2009) indicated a small effect size for school achievement for students involved in the arts. Participants in a preschool music education program exhibited enhanced performance on a measure of verbal intelligence that was positively correlated with changes in functional brain plasticity (Moreno, Bialystok, Barac, Schellenberg, Cepeda, & Chau, 2011). Rinne, Gregory, Yarmolinskaya, and Hardiman (2011)

identified eight mechanisms, naturally embedded in arts instruction, that increase student retention of content. These mechanisms, incorporated into the present study, are: rehearsal, elaboration, generation, enactment, oral production, effort after meaning, emotional arousal, and pictorial representation.

Positive Self-Concepts Enhanced by the Arts

Farris (2015) outlined six basic tenets of social studies education that were addressed by this complex project: active involvement in learning, opportunities to make decisions, scaffolding of new learning on previous knowledge, development of a positive self-concept, appreciation for the aesthetics of school subjects, and involvement as productive, contributing citizens. Of particular interest for many of our participants was the development/reinforcement of a positive self-concept, as students were recommended for this after-school program by teachers, home-school support workers, counselors, or school administrators because they thought they would benefit from this motivating, multicultural, arts-integrated, academic and social program. A study (Diamond & Lev-Wiesel, 2016) focused on adult recollections of being a child in expressive arts group therapy, often for being a victim of excessive bullying. The arts-therapy program was seen by participants in that program as a safe haven and a place of freedom-enhancing spontaneity, but most participants were unable to provide the exact positive effects of the experience. The arts involvement was valued for the freedom to create as they wished, together with the art materials at their disposal (Diamond & Lev-Wiesel, 2016).

A longitudinal study of school, home, and community factors affecting students academically and non-academically (Martin, Mansour, Anderson, Gibson, Liem, & Sudmalis, 2013) found that when sociodemographics, prior achievement, and prior variance in outcome measures were taken into account through structural equation modeling, at-home and in-school participation in the arts (art, dance, drama, film/media, music) emerged as major positive factors.

Motivation through the Arts

Motivation refers to a person's reason for participating in an activity, the degree to which the activity is pursued, and the person's persistence (Graham & Weiner, 1996). In a review of the dispositions and skills transferred from the arts to other subjects (Burton, Horowitz, & Abeles, 2000) the researchers found improved motivation to learn and enhanced self-esteem as the strongest transfers. The mechanism for this transfer was improved teacher expertise from involvement with the arts resulting in greater teacher excitement, insight, and knowledge to guide students, leading to more positive student reactions to school learning (Unsworth, 1990). A more recent investigation examining the effects of a preschool program involving music, dance and visual arts (Brown & Sax, 2013) found that, compared to a control, children showed more positive emotions such as interest, happiness, and pride, with greater emotional regulation growth across the school year.

A review of the literature of the effects and mechanisms of therapeutic art experiences for oncology patients (Hartman, & Brown, 2016) revealed that the ability to make autonomous decisions and to structure and organize the artwork as desired gave patients a sense of control over their artwork and over the therapeutic experience. Students learning new or difficult information may also gain a sense of control through integration of the arts, thereby influencing their attitudes toward learning. Therefore, the choice of arts integration into science and social studies was an effective combination for introducing this population of students to these concepts.

Theoretical Foundation in Constructionism

The theoretical foundation for the current study was constructionism (Papert, 1986). Papert worked with Piaget in Geneva during the later 1950s and early 1960s, developing a theory of learning based on constructivism, but called *constructionism* (with an "n" instead of a "v") to call attention to the fact that this learning happens in a context in which "the learner is consciously engaged in constructing a public entity" (Papert, 1991, p.1) or a product for a real-world audience. Papert believed that expressing inner feelings through one's work was key to learning because this

expression makes ideas tangible, sharable, and communicable, allowing the learner to shape and sharpen ideas through interaction (Ackermann, 2001). Papert (1991) explained how constructionism is connected to the arts in the sense that the learning process embodies the personal *style* of the learner as either working closely with objects, or working with abstractions, or both:

The simplest definition of constructionism evokes the idea of learning by making... ..but there is also a line of descent from the style idea... ..[The student] is guided by the work as it proceeds rather than staying with a pre-established plan... ..The other takes off from a more subtle idea which we call "closeness to objects" – that is, some people prefer ways of thinking that keep them close to physical things, while others use abstract and formal means to distance themselves from concrete materials. Both of these aspects of style are very relevant to the idea of constructionism. (p. 6)

In the current study, students worked together to dramatize indigenous cultural animal legends from three geographic regions (America, Africa, Mexico) for a public presentation. They made animal masks in which they incorporated their own ideas with elements of the style of the cultural group, created drum rhythms as auditory signatures for the animals during the story enactments, and devised symbolic dance actions for these characters to tell the story through drama. Students also learned about the forms and functions of the highlighted animal body parts through interaction with card-and-object sets that used analogies to manufactured items to emphasize form and function. The forms and function of the animals were an integral part of the legends, reinforcing the integration of science into the arts. The project's aspects of creating the drumming-dance-legend dramatizations and making the masks correspond to Papert's learning by making, especially when students reflected on how their efforts contributed to the whole production and how the abstract idea of form supporting function was carried out in animal body parts designed for survival.

National Standards Addressed

A unifying concept of science, standards from the Next Generation Science Standards (NGSS Lead States, 2013), a social studies theme from the National Council for the Social Studies standards, and several National Arts Core Standards were incorporated into this project. The following sections present these standards in more detail.

Unifying Theme: Structure and Function

Form and function is a unifying theme of science education identified in the National Science Education Standards (National Committee on Science Education Standards and Assessment and National Research Council, 1996). Both the natural and designed worlds evidence this theme, thereby supporting analogies between these domains. *Form* includes any physical attribute of an object such as shape, pattern, color, configuration, characteristic motion, texture, sound, smell, taste, and so forth. *Function* refers to the use, purpose, goal, or task of a component. In recent years, the word "structure" is often substituted for form. Forms or structures support the functions of manufactured objects, animal body parts, plant parts, and other aspects of organisms. For example, the long, sharp canine teeth (form) of a wolf help the animal *to grab onto and pierce* (function) the skin, tissue, or bone of prey, allowing the wolf to obtain food for survival. Similarly, a barbeque fork has long, sharp tines (form) *to grab onto and pierce* (function) food being cooked.

Studies have been conducted to determine the efficacy of using analogies between animal or human body parts and commonly recognized manufactured items in understanding form and function during science instruction. Form and function analogies have been used with high school students to teach human body systems (Rule & Furletti, 2004). These researchers found students had greater gains in human body system content with a large effect size when using the analogies compared to a control group. In another study with second graders (Rule, Baldwin, & Schell, 2008), students learned animal adaptations better using form and function analogies compared to reading informational text about animal adaptations and researching

the information via the Internet. These two studies utilized a unique instructional material called an “object box” which consisted of a plastic shoebox containing twelve cards describing the form and function of an animal or human body part and a corresponding set of twelve manufactured items with the same forms and functions. A student chose a card, read about the form and function of the body part, then searched through the manufactured objects to locate one with a similar form and function. After matching all cards to items, the student then examined the reverse side of each card on which was printed the analogous manufactured item and a description of how its form and function was similar to that of the body part for self-checking. Similar sets of cards and analogous manufactured objects were used in the current study. The following animals, also highlighted in the cultural animal legends and in photographic slide shows of animal form, function, and behaviour for survival, were addressed by the form and function analogy materials: deer, jaguar, wolf, whale, lion, and frog. The whale and wolf sets from Rule (2015) were used in the current study; additional sets were made for the remaining animals.

Next Generation Science Standards

The life science structure and function theme occurs at several grade levels of the Next Generation Science Standards (NGSS Lead States, 2013). At the first grade level, in 1-LS1 From Molecules to Organisms: Structures and Processes, students are directed to “use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.” This activity requires a knowledge foundation of the form and functions of animal body parts for survival. At the fourth grade level, in 4-LS1-1, students are asked to “construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.” In MS-LS1-4, middle school students are required to “use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.” All of these Next Generation Science standards at different grade levels

support the animal form and function activities in this arts-integrated project.

Social Studies Learning

Students encountered legends representing three cultures (the Maya of Mexico, Tsimshian Native Americans of the Northwest Coast region of the United States, and indigenous people of South Africa) during this enrichment project. The interpretation and dramatization of these legends, along with the appreciation of mask art styles and incorporation of style elements into the masks students made supported National Council for the Social Studies standards (2010) under the theme of “Culture.” In particular, the idea that students will identify items of culture through experience, observation, and reflection was addressed by this enrichment project. After students listened to the animal legends of different cultural groups and viewed the traditional masks of those groups, they identified similarities and differences among the groups and across time and place. Another cultural element introduced through the lessons was the use of traditional African drums. Although all three groups used drumming for cultural events, the instruments available and used in the drum circle were African drums. The authors hoped that students would come to better appreciate and value the contributions of these cultural groups through this enrichment project.

National Core Arts Standards

Several National Core Arts standards (National Coalition for Core Arts Standards, 2014) were supported by this project. The music standard MU:Cr1.1.3: Improve rhythmic and melodic ideas, and describe connection to specific purpose and context was implemented as students created drum rhythms for different characters in the stories being enacted. The dance standard DA:Cr2.1.3b: Develop a dance phrase that expresses and communicates an idea or feeling was supported as students interpreted story actions through dance. Students addressed the visual arts standard VA:Cr3.1.3a: Elaborate visual information by adding details in an artwork to enhance emerging meaning as they added papier-mâché features to their animal masks and painted them with designs related to styles and symbols of different cultures.

Method

Design and Research Questions

The enrichment project addressed four research questions:

1. What science and arts (art, music and dance) self-efficacy do students have before and after the lessons?
2. How much science learning about animal form and function of body parts for survival do students exhibit before and after the lessons?
3. Does learning about African, Native American, and Native Mexican culture change student perceptions of people with indigenous heritage?
4. What animal masks and performances were the students able to create?

This is a simple pretest-posttest design study. The researchers monitored components related to these research questions through pretest-posttest questionnaires along with examination of student performance in making masks and acting out animal legends.

Participants

The two-semester afterschool project was designed to provide enrichment opportunities for students from low-socioeconomic communities of two elementary schools and one middle school of a local school district. Students traveled by bus after school once a week on Wednesdays to the university where the project activities took place. In addition to participating in the project described here, students engaged in other activities. The additional activities included working in the computer lab, completing homework, making craft jewelry, participating in counseling sessions, viewing ethnic documentaries with related discussions, learning yoga, listening to and creating lyrics for rap music, singing, playing instruments, photography, creative writing, publishing their own book through a publishing company, along with learning about problem solving strategies and becoming a more successful student.

The students were identified for the larger program by their teachers, home-school support workers, counselors and/or administrators. Various criteria were used by the schools in selection of students: 1) students from low socioeconomic backgrounds; 2) students who were showing successful progress in school; 3) students who were trying, but who could become motivated through this program; and/or 4) students struggling academically, socially, behaviorally

but could improve in school through involvement in the program.

Approximately 40 students in grades kindergarten through twelfth participated in the project, but data are only reported for those students who provided signed parent and student consent forms for research data and photo use, who completed both the pretest and posttest, and who participated consistently in the project activities.

The participants were 9 female, 4 male; 12 Black, 1 White; 2 age eight years, 4 age nine years, 2 age ten years, 1 age eleven years, 1 age twelve years, 2 age thirteen years, and 1 age seventeen years. All students qualified for free lunches at their respective schools. This project was approved by the overseeing university's internal review board and human subjects committee.

Design of the Enrichment Project

The enrichment project had five major components that worked together to form a rich, arts, science, and social studies integrated project: 1) papier-mâché mask-making; 2) slide shows of targeted animals; 3) hands-on science materials; 4) drumming rhythms; and 5) dramatization of animal legends through dance. See Table 1. Students participated in using traditional African Djembes, frame drums, and shakers to create rhythms during a drum circle, taught by University Community Music School music personnel. Participants were introduced to the cultural significance of the West African Drums (djembes, frame drums, and shakers), instructed in terminology, and taught techniques of hand drumming. The instructor also facilitated the creation of rhythmic patterns that represented the different animals during dramatization of the legends.

Mexican, African, and Native American legends that featured animals were highlighted in the project. A doctoral student transformed the legends into plays that could be acted out by students to drum rhythms. These plays emphasized the form and function of the animals' bodies and are included in the Appendix. Another education professor with expertise in dance assisted students in devising rhythmic movements to dramatize the three animal legends. Students worked with a gifted education professor and the doctoral student to make papier-mâché animal helmet crest masks to be worn on top of the head like a hat during the performance. This mask style ensured student vision and audience view of students' facial expressions.

Besides the form and function science being incorporated into the animal plays, two other types of teaching materials were prepared. The gifted education professor and the doctoral student created several sets of form and function analogy hands-on materials to teach how

animal body parts help the animals survive in their environments through analogy to common manufactured items with the same form and function. Students worked in small groups to explore these materials. See Figure 1 for example cards of this teaching material. Additionally, one of six electronic slide shows with close-up photographs a featured animal (deer, jaguar, lion, frog, wolf, orca) including brief text about body structure and function were presented to the group as they waited for the drum circle to be set up.

Finally, at the end of the school year, the university had a group of teachers from Myanmar visiting and one of the animal legends was performed for them, other interested faculty members, and university students. This allowed the students to showcase the masks they had created through their drumming and dramatization of cultural animal legends.

Table 1. *Chart of How Main Components of the Project Supported the Various Learning Objectives of the Project*

Major Instructional Component of the Project	Science Learning of Animal forms (Structures) and Functions	Social Studies Learning about Culture	Self-Efficacy Learning	Arts Learning
Masks: Making papier-mâché masks of animals highlighted in the project	Animal head or body (e.g., whale) shape or features (e.g., antlers) and functions for eating, attracting a mate, or other survival	Learning some art styles of the Maya of Mexico, Tsimshian Native Americans, and indigenous people of South Africa	Pride in having made an appealing animal mask in a long, step-by-step process	Noticing, appreciating, and reproducing different cultural art styles on the masks
Slide Shows: Viewing slide shows presenting photographs of the targeted animals that explain their body forms and functions for survival	Animal body parts and their functions for animal survival	Learning the geographical distribution of the targeted animals in their natural environments and the indigenous people who interact with the animals.	Practicing the ability to focus attention on an image and derive pleasure from thinking about it	Noticing the aesthetic aspects of good photography such as angle of the shot, lighting, and detail
Hands-on Science Materials: These materials focused on analogies between animal body part forms and functions and the forms and functions of manufactured objects.	Connecting science principles from the natural world to engineering principles for manufactured items	Humans make use of form and function when they design items for use in their cultures	New insights of how people gain ideas for making things by considering animal body parts and their forms and functions	Appreciation of the high-quality materials with cards mounted carefully on mat board
Drumming: Playing rhythms for the different animals when the actors dramatize their actions	Using a drum rhythm to express an animal's pattern of movement related to the form and function of legs, body, or wings	Learning about the different drums and percussion instruments of Africa	Sense of accomplishment in keeping pace with drum rhythms and producing a pleasing musical accompaniment	Tempo, speed, and volume of rhythm patterns to express the emotions, actions, and overall mood of the storyline
Dance-Dramatizing: Dramatizing an animal legend with dance steps to drum rhythms	Imitating the animal movements through dance	Listening to animal legends from three cultures and appreciating their stories and styles	Sense of accomplishment in successfully acting out dance motions for an audience of peers and later, guests	Gestures and dance actions as a way of artistically communicating the story action and emotion





 <p>A jaguar has <u>very powerful jaw muscles</u> so strong that it can kill prey by <i>piercing</i> the skull with its teeth.</p>	<p>Stapler</p> <p>A stapler has a <u>powerful spring-load jaw</u> that is <u>strong enough to pierce</u> multiple layers of paper. Similarly, the jaguar's <u>jaw muscles are strong enough to push</u> the jaguar's teeth into a skull.</p>
<p>Jaguars <u>leap onto</u> prey to <i>surprise</i> them.</p> 	<p>Spring Toy</p> <p>A spring toy <u>suddenly leaps</u> into the air to <i>surprise</i> the person playing with it. Similarly, a jaguar lies in wait and <u>suddenly springs</u> onto prey to <i>surprise</i> it.</p>
 <p>A jaguar has <u>black rosette-shaped spots</u> to <i>camouflage</i> it in the shadows of leaves.</p>	<p>Camouflage Cloth</p> <p>Camouflage cloth has <u>dark spots</u> to <i>hide</i> the wearer in the shadows of leaves. Similarly, a jaguar has <u>dark spots</u> so that it is <i>hidden in the shadows</i> of a forest.</p>
 <p>A jaguar usually has two cubs - twins. The cubs <u>stay in the den</u> to be safe while the mother hunts.</p>	<p>Playpen or Crib</p> <p>A child is often <u>left in a crib or playpen</u> for <i>safety</i> while the mother works around the house or prepares food. Similarly, the mother jaguar leaves her cubs in a <u>den</u> for <i>safety</i> while she hunts.</p>

Figure 1. Jaguar Form and Function Cards. Fronts (Left Column) and Backs (Right Column) of cards show the forms underlined and the functions italicized.

Instrumentation

There were three pretest-posttest instruments used in the study. The first measured self-efficacy in the different disciplines of science, art, dance, and music (Marsh, 1992). Positive validity and reliability evidence for this instrument can be found in Marsh (1994) and in Rinn, and Cunningham (2008) who report moderate internal consistency and moderate external validity. See Table 2 for the instrument. The actual instrument had a short set of the

same questions for each discipline with the blank space filled in with the name of that discipline for that question set. The fourth question, “I’m hopeless when it comes to _____ (science, art, dance, music),” was scored in reverse because of the negative word “hopeless.” Therefore, a score of “0” was converted to “5”; a score of “1” was converted to “4”, and so forth. The mean self-efficacy score for each subject area was then determined with standard deviation.

Table 2. *Self-Efficacy Instrument for Science, Art, Dance, and Music*

Statement	False	Mostly False	More false than true	More True than false	Mostly True	True
1. Compared to others my age, I am good at _____ (science, art, dance, music).						
2. I get good grades in _____ (science, art, dance, music).						
3. Work in _____ (science, art, dance, music) is easy for me.						
4. I’m hopeless when it comes to _____ (science, art, dance, music).						
5. I learn things quickly in _____ (science, art, dance, music).						
6. I have always done well in _____ (science, art, dance, music).						

Note. Scored from “0” (“False”) as “low self-efficacy” and “5” (“True”) as “high self-efficacy” (adapted from Marsh, 1992)

The second pretest-posttest instrument was criterion-referenced and measured science knowledge of animal form and function. The page students completed had much more room for responses than what is shown in Table 3. To receive a point, the student needed to mention a body part with an appropriate descriptor such as “long” or “sharp” or “broad” for the form and also give a purpose such as “eating” or “defense.” Partial credit (one half-point) was given for naming only the body part and its form or only naming the body part and its function. These were tallied for each animal and a mean with standard deviation was calculated for the group of participants.

Table 3. *Pretest-Posttest Items about Animal Form and Function Science Content*

For each animal below, tell form and functions of body parts that help the animal survive.	
Deer	
Jaguar	
Wolf	
Whale	
Lion	
Frog	



Two items from the Multidimensional Inventory of Black Identity – Teen (Scottham, Sellers, & Nguyen, 2008) were used to measure attitude toward people of different heritage groups. See Table 4. The means of scored

responses to both questions about the same group of people were calculated and means for the participants on the pretest and posttest were determined with standard deviations.

Table 4. *Attitude Scores toward Different Heritage Groups.*

Statement	False	Mostly False	More false than true	More True than false	Mostly True	True
1a. I feel good about people with African heritage.						
1b. I feel that people with African heritage have made major contributions to the world.						
2a. I feel good about people with Mexican heritage.						
2b. I feel that people with Mexican heritage have made major contributions to the world.						
3a. I feel good about people with Native American heritage.						
3b. I feel that people with Native American heritage have made major contributions to the world.						

Note. Scored from “0” (“False”) as “low regard” and “5” (“True”) as “high regard”

Results

Overall, students appeared to enjoy the enrichment activities. The group was usually very large (30 to 40 students) and ranged widely across grade levels. Settling students to the activities was sometimes difficult because of the large group size and age range, but also because some students had ridden for more than an hour on the bus to pick up students at several schools. Showing the electronic slide presentation featuring photographs of animals with accompanying information of their body structures and functions was always greeted with great

attention. By the time the slide show was over, the drums had been set up for practicing of drumming patterns.

Pretest-Posttest Scores

Table 5 shows mean student self-efficacy scores in science, art, dance, and music. Although all posttest scores trended higher in self-efficacy, the only statistically significant difference was in art self-efficacy (paired *t*-test, $p = 0.04$) with a medium effect size (Cohen’s $d = 0.53$). This change in self-perception of artistic ability was likely due to the animal masks that these participants made. The students expressed great pride in their work when they completed the masks.

Table 5. *Mean Student (n=13) Self-Efficacy Scores in Science, Art, Dance, and Music*

Time	Science	Art	Dance	Music	All Subjects
Pretest	2.8 (1.5)	3.2 (1.6)	3.3 (1.6)	3.8 (1.0)	3.3 (1.1)
Posttest	3.1 (1.2)	3.9 (1.3)	3.3 (1.7)	4.2 (1.2)	3.6 (1.0)

Note. Scored from “0” as “low self-efficacy” to “5” as “high self-efficacy”



Students evidenced much science learning from this project. Table 6 shows the mean number of form and function characteristics given by students for each individual animal and for the set of animals together. A paired t-test was conducted comparing student pretest and posttest scores on the total number of animal form and function

characteristics in student responses. The test results showed a significant difference ($p = 0.02$). Cohen's d was 0.83, a large effect size, indicating that students learned much concerning animal form and function from the beginning to the end of the project.

Table 6. Mean Number of Form and Function Characteristics Stated for Study-Related Animals

Time	Lion	Deer	Wolf	Whale	Jaguar	Frog	Total for All Animals
Pretest	2.2 (1.4)	2.7 (1.8)	3.2 (1.5)	1.2 (1.4)	2.4 (1.5)	1.5 (1.5)	13.2 (7.4)
Posttest	5.5 (4.7)	4.5 (4.0)	4.4 (4.7)	4.2 (3.3)	4.4 (4.4)	3.9 (3.1)	26.9 (22.4)

Table 7 shows average attitude scores toward the heritage of different groups. Although students showed a trend toward greater recognition of contributions and positive

regard for Mexicans and Native Americans on the posttest, there were no statistically significant differences.

Table 7. Mean Attitude Scores toward Different Heritage Groups from "0" as "low regard" and "5" as "high regard"

Time	African Heritage	Mexican Heritage	Native American Heritage	Student's Own Heritage
Pretest	4.0 (1.2)	2.9 (1.7)	3.6 (1.6)	3.8 (1.2)
Posttest	4.0 (1.6)	3.3 (2.0)	4.0 (1.8)	4.0 (1.2)

Student Enrichment Products

Table 8 shows the dance movements and drum patterns that students devised with the help of faculty with dance and music expertise. Many positive comments were

given by the audience of international teachers and interested faculty that viewed the final performance.

Table 8. *Dance Motions and Drumming Patterns for Dramatizing the Cultural Legends*

Culture and Legend	Character and Action	Dance Movements	Drum Pattern for this animal
Mexican Legend of Deer and Jaguar	Deer walking	Bend at waist slightly, raise left knee, point left foot toward back, and, then, place left foot on the ground. Follow with right knee and foot, repeating to drum beat.	Pine-ap-ple / pine-ap-pple L S L / L S L ta ti ta / ta ti ta
	Deer sweeping	Step forward with arms raised over and close to head, representing antlers. Bend at waist and use arms/antlers to sweep left to right.	
	Deer rolling jaguar	Step forward. Use hands with palms down to roll the old jaguar home. Repeat until drumming stops.	
African Lion, Crows and Frog Tale	Deer Running	Perform the "deer walking" motions at a faster rate to exit the stage area.	
	Jaguar	Position self on hands and knees. Use opposite hand and knee (right hand and left knee) to move forward, then repeat with remaining hand and knee. Keep head up and continue moving until drumming stops.	Blue-ber-ry / blue-ber-ry L S S / L S S ta ti ti/ ta ti ti
	Lion dragging animal held with mouth	Position self on hands and knees. Use opposite hand and knee (right hand and left knee) to move forward, then repeat with remaining hand and knee. Keep head up, look around, and continue moving until drumming stops.	Jump /up-and-down /jump /up-and-down L / S S L / L / S S L ta / ti ti ta / ta / ti ti ta
Native American Sea Wolf or Whale Legend	Crows	Place hands under each armpit or on shoulders. Flap arms with bent elbows like wings.	
	Frog	Squat low and hop forward with hands to floor for balance. For big hop, jump up to almost your full height.	Rib-bit /rib-bit /rib-bit S S / S S / S S ti ti/ ti ti/ ti ti
	Wolf sitting	Kneel with hands on floor and arms held straight down. Look around.	Pep-per-o-ni /sauce /meat-ball-pie
Native American Sea Wolf or Whale Legend	Wolf sleeping	Lay on side in sleep pose with eyes closed.	S S S S / L / L L S ti ti ti ti/ ta / ta ta ti
	Grandmother	Put arms around the sitting wolf as the wolf changes to an orca.	Turn a-round /turn a-round S S L / S S L ti ti ta / ti ti ta
	Orca emerging from wolf	Grandmother hugs the wolf. She pets the wolf's back two strokes. On the second stroke, Orca comes out from under the table and stands in front of the wolf as Grandmother continues petting the orca two strokes.	
	Orcas at Sea	Several orcas step together while arms are tracing wavelike up-down forward-backward patterns with arms clasped palm to palm in front.	

Figure 2 shows photographs of students wearing the animal helmet crest masks. Figure 4 presents additional

photographs of the some of the masks made by students in this enrichment project.



Figure 2. Students Wearing the Animal Helmet Crest Masks. Clockwise from upper left: white wolf, yellow jaguar, pink lion, and blue whale.



Figure 3. Animal Helmet Crest Masks Made by Students. Clockwise from Upper left: yellow jaguar, blue whale, orange deer, pink lion, white wolf, green frog.

Discussion and Conclusion

Summary

Students evidenced growth in art self-efficacy with a medium effect size as a result of the project. Students also experienced gains in scientific knowledge of the targeted animals' forms and functions for survival with a large effect size. Students, on average, were able to provide twice as many form and function relationships for each animal at the end of the project. Students visibly enjoyed the drumming work, the dramatizing of animal legends through dance moves, and the creation of the animal helmet crest masks. Their final performance was very engaging for the audience and students made comments indicating they were proud of their accomplishments. Although student regard for Hispanic and Native American cultural contributions improved over the course of the study, the increase was not enough to be statistically significant for this small group of students.

Science Learning

The arts-integrated science activities likely led to students enjoying and learning the animal science content. Rinne, Gregory, Yarmolinskaya, and Hardiman (2011) reviewed eight mechanisms through which arts-integration benefits long-term learning of content: rehearsal, elaboration, generation, enactment, oral production, effort after meaning, emotional arousal, and pictorial representation. All of these strategies were employed in this project. Rehearsal of animal form and function content occurred as students practiced the animal legend with their built-in form and function concepts and reinforced this by participating in the hands-on animal form and function analogy work. Semantic elaboration and enactment occurred as students acted out the animals' actions during the dramatized plays. Students generated the animal masks with key animal form and function elements on them such as antlers, spotted patterns, manes, and orca patterns. Oral production and effort after meaning occurred as students were asked to interpret the play scripts or determine the form-and-functionally analogous manufactured item for an animal's body part. Emotional arousal occurred when the slide shows of animal

photographs were shown, evidenced by audible gasps and comments such as "aw," "ooo," and "ah!" Movement and music were outward expressions of internal emotions. Pictorial representation was used in the pictorial form-and-function cards, in the slide shows, and in the making and wearing of the animal masks. All of these components worked together through the arts to make the project a meaningful and enjoyable learning experience.

As researchers (Catterall et al., 2012) have noted, youth perform better academically when the arts are integrated into the academic content. Similar to Burton et al.'s study (2000) students displayed improved motivation to learn when music, drama, and art were combined with science learning. Beautiful photography can also command focus and inspire a sense of wonder. The slide shows of carefully-selected photographs of the animals emphasized in this study were always greeted with rapt attention as students listened to the form and function information being read for each slide. The magnificence of each animal's form and function commanded student respect; often, students commented, "Oh, I like that one!" or "Yes, this animal is cool!" As students became more familiar with form and function, the photos were presented without their form and function captions for students to initially guess them and then have them electronically revealed. The multiple ways animal form and function were incorporated into the instructional unit (through drum rhythms, text of the animal legends, hands-on analogy exercises, and photographic slide shows) likely reinforced the learning.

Benefits from Music Integration

The West African drumming benefited arts integrated learning in several ways. Drumming required mental focus because the drumming patterns were learned by listening to the instructor and then duplicating the patterns on the drum. Often more than one rhythm pattern was being played at the same time across the circle, necessitating concentration on the rhythm one is playing and shutting out of others. Drumming utilized the learning process of transferring auditory signals to physical responses, and similarly, dance employed the interpretative skill of appropriate application of dramatization and motion to

drumming patterns. Tempo, speed, and volume of rhythm patterns helped express the emotions, actions, and overall mood of the storyline, similar to the soundtrack of a movie. Participants learned through repetitive rehearsing for the performance. Through the process of preparation for the final presentation, participants became a proud, supportive team.

Art Self-Efficacy

Student ability to make autonomous decisions and to structure and organize the artwork as desired gave students a sense of control over their artwork, contributing to art self efficacy and positive experiences (Hartman & Brown, 2016). In constructionism, “the learner is consciously engaged in constructing a public entity” (Papert, 1991, p.1). Students learned to make the masks by doing: they constructed the mask bases by using white craft glue to cover a large balloon with recycled paper, then, after these had dried, added features with cardboard pieces and more papier-mâché. They learned paint mixing and application through demonstration and experimentation. These exciting animal masks were then presented in a public dramatization of the legends, inspiring much pride in the work.

Social Studies Learning

The six basic tenets of social studies education presented by Farris (2015) were supported by this complex project. First, students were actively involved in their learning. The group, because of its great age range from kindergarten through middle school and even high school, and because of the long bus ride to campus, could be challenging to manage. However, presenting awe-inspiring photographs of animals with the opportunity to guess the survival information and then engaging students with drumming, allowed them to actively participate in their learning. Second, students had many opportunities to make decisions during the dramatization of cultural animal lessons. They were called upon to explain parts of the story and to develop drum patterns or dance steps to enact these ideas. During the mask-making, students chose their animals, paint colors, and styles of decoration.

Third, new learning was scaffolded on previous knowledge as the project slowly unfolded and students were asked to describe their new understandings of legends and artistic styles. Fourth, students developed more positive self-concepts in art as a result of the mask-making activities. They had not previously had the opportunity to make a longterm, complex project such as the papier-mâché masks and remarked that they felt very good about their accomplishments. Fifth, students developed an appreciation for the aesthetics of school subjects as they learned how social studies can involve the arts through music, drama and visual arts. Finally, students were involved as productive, contributing citizens during the preparation for and presentation of their dramatized animal legend to the international visitors from Myanmar.

Implications for Practice

Due to No Child Left Behind legislation, the schools in the district from which the students in the project came provided few opportunities for the students to engage in arts-integrated or science experiences such as the ones provided here. Therefore, the science and social studies information, as well as the arts activities, were new to the students. The novelty of content and experiences had students responding positively. Experiences based on more than one correct response with less-limiting use of materials and ideas seemed to be the highlight of the project for many students. They became more engaged when they realized that their participation and/or responses were valued. The authors recommend that teachers integrate arts experiences for their students that allow students choice and control over their work, as these components were very motivating (Hartman & Brown, 2016).

Suggestions for Future Research

The current study could have been enhanced by having a control group for comparison. Perhaps the control could be a group that was engaged in coming to campus for enrichment that addressed the same concepts without integration of the arts.

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Appendix

Three Animal Legends with Integrated Animal Form and Function Ideas

1. *The Deer and the Jaguar: A Mayan Legend from Mexico* (Adapted from Barry, 2001)

A deer went to look for a place to build a house. After much searching in the jungle, the deer found a wide flat place to build his house. The deer used his long, powerful legs to support him as he hid in the tall grass so that he could see predators approaching the new place he had chosen for his home. He said to himself, I will return tomorrow to clear this land for my new home. DEER DANCE AND DRUMMING PATTERN

There was also a jaguar who was looking for a place to set up a house. After much searching the jaguar found what she thought was the perfect place to make a den. Using her toes to grip the bark of a tree on the edge of her new home site, she climbed to see if the area would meet her needs when she was hunting close to home. Jaguars sometimes hide in trees to leap out at their prey to surprise them. JAGUAR DANCE AND DRUMMING PATTERN

Unsuspecting prey usually cannot notice the jaguar behind the leaves because of the pattern in the jaguar's fur. When attacking prey, the jaguar uses powerful jaw muscles to push canine teeth into the skull of the prey, killing it. Once she was satisfied that the trees and tall grass would allow her to hunt close to home, she said to herself, I will return tomorrow to clear this land for my new home. She did not realize that she had chosen the same place as the deer. JAGUAR DANCE AND DRUMMING PATTERN

The next day the deer rose early and ate a big breakfast. He used his long neck to easily reach to the ground to eat grass and to reach up into his favorite trees for leaves. Instead of front teeth at the top of his mouth, he had a tough pad to help in grabbing and pulling off leaves. Deer have flat back teeth with large surfaces for grinding the leaves. DEER DANCE AND DRUMMING PATTERN

After breakfast he set off to go to his new home. When he arrived, instead of using his antlers to defend himself, he used them to sweep away the low plants at his home site. It was not long before he had cleared a large area and decided to go home and return the next day. DEER DANCE AND DRUMMING PATTERN

The jaguar had a good day. On the way to her new home site she climbed a tree to see what animals were around that she might eat for lunch. Having black rosette-shaped spots helped her to blend in with the leaves in the trees. She used her long tail to help her balance while climbing on the narrow branches of the tree. JAGUAR DANCE AND DRUMMING PATTERN

When she reached her new home site. She was not sure this was the right place. "It seems someone is helping me." Using her sharp teeth she snapped off some small trees to use for her den. After gathering the saplings, she then stuck the biggest tree into the ground and set up the framework for her den. On the larger trees she made scraping marks with her claws to mark her territory. JAGUAR DANCE AND DRUMMING PATTERN

The next day the deer came back. When he saw the frame for the house, he said: "It seems someone is helping me." Then he covered the house with the pile of branches left by the jaguar and made two rooms, one for him and the other one for whomever was helping him. The next day the jaguar saw that her home was finished. She went in one room and fell asleep. The deer came later and went to sleep in the other room. DEER DANCE AND DRUMMING PATTERN

Each day the two animals would leave to search for food. One day the two came home at the same time. When they saw each other, the jaguar asked the deer, "Was it you who helped me?" The deer answered: "Yes, it was me." Then, the jaguar suggested, "Let's live together." "Yes, let's live together," replied the deer. They went to sleep and the following morning, the jaguar said, "I'm going hunting for our dinner." JAGUAR DANCE AND DRUMMING PATTERN

The jaguar went into the woods to hunt. The jaguar's large size allowed her to attack and drag large prey. She brought a large deer home and said to her companion: "Let's eat what I have caught." But the deer didn't want to eat; he was very much afraid and just went to bed. DEER DANCE AND DRUMMING PATTERN

Early the next morning before the jaguar was awake, he went to the woods and met a very large, old jaguar. The old jaguar was dying. The deer brought him water and the jaguar was grateful. He asked the deer to sit with him until he had moved on to the spirit world. "You can have my beautiful skin to keep you warm at night." After the jaguar had died, the deer, using his antlers, dragged the dead jaguar to his home. DEER DANCE AND DRUMMING PATTERN

When he arrived home, he said to his companion: "Let's eat what I have caught." The jaguar didn't want to eat; she was very frightened. That night she couldn't sleep thinking about the deer killing jaguars; and the deer couldn't sleep thinking about the jaguar killing deer. Both were very frightened. JAGUAR DANCE AND DRUMMING

At midnight as the deer moved his head, his antlers struck the wooden walls of the house. The jaguar and the deer were frightened by the noise, and both of them ran out of the house without stopping. DEER DANCE AND DRUMMING PATTERN

Trust is a gift....don't throw it away.

2. Native American Orca Clan Story (Adapted from Ceta Cousin, n.d.).

I used to be a beautiful white wolf. I was created by the wife of He Who Made All Things. She created only one of me because she thought I was the most beautiful of the four-legged animals. Even though I enjoyed being amongst the gods, I was lonely, so I began to wander throughout the world looking for someone like myself. WOLF DANCE AND DRUMMING PATTERN

Every now and then, using my cupped ears, I picked up the sound of other wolves. We wolves travel in packs and I found myself an unwelcome stranger in the wolf world. I came back from my journey very unhappy; I was the only white wolf in the world. WOLF DANCE AND DRUMMING PATTERN

One night, not long after my return, I fell into a deep sleep. As I slept I had a magical vision of a new life. When I awoke, I rushed to find my creator. "Grandmother, I have had a great vision, it calls for me to go below the great waters and sing the history of the world. As you know, I am very lonely in my present form." Grandmother was sad, she tried to talk me out of following my vision, but realized the power of my vision was too strong within me. WOLF DANCE AND DRUMMING PATTERN

For the last time, I used my long, flexible, wet tongue to lick the dirt from my face. I presented myself to Grandmother ready for my new journey as a creature of the sea. She hugged me and slowly I felt myself being turned into a shiny black whale. To remind me that I used to live on land as a wolf, she painted white markings on my sides. I sank below the great waters singing the song of my journey. I had found a place to belong, I was lonely no more. ORCA DANCE AND DRUMMING PATTERN

Beneath the sea, I needed to learn how to live in my new environment. Eating, swimming, communicating, and breathing were all very difficult tasks for me to learn under the ocean. I tried many whale forms. First I became a humpback whale: I had to learn how to eat by using my baleen instead of teeth. Baleen are long brush-like fibers hanging from the roof of my mouth. These fibers strained food from the water. WHALE DANCE AND DRUMMING PATTERN

During my first few days in the ocean, I did not have a good sense of balance. I kept rolling over on my back. I gradually learned to use my flukes or what you would call my tail. My tail is strong and moves up and down, not side to side like a fish's tail. Using my flukes I propelled myself through the water. My side fins also helped me to distribute some of my weight and provided a surface for me to push against the water. My flipper fins helped to stabilize me in the water, which helped me keep to my balance just like a wolf's long, flexible tail stabilizes the wolf as it runs. WHALE DANCE AND DRUMMING PATTERN

After a few weeks I began to understand whale song. I learned to listen carefully for the differences in the song of each member of my pod. We whales make noises that are whistles, buzzes, and cries. We use these noises to communicate over long distances, just like the wolf uses its howl to communicate with its pack. While the structure of the ears of a wolf and whale are different they serve the same purpose. A whale ear and a wolf are able to pick up sounds from different directions. Breathing under water was very difficult for me to learn. DANCE AND DRUMMING PATTERN

I learned to expand the skin folds on my belly to gulp in water and contract the folds as I expelled the water. There are some similarities between whales and wolves that made the adjustment easier for me. Just like a wolf runs at a high speed, whales are very fast swimmers. Killer Whales hunt in groups just like wolves hunt in a pack. Whales and wolves also live together for socializing and mutual protection. Whales' and wolves' eyes receive enough light for excellent night and low light vision. Wolves and whales are mammals. We are both warm-blooded, give birth to live young, and feed our young with milk produced by the mother. Our differences allow me some freedoms that I did not have as a wolf. WHALE DANCE AND DRUMMING PATTERNS

I tried many whale forms before settling back on the form that Grandmother had chosen for me. Once I decided to stay an Orca forever, I was adopted into a pod. I learned to hunt sharks and to protect the young, the sick, and the injured in our pod. I am no longer lonely. I sometimes rescue fishermen when their boats overturn and bring them to live in the sea as orcas. To this day, a whale near the shore is considered to be a human transformed and trying to communicate with his family. WHALE DANCE AND DRUMMING PATTERN

3. *South African Legend: When Lion Could Fly* (Adapted from Honey, 1910)

Lion, it is said, once was able to fly, and when he flew, he caught every animal he wished to hunt. When flying, he could even sneak up to extremely large prey to make a kill. Lion did not want the bones of what he caught to be broken into pieces because he knew that would destroy his magic power. He forced a pair of White Crows to watch over the bones of the animals he killed and ate, leaving them behind at the kraal (or home place) while he went hunting. LION DANCE AND DRUMMING PATTERN

One day, while the lion was out hunting, Great Frog came to his kraal, broke the bones into pieces, and said to the crows, "When lion comes, tell him that I live at the pond over there. If Lion wants to see me, he needs to come to the pond." CROW DANCE AND DRUMMING PATTERN

Lion had been lying in wait for an animal to come by all morning, when a gazelle appeared by the stream below. As he waited for the gazelle to get closer he readied himself to fly. Something felt wrong, he wanted to fly up, but found he could not fly. He then used his powerful legs to spring from the rock ledge where he had been hiding. Since he could not fly he missed the gazelle, who went bounding into the tall grass by the river. He thought something must be wrong at the kraal, and he returned home. DANCE AND DRUMMING

He asked the crows, "What have you done that I cannot fly?" They answered saying, "Someone came here, broke the bones into pieces, and said, "Tell lion if he wants me, he may look for me at yonder pond!" Lion went to the pond. CROW DANCE AND DRUMMING PATTERN

When lion arrived the Great Frog was sitting at the water's edge. Using the soft pads on his paws, lion tried to creep stealthily up on the Great Frog. As the lion was about to grab her, the Frog said, "Ho!" and, dove into the pond with a great splash which surprised the lion. The frog's smooth skin allowed her to swim to the other side of the pond effortlessly. The lion's claws came together with a loud clacking sound. Retracting his claws, he walked silently around the pond to the other side. LION DANCE AND DRUMMING PATTERN

A male lion has a thick mane of fluffy hair that makes the lion appear larger to frighten other animals. Puffing out his mane and giving out a loud frightening roar let all the animals in the area know he was displeased. The frog was not frightened by the lion's roar. Looking up, the lion saw the frog on the other side of the pond with a grin on her face. Having wide, webbed feet increased the surface area of the frog's feet so she could swim faster in the water. As long as she stayed in the water, she knew she would be able to stay away from the lion. FROG DANCE AND DRUMMING PATTERN

Lion could not wait to get his sharp claws into the flesh of the frog who had stolen his flying power. As the afternoon wore on, he could taste the sweetness of the frog's flesh in his mouth. The lion's long, sharp canine teeth began to ache with the desire to taste frog flesh. After hours of not being able to catch the frog, the lion began to wish that he had a mate who would be able to catch the frog for him. Female lions usually do most of the hunting because they are smaller, swifter, and more agile than males. Their quick motions allow them to catch prey faster than a male lion. LION DANCE AND DRUMMING

Becoming bored, the frog decided to use her ability to change her color to torment the lion. Climbing out onto a dry high rock in the middle of the pond, the frog, once she was warm and dry, lightened her skin to reflect sunlight, and shown like a beacon for the lion to see. Periodically, the frog would dive back into the water with a loud splashing sound that would startle the lion. Once in the water, the frog would cool off and darken her skin to absorb heat. When the frog wanted to disappear on the rock, she used her ability to expand and darken or contract and lighten her skin's brown-black pigment. This kept the lion guessing as to where the frog would appear next on the rock, in the water, or among the dark green plants at the water's edge. The frog knew that she had three

different color pigment cells: white, yellow, and brown-black in her skin and she used them cleverly to frustrate the lion. FROG

DANCE AND DRUMMING PATTERN

The lion pursued the frog all over the pond from one side to the other. From time to time, the lion stopped to take a drink of water. The frog, who did not drink water, but rather absorbed it through her skin would swim up and splash water in the lion's face and swim laughingly away. FROG DANCE AND DRUMMING PATTERN

As sunlight turned to dusk the lion was able to use his very large eyes to let in more light so that he would be able to see the frog in the low light. The frog, however, also had large eyes and could watch the lion in the twilight. When the moon came up full and bright the frustrated lion gave up trying to catch the frog and returned home. LION DANCE AND DRUMMING PATTERN

As he padded away, the lion dreamed of holding the frog by its hind legs and licking its flesh off with his large rough tongue. LION DANCE AND DRUMMING PATTERN