

S.T.E.M. to S.T.E.A.M.: Why the “A” is a Crucial Component of Student Learning

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Introduction

“The value of arts education is often phrased in enrichment terms—helping kids find their voice, rounding out their education and tapping into undiscovered talents. This is true, but as the President’s Committee saw in schools all over the country, it is also an effective tool in school-wide reform and fixing some of our biggest educational challenges. It is not a flower, but a wrench.”ⁱ

There is no question that the advent of high stakes testing has changed what goes on in the classroom today. Its effects are apparent from the curriculum we use to the time we spend on each content area. All elementary classes must now have 90 minutes of uninterrupted Reading instruction and Math is currently moving in the same direction. Given the need for lunch, recess, and a 45 minute planning period for teachers, little time is left behind for other subjects in the school day. Indeed, according to the Arts Education in Public Schools:1999-2000 and 2009-2010ⁱⁱ, only 3 and 4 percent of elementary schools reported specific instruction for dance and drama/theater in 2009-2010, representing a decrease from 20 percent in the 1999-2000 school year.

However, upon closer inspection, it has become evident that our scores are also falling behind in Science, Math and Technology. Here enters one of the latest acronyms in the education world: “S.T.E.M”. S.T.E.M. stands for Science, Technology, Engineering and Math. In an effort to keep pace with the world’s need for creative problem solvers, designers and scientists, schools are incorporating these activities into their classroom and after school activities. This has a direct impact on the types of activities we design for our students. More problem based projects require students to apply their knowledge in a practical, hands on way, and thus deepening their understanding. My school recently was awarded a grant from a large company after describing an initiative to change the way we approach our science curriculum. Rather than following the prescribed science kit verbatim, selected teachers are spending more time on the units, including extended thinking activities and opportunities for individual research and authentic applications. The goal of this unit is to further extend student thinking by integrating arts activities into the science curriculum.

I was initially interested in this seminar because I felt that integrating the arts into my enrichment curriculum could motivate and develop my students’ creativity, ability to work together, and problem solving skills. However, I then began to consider the way that I could infuse the arts into the new science activities by working collaboratively with the classroom

and expressive arts teachers in my school. After careful consideration, I chose to focus on the fifth grade Ecosystems kit. This is a popular kit that students enjoy, mostly because they create a terrarium style ecosystem from a large soda bottle, to which plants, snails and fish are added. This kit is taught to all fifth graders across my District and my goal for this unit is to provide lessons in which art standards are also addressed. By integrating the arts into the science curriculum, I aim to deepen the students' understanding through visual art, dance and drama.

Demographics

Thurgood Marshall Elementary is a large suburban school in Newark, Delaware. Our demographics are diverse, with approximately 31% of students reporting their race as African American, 40.5% as white, 14% as Asian American and 9% as Hispanic ⁱⁱⁱ. Other characteristics include 8.7% of students are English Language Learners, 37% are from low income families and 7% are identified as Special Education students. At year end this year, our principal announced that we are now considered "the most diverse school in our District". Our connections to the community are strong and we have significant parent involvement. Teachers work diligently to strengthen this bond and building a positive school environment is a key part of our School Improvement Plan. We have consistently been rated a "Superior" school for the past several years.

I am the Enrichment Teacher at Thurgood Marshall and have been there for the past 9 years. My District has adopted a pullout program for advanced students. My students reflect the top ten per cent of grades three to five (academically) in the areas of Language Arts and Math, and are seen during intervention time. Intervention time is usually a period of 45 minutes each day. Many students qualify for both classes and are thus pulled from the regular classroom up to twice a day. The curriculums adopted by the District are rigorous and appropriate for advanced elementary children.

Within the regular classrooms, teachers try to differentiate for all their students in an effort to give each child what is needed. Obviously this is a difficult endeavor and thus our school community works together. Along with actively teaching, I also work collaboratively with my colleagues, providing guidance, materials and strategies appropriate for advanced students.

Why Integration is Important

"Education in the arts is more important than ever...To succeed today and in the future, America's children will need to be inventive, resourceful, and imaginative. The best way to foster that creativity is through Arts Education"^{iv} -Arne Duncan, U.S. Secretary of Education

We all feel the pressure to prove that our students are growing. Accountability and assessment are present everywhere we turn. Teachers across the country feel that there is not enough time in the day to cover all their curriculums. Many feel that their creativity has been taken away as they must keep up with pacing guides and state testing. As we strive to raise standardized test scores, I can't but help feeling that we are leaving more than the children behind. Where is the love of learning, the joy of expression and discovery of new knowledge? Have we lost that too? I have fond memories of creating objects of art for holiday gifts at school. I loved the feeling of being on stage performing in front of my school for Christmas assemblies. But today, it seems that there is little time for interrupting instructional time for activities that cannot translate to hard data. Gone are the days of whole school assemblies where everyone is brought together for visiting performances or enrichment type activities.

This is precisely where the argument for integrating the arts comes in. There is empirical evidence that integrating the arts across the curriculum can produce an increase in student engagement and achievement. Across the country, schools have been taking back the arts; places where art and music have been eliminated because of financial restraints. This concept of arts integration is not intended to replace the teaching of the arts—classroom teachers are not usually trained arts specialists—but to incorporate and blend with core subject areas to develop a deeper understanding. The benefits of this type of integration are many: it encourages problem solving through creative and multi-disciplinary thought and visualization, it can improve students' ability to communicate and express ideas, it can teach the value of hard work and determination to reach a goal and of course, it can strengthen social and emotional development. In fact, according to the Arts Education partnership, created by the National Endowment for the Arts is a clearinghouse of research examining the body of evidence on the benefits of arts education. Their surveys and research shows that not only can the arts support academic achievement, but it can strengthen the skills needed for the 21st century workforce, and can do so much more for to enrich the lives of young people and communities.

“As children play music, as they paint or draw or design, many develop new passions, come to express themselves in original ways, and discover innovative pathways to success”^v

These words come from a report presented by the National Center on Time and Learning, which looked at five struggling schools that successfully turned themselves around. Consistently, each school invigorated their curriculums by infusing the arts, by providing quality, targeted professional development and by requiring collaboration between classroom teachers and art specialists.

In another important report, the President's Committee on the Arts and Humanities spent eighteen months on an in-depth review of the current practices and challenges facing arts education today. In their summary of the project (titled aptly “Reinvesting in Arts Education: Winning America's Future Through Creative Schools”), after examining the current research, talking with educational leaders and visiting successful turn-around schools across the country, it was agreed that a greater investment in the arts is an effective way to

prepare our students for the skills they will need to be successful in the jobs of the future. It stated that they found “robust data” that clearly shows the connection between arts education and academic achievement.

One such celebrated school is Bates Middle School in Annapolis, Maryland. This was one of the first turn around schools that I read as part of this seminar. Before the Arts Integration Model was implemented, this middle school had dismal test scores, high truancy rates and behavior was a definite issue to all. Then in 2008, the school was awarded a four year grant by the Arts in Education Model Development and Dissemination Grant Program. Data clearly shows that there were huge changes that happened in that building. Students meeting the reading standards ¹rose from 73% to 81% and those meeting the math standards went from 62% in 2008 to 77% in 2012. Science score also showed similar gains. How does this compare to the rate of increased scores for the rest of the state? It’s twelve times faster in reading and four times faster in math!

Of course, this transformation is not simply attributed to adding some art lessons to the curriculum. Rather, it is due to a very structured plan that included a several research based strategies and careful implementation. These practices included: training in Artful Thinking (a program developed by Project Zero at Harvard that methodically teaches creative and critical thinking via art and other subjects), differentiated arts activities that target memory processes, common planning time for faculty and targeted, professional development. This is not something that happened overnight after a couple of days’ worth of professional development, but rather it was a journey that the entire faculty embarked upon together, coupled with quality leadership that inspired confidence in the difference that they were making for their students. Bates is not the only school in the United States that has successfully changed the outcomes for their students through using the arts—there are many such stories that can be easily found. A simple Google search for “arts integration schools” will return with a multitude of articles, programs and reasons why it works.

Brain Research That Supports Arts Integration

We all want our students to be actively engaged in our classrooms and we want them to enjoy learning. However in the current educational climate, it might seem difficult to justify using dancing, dramatizing and musical activities as we teach to the standards in subjects like science and math. The good news is that there is research to show that when we nurture the creative, social emotional side of our students, the intellectual side will greatly benefit as well. Benefits include: providing a safe opportunity for healthy risk taking, helping children to recognize new skills in themselves and others, providing teachers a method of differentiation, building student collaboration, bridging differences and last but not least, it can draw parents and community into the school.

In their article, “Why Arts Integration Improves Long-Term Retention of Content”^{vi} Rinne et al. reviewed the research from the field of cognitive psychology regarding the long

term memory effects and the use of the integration of the arts as a teaching method. Among their findings were that by designing activities with embedded arts standards, students were more able to absorb difficult concepts and apply it with greater success at much higher levels. For example, by creating and performing a dance or song about a concept such as the water cycle, students have the opportunity not only to exercise their creative muscles but to further deepen their understanding of the concepts taught in class.

Many of the positive effects of arts integration are not necessarily measurable by state tests. Have you ever known or taught a student who was also a musician? Or perhaps you are a musician yourself. What does it take to master an instrument (or two, or three)? Discipline, consistent practice and intense attention and concentration are all skills that often then are applied to other learning. Many studies have supported this, including Fiske^{vii} who found that these students are more likely to rise above their peers on standard achievement measures. Isn't it ironic that these are just the classes that are being cut due to financial restraints? Irony aside, there are ways that the classroom teacher can still design lessons that will ignite our students' passions and allow them to be creative, while still teaching the subject standards.

Integrating the Arts in the Elementary Classroom

When considering integrating the arts into lesson planning, teachers need to begin with their content standards. A truly integrated lesson will be aimed at standards in both disciplines, such as science and art. Thus it is important to collaborate with the expressive arts teachers available in the school. True arts integration will address the standards in both subject areas. Classroom teachers are not usually artists, or dancers, or musicians, but by collaborating with experts in their buildings, teachers can feel confident that they can begin to truly offer students an opportunity to deepen their understanding of any subject matter. There are many places that teachers might choose to begin. A good choice is a subject that feels comfortable. Remember, the teacher doesn't have to be an accomplished artist—students will enjoy the experience of movement, music and drama as they learn.

The following is an overview of the major topics that are critical in the integration of the arts into the elementary classroom.

Movement and Dance

In seminar, we began with movement. Many of our activities were from “Interdisciplinary Learning through Dance: 101 MOVEntures”^{viii}. We were so fortunate to have one of the authors as our seminar leader. Her book is an excellent resource, especially for an arts novice. It provides teachers with examples of activities for all subject areas and is truly a wonderful way to get started integrating movement into your lessons.

In getting started with movement in the classroom, the environment is key. Classroom management strategies must be employed to make it work effectively. Essential guidelines

need to be clarified, such as rules about personal space, signals for stopping (clapping, snapping?), and signals for transitioning to the next activity (eg. “Find a partner by the time I count to 3”) The teacher also needs to be mindful about providing specific feedback to students about their participation so that they feel that it’s a safe environment for risk taking and that their contributions are acknowledged in a positive way. So decide on these guidelines before you begin the activity and depending on your grade level, provide chances to practice.

“*Movement has a language*”, Dr. Overby explained, as she guided our seminar through activities to explore the key vocabulary of movement. These terms are important core concepts that need to be taught and practiced in the classroom before applying them to curricular activities. . They would also make a valuable word wall. Essential terms include:

Space: considered the “where” of dance, it is the location of the moving space. It includes direction (forward/backward, right/left, up/down, clockwise/counterclockwise), levels (low/middle/high), pathways (straight/curved/zigzag) and positive and negative space (positive is the space that is taken up by the body, negative is the empty space between).

Movement Skills: considered the “what” of dance, including locomotion (walking running hopping), non-locomotion (rotating, stretching, bending, pushing, pulling), body shapes (curved/straight, angular/twisted, symmetrical/asymmetrical).

Relationships: considered the “setting” of dances, this includes others or objects, and where they are in relation to each other (between, around, through, in front of/behind/beside, under/over, and above/below).

Choreographic Design: Refers to the actual design of the dance. Is it improvisation or does it have a movement pattern or phrase? It could also be a narrative, by which a story is told.

Time: is the “when” of dance, including pulse, pattern, accent, tempo, counter point and/or felt time.

Force/Dynamic: This is the “how” of Dance, referring to the energy, weight, flow and qualities of movement.

Abilities and Principles: include the concepts of balance, flexibility, strength, cardiovascular efficiency and alignment.

We practiced these elements in seminar by creating movement maps, in which we incorporated several of these elements, strung together. This type of activity lends itself well to language arts and poetry. Student learning can be assessed using a rubric, like the Comprehensive Assessment found in Dr. Overby’s book and student participation in the activity.

Drama

Drama can be an extremely useful tool in the classroom. You don't have to be a trained actor or actress to participate fully in drama activities. Rather, drama is a process-oriented experience. Along with providing a fun introduction to the theatre, drama gives the opportunity to develop imagination and aesthetic awareness, independent and critical thinking, social collaboration, and improved communication skills. It can also provide a healthy, appropriate release of emotion and promotes self-awareness.

In seminar, we began our study of drama with tableaux. Using the story of Ruby Bridges, we created silent "frozen pictures" of the key scenes from the story. Participants represented both living and non-living elements from the story. When I tried this activity with my students, I actually took a digital snapshot of their scenes, which we then connected together (like a slide show) and analyzed on the class Smart Board. Tableau is a simple, non-threatening way to begin using drama in the classroom.

Pantomime

Pantomime seems to be a natural extension of Tableau. Where tableau is still, pantomime consists of movement, sometimes with a narrator. To practice this type of drama, we were given several short descriptions that we acted out with a partner, one person mirroring the other. For example, I was a dance teacher and my partner followed the lead of my actions. Facial expressions and body positioning help communicate the story being told. This type of activity could be applied to a variety of stories, from fiction to historical situations. Students have to think critically about the character they portray and how that character might look and react. Imagination activities might be as simple as pantomiming everyday situations like handling an imaginary object, or watching a funny movie. Conjuring up sense images can be fun too, such as pantomiming eating a piece of delicious candy, touching a hot stove, or catching the scent of cookies baking when you enter a room.

Improvisation

Improvisation includes the use of voice or can include a narrator with a pantomime. This can be a unique opportunity for students to work in groups, whereby they must work together to produce a scene or scenes. Dr. Overby handed out several short descriptions to us and in groups, we acted them out. For instance, I participated in a scene of Christmas Eve in a toy shop after the store was locked up for the night. As toys, we improvised our dialogue about our feelings of not being taken home by customers. Each scene had to include an initial situation, complications and suspense needed to be shown and each scene had to have a conclusion.

Another activity that falls under improvisation is called "Verbal Jousting". In this activity, teams use only their voice to "sing" one, two and three syllable words. Judges, with their backs turned, decide which team portrayed their word in the best possible way. My students really enjoyed this one!

Building Plays from Stories

Folk tales and picture books make great introductions to this type of drama. Just be sure that the selected piece has a clear beginning, middle and end. Students can practice telling the story to a small group (demonstrating their comprehension and exercising their communication skills), or dramatizing as a narrative pantomime, a small group or whole class dramatization. Audiences can be small or large, formal or informal.

Reader's Theater offers a beginner's option for plays. In particular, Rosalind M. Flynn's Curriculum-Based Reader's Theater Scripts: Science^{ix}. In this book, she offers 26 reproducible curriculum-based scripts that can increase reading fluency, retention of content learning and offers the opportunity to practice theatrical skills by reading, rehearsing and performing fact based skills. Other content areas include ELA, Math and Social Studies scripts.

Puppetry

Puppetry and masks are natural extensions of drama and offer unique opportunities to transform into someone or something else. They can help shy children project onto their puppet, or hide behind their mask to perform. Both can be used with an existing story or to create an original script. Once again, this is an arts opportunity where by students can think more deeply, by actually becoming a character and improvising how that character might react in a given situation.

There are many types of puppets that can be made simply and inexpensively in the classroom. Sock puppets, stick puppets, and paper bag puppets are all examples that children will be able to create independently and put to use quickly. In seminar, Dr. Overby set out lots of materials and we just let our creative juices flow. Students will likely act in the same manner. Evaluations of puppetry can include a look at the way that the student uses the puppet and props, use of voice, meaningful movements and evaluation of dialogue and characterization.

Music

Our connection to music is innate. It has the power to make us feel, move and interact with it. We can make it, feel it see it and hear it. Children will respond enthusiastically to its inclusion in any subject. If we put knowledge to music, facts are more easily remembered. Consider the ABC song or "School House Rock". Anyone who has had a song stuck in their head (this is called "audiation"!) knows that the brain absorbs music and memorizes it!

Here is a quick overview of the fundamentals of music

Beat: Tempo (pulse), Rhythm (beat) Meter (organization and division of steady beats)

Sound: Tone (pitch, range, quality), Harmony (different pitches at the same time), Timbre (tone quality, distinguishable sign)

Beat and Sound: Melody (pitch and rhythm), Dynamics (volume)

In seminar we did many activities to explore sound and beat. To warm up, we used “spider hands” with fingers curled to tap a beat on our legs simultaneously, keeping the same beat. Then we explored rhythm and tempo as we clapped our names and echoed the rhythms of others. Perhaps my favorite activity was “Hearing the Three Little Pigs”. This was an abstract activity in which the group created a ‘soundscape’ that told the story by using different timbres for each character in the story. As the story is told by a narrator, participants perform their sounds for each character. This type of activity could be applied to fiction or nonfiction pieces, after giving students time to reflect upon the characters, setting, mood and theme.

Music also lends itself well to math and science. For example, time signatures and beat can be used when teaching fractions. It is very exact and logical. Liquid volume sounds very different when glasses filled to different levels are tapped. Use melody and song to reinforce vocabulary and processes or procedures. The possibilities are endless!

Assessment, Common Core and Integrating the Arts

“The great news is that the standards call on so many things the arts do well. The tradition of careful observation, attention to evidence and artists’ choices, the love of taking an artist’s work seriously lies at the heart of these standards”^xThe Common Core proposes to provide a nationwide consistency for learning. It provides a continuum across grade levels and integrates subject areas. In fact, the word “integrate” is used frequently, along with words like “engagement” and “meaningful connections”. By integrating the arts across the elementary curriculum, student learning is extended, as students use new information and apply it to create solutions to new problems. It encourages higher order thinking, creativity, connections across, between and within subject areas and is linked closely to formative assessment. Project based strategies can provide a great deal of feedback for students and teachers, as they reflect upon their learning using clearly defined rubrics. Using rubrics can provide powerful self-assessment for students and teachers alike.

When considering assessment in the arts, teachers need to keep in mind that authentic assessments show growth; not judgment. When the Fine Arts are taught simultaneously with other content standards, the process can be assessed as students apply their new knowledge. Activities that show student work, such as performances, dance, poems, and technological presentations can all be assessed as checkpoints. Whereas a product can be viewed as a summative tool, defining the student’s overall knowledge of a topic, the arts should be seen as a formative assessment that checks student understanding and the ability to apply their new knowledge appropriately.

Activities

As stated earlier, this unit was written to supplement the fifth grade ecosystems unit presently taught at my school. To extend the present kit, students chose an endangered species from our state and researched its current status. One local interesting ecological dilemma is the interaction of the Red Knot bird, the Horseshoe Crab and the Delaware Bay.

Activity One: Saving the Red Knot: An Introduction to Pantomime

This activity integrates science standards with Theater and Dance.

Objectives:

Students will understand the importance of body language in self-expression, demonstrate mime techniques as a means of communication, sequence scenes into a dramatic study with a beginning, middle and an end and demonstrate their understanding of the connectedness of an ecosystem. Students will understand the importance of body language in self-expression, demonstrate mime techniques as a means of communication, sequence scenes into a dramatic study with a beginning, middle and end and demonstrate their understanding of the connectedness of an ecosystem. Students will collaborate as they work together to create and perform in small groups.

Specific standards addressed include:

Delaware Science Standard 8: Organisms are linked to one another in an ecosystem by the flow of energy and the cycling of materials. Humans are an integral part of the natural system and human activities can alter the stability of ecosystems.

National Theater Standard 2: Acting by developing acting skills to portray characters who interact in improvised and scripted scenes.

National Dance Standard 1: Identifying and demonstrating movement elements and skills in performing dance,

National Dance Standard 3: Understanding dance as a way to create and communicate meaning

National Dance Standard 4: Applying and demonstrating critical and creative thinking skills in dance.

National Dance Standard 7: Making connections between dance and other disciplines

Materials: “Horseshoe Crabs and Shorebirds: the Story of a Food Web^{xi}” or use one of several You Tube videos available from the Delaware Bay Shore Bird Project

Introduction and warm up: Begin by showing students a few silent film clips. Draw their attention to the use of body movement and facial expression. A great introductory activity is called the “Imaginary Object Pass”: arrange students in a circle and pretend to pass an object around the circle, using different levels of movement, facial expressions, etc to convey the identity of the object. It might be a soft and cuddly kitten, a heavy rock, or a dirty diaper! Focus on the way that we use our hands and expressions to show feelings and emotions.

Then have students try acting out several situations, such as being stuck in traffic, eating an apple, getting a haircut or grocery shopping. Have others observe and provide feedback about their observations.

Next read and discuss “Horseshoe Crabs and Shore Birds: the Story of a Food Web” or show Red Knot video found on YouTube. (see teacher resources). Students will then pantomime, in small groups, scenes from the beginning, middle and end of the shorebirds journey:

Beginning: starting out strong and fat, happy but as time goes on they get weaker, hungry, more desperate

Middle: stopping at the Delaware Bay, where there are lots of horseshoe crab eggs to feast on (or not, if you want to show the endangered aspect), and the birds become fat, happy and strong

End: The arrival at their breeding grounds in the Arctic

Assessment: Students can be evaluated based on their participation and demonstrated understanding of the migration cycle and the importance of the food web to these local species.

Activity Two: Creating Paper Mache Masks of Chosen Endangered Animal

In this activity, students will construct masks of their chosen endangered animal. This will integrate Science Standards and also visual arts standards.

Objectives:

Students will gain an awareness, appreciation and understanding of the use of masks. They will show an understanding of the characteristics of masks: exaggeration, distortion and symmetry. The end product is the creation of a sculptural mask using paper mache, exhibiting craftsmanship and creativity in the completion of mask details and choice of finishing embellishments.

Specific Standards Addressed:

Delaware Science Standard 8: Organisms are linked to one another in an ecosystem by the flow of energy and the cycling of materials. Humans are an integral part of the natural system and human activities can alter the stability of ecosystems.

National Visual Arts Standard 1: Understanding and applying media, techniques and processes

National Visual Arts Standard 5: Reflecting upon and assessing the characteristics and merits of their work and others

National Visual Arts Standard 6: Making connections between visual arts and other discipline

Materials: donated and recycled materials (such as egg cartons, foil, construction paper scraps, brown paper towels, sand paper, feathers, fake fur, beads, etc) gallon milk jugs (cut “face” of jug off, removing handle side with utility knife) flour paste, masking tape, clay, yarn

Begin by showing examples of masks from books and/or internet to introduce mask making. Concentrate heavily on details that make a mask interesting and enjoyable to look at.

Have students brainstorm and sketch out their masks.

Tear newspapers into strips. Students will dip strips in the paste, smooth off excess and layer on milk jug form until it is strong enough to add features (like eyes and snout) with clay or aluminum foil to build up features.

Add more strips in layers. Soaked brown paper strips also work well for last layer.

Let dry and sand with sandpaper.

Provide choices for finishing—tempera paint, torn or cut tissue paper.

Embellish with beads, feathers, fake fur, buttons, shells, etc.

Assessment: Student products can be evaluated for their artistic choices, quality of end product, and resemblance to their chosen animal.

Activity Three: “Save the Delaware Bay” adapted with permission from Lynnette Overby

This activity addresses standards in Science and Dance.

Objectives:

Students will be able to connect scientific concepts with movement and dance concepts, describe various components of the ocean environment, describe human’s negative effects on the environment and perform a story dance about the ocean with appropriate use of space, time , force and body movement.

Specific Standards Addressed:

Delaware Science Standard 8: Organisms are linked to one another in an ecosystem by the flow of energy and the cycling of materials. Humans are an integral part of the natural system and human activities can alter the stability of ecosystems.

National Dance Standard 1: Identifying and demonstrating movement elements and skills in performing dance,

National Dance Standard 3: Understanding dance as a way to create and communicate meaning

National Dance Standard 4: Applying and demonstrating critical and creative thinking skills in dance.

National Dance Standard 7: Making connections between dance and other disciplines.

Begin by having students identify the major creatures in the Delaware Bay ecosystem (crabs, sharks, flounder, Red Knots, sandpipers, jellyfish). Brainstorm the types of movements that might be appropriate. For example ask, "How would a crab move?" All students will first create movements for all these creatures.

As narrator, teacher reads the following as students listen: *"On the beautiful Delaware Bay, the waves lap the shore and the shorebirds are singing and flying happily in the breeze. Plants in the ocean are green and healthy and the fish play tag as they move in and out of the leaves. On the sandy ocean floor, hermit crabs scuttle about and sharks swim lazily..*

But soon, men dump pollution into the water and over- fish the area. They fill in the precious wetlands to build houses. The animals look around for food. They find it hard to breathe, and one by one, they die.

After many years the water begins to be cleaned up. Over- fishing stops and the animals and plants return one by one.

Once again, the plants and fish return to play amongst themselves. The birds sing and fly and the crabs scuttle about on the ocean floor.

We must protect our beautiful Delaware Bay and the creatures that live there. Not just for the beauty and recreation they offer us, but for the perfect ecosystems that they are."

Performance: Divide students into groups: fish, sea plants, crabs, birds, waves. As the narrator repeats the story, students enter the dance on cue and perform the dance story.

Evaluation will include the students' ability to describe the components of the ocean environment and the negative impact of the human actions on the environment. They should also be able to discuss the movement they chose to perform in the Delaware Bay dance.

Conclusion

In researching the studies that support integrating the arts, I was thrilled when I came across the following quote from Judy Willis, a neurologist who was also a classroom teacher. It truly reflects the way I feel and affects the way I teach everyday:

In other words, when a classroom is a motivating, exciting place where there is an adult that wants to see everyone be successful and has fun in the process, the learning takes place in a deep and meaningful way. Integrating the arts into your curriculum is an absolutely perfect way to achieve this goal—and the research is there to prove it!

Notes

ⁱ President’s Committee on the Arts and the Humanities, *Reinvesting in Arts Education: Winning America’s Future Through Creative Schools*, May 2011

ⁱⁱ Arts Education in Public Elementary Schools:1999-2000 and 2009-2010, National Center for Education Statistics, U.S. Department of Education

ⁱⁱⁱ DE Department of Education, 2010

^{iv} President’s Committee on the Arts and the Humanities, *Reinvesting in Arts Education: Winning America’s Future Through Creative Schools*, May 2011, p. 39

^v (Advancing Arts Through An Expanded School Day: Lessons from Five Schools 2013)

^{vi} (Rinne, et al. 2011)

^{vii} (Fiske 1999)

(Willis 2007)

^{viii} Young Overby, Post and Newman “Interdisciplinary Learning through Dance”

^{ix} Flynn, Rosalind M. Curriculum-Based Reader’s Theater Scripts: Science, 2011

^x Coleman, David, ARTSblog, 17 September 2013

^{xi} Crenson, Victoria, and Annie Cannon. *Horseshoe crabs and shorebirds : the story of a food web*. New York: Marshall Cavendish, 2003

Content Standards

The new Common Core standards demonstrate a definite shift toward the instructional use of more informational texts that contain data and content specific information. It requires students to build knowledge from multiple sources and to be able to cite evidence to support a position. The activities in this unit have been designed to provide students with opportunities to construct arguments in conversation and writing, responding to a variety of texts. Academic vocabulary will be developed and used in all activities.

Therefore the unit is cross-curricular, addressing standards in English Language Arts, Science, Theater, Dance and Visual Arts. The outcomes include critical thinking, global and community involvement, awareness of one's own worldview, and making connections between personal experience and research. Specifically, the following standards will be addressed from the Common Core:

Reading

1. Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. **CC5RI1**
2. Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text. **CC5RI3**
3. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area. **CC5RI4**
4. Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/ solution) of events, ideas, concepts, or information in two or more texts. **CC5RI5**
5. Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent. **CC5RI6**
6. Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. **CC5RI7**
7. Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. **CC5RI9**
8. By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4-5 text complexity band independently and proficiently. **CC5RI10**

Writing

Students will:

Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

- a. Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped to support the writer's purpose.
- b. Provide logically ordered reasons that are supported by facts and details.
- c. Link opinion and reasons using words, phrases, and clauses (e.g., consequently, specifically).
- d. Provide a concluding statement or section related to the opinion presented

Speaking and Listening:

Students will:

-
- a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
 - b. Follow agreed-upon rules for discussions and carry out assigned roles.
 - c. Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
 - d. Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

Comprehension and Collaboration:

Students will:

- a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
- b. Follow agreed-upon rules for discussions and carry out assigned roles.
- c. Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
- d. Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions

Arts:

Theater:

National Theater Standard 2: Acting by developing acting skills to portray characters who interact in improvised and scripted scenes.

Dance:

National Dance Standard 1: Identifying and demonstrating movement elements and skills in performing dance,

National Dance Standard 3: Understanding dance as a way to create and communicate meaning

National Dance Standard 4: Applying and demonstrating critical and creative thinking skills in dance.

National Dance Standard 7: Making connections between dance and other disciplines.

Visual Arts:

National Visual Arts Standard 1: Understanding and applying media, techniques and processes

National Visual Arts Standard 5: Reflecting upon and assessing the characteristics and merits of their work and others

National Visual Arts Standard 6: Making connections between visual arts and other discipline

Science:

Delaware Science Standard 8: Organisms are linked to one another in an ecosystem by the flow of energy and the cycling of materials. Humans are an integral part of the natural system and human activities can alter the stability of ecosystems

Annotated Bibliography

"Arts Integration Solutions | Arts Integration Training Programs." Arts Integration Solutions | Arts Integration Training Programs. <http://artsintegration.com/> (accessed August 9, 2013) Wonderful site for Arts integration, including Professional Development, videos and searchable lesson plans and resources for integrating the arts with STEM

Crenson, Victoria, and Annie Cannon. *Horseshoe crabs and shorebirds : the story of a food web*. New York: Marshall Cavendish, 2003. This can be used with the pantomime activity.

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Generation Science Standards. Easy to navigate and understand.

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Overby, Lynnette Young, and Beth C. Post. *Interdisciplinary teaching through dance: 101 MOVentures*. Champaign, Ill.: Human Kinetics, 2005. Well worth the investment as this book covers all subject areas and includes a DVD and CD of music. Everything you need to begin integrating the arts into your present curriculum.

Riley, Susan. "Home - Education Closet." Education Closet. <http://educationcloset.com/> (accessed December 9, 2013). This site is a treasure trove of arts integration activities and current news on the subject.

Riley, Susan M.. *Shake the sketch: an arts integration workbook*. Lexington, KY: CreateSpace, 2012. Provides step by step instruction and ideas about how to integrate the arts into your school. Makes suggestions and includes what to expect from your staff and how to handle this complicated process.

Riley, Susan M.. *Steam point: a guide to integrating science, technology, engineering, the arts and math through Common Core*. Westminster MD: EducationCloset, 2012. Awesome resource that includes curriculum maps and assessment strategies

"Science Rap B.A.T.T.L.E.S. Bring Hip-Hop Into The Classroom : Code Switch : NPR." NPR : National Public Radio : News & Analysis, World, US, Music & Arts : NPR. <http://www.npr.org/blogs/codeswitch/2013/08/08/207348197/science-rap-b-a-t-t-l-e-s-bring-hip-hop-into-the-classroom> (accessed August 10, 2013). An inspirational video about the power of integrating music with the secondary science curriculum. Using a rap competition, urban students demonstrate their understanding of the science material as they compete with the winners from other schools.

"Singing in science: Writing and recording student lyrics to express learning." ArtsEdSearch Home. <http://www.artsedsearch.org/summaries/singing-in-science-writing-and-recording-student-lyrics-to-express-learning> (accessed August 10, 2013).

Sousa, David A., and Thomas Pilecki. *From STEM to STEAM: using brain-compatible strategies to integrate the arts*. Thousand Oaks, CA: Corwin, 2013. Wonderful resource that includes techniques, lesson plans and worksheet template

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<http://www.aep-arts.org/research-policy/state-policy-database/state-policy-summary-2012/> (accessed August 10, 2013). Helpful resource to read so that you know where your state stands on this topic and to make you aware of how things are in other states.

Willis, Nancy Carol. *Red knot: a shorebird's incredible journey*. Middletown, Del.: Birdsong Books, 2006. This book can be used for the pantomime activity in this unit.

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<http://www.edutopia.org/stw-arts-integration-research> (accessed October 10, 2013).

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Curriculum Unit Title

S.T.E.M. to S.T.E.A.M: Why the "A" is a Crucial Component of Student Learning

Author

Nancy E. Ventresca

KEY LEARNING, ENDURING UNDERSTANDING, ETC.

Living and nonliving things are interdependent. Living things impact the ecosystem as they satisfy their basic needs for survival.

Art is a distinct form of communication that enriches the understanding of other disciplines.

Art media, techniques and processes work together to create performances and works of art.

ESSENTIAL QUESTION(S) for the UNIT

- How do organisms interact with the living and non-living parts of the environment? What skills and knowledge are needed to create a performance?
- How do organisms impact an ecosystem? How do performers and audiences communicate?
- How can I use my science knowledge to create art?

CONCEPT A

CONCEPT B

CONCEPT C

Basic Needs

Structure/Function

Human Impact

ESSENTIAL QUESTIONS A

ESSENTIAL QUESTIONS B

ESSENTIAL QUESTIONS C

What basic needs do organisms have for survival?
How do organisms' structures help them to survive?

How do organisms' life cycles impact the ecosystem?
How does a change in one part of an ecosystem affect the other parts of an ecosystem?

How do humans impact an ecosystem?
Can damage to the ecosystem be reversed?

VOCABULARY A

VOCABULARY A

VOCABULARY A

Basic needs, water, sun, food, space, fins, legs, fur, environment, endangered species
Symmetry, balance, design, media, dimension, sculpture, texture

Food chain, producers, decomposers, energy transfer, interdependence, ecosystem, habitat, non-living/living, dependent
Locomotor, non-locomotor, body shape, body part, space, tempo, energy

Point of view, pollution, pollutant, trade-offs
Pantomime, improvisation, movement, gesture, tableau

ADDITIONAL INFORMATION/MATERIAL/TEXT/FILM/RESOURCES

This DTI unit was created to *integrate* the Arts into this 5th grade Ecosystems unit. Essential questions are included for the Arts and Science.

Activity 1 integrates Theater and Dance standards with a pantomime activity that deepens student understanding of the interdependence of the Horsehoe Crab, the Red Knot bird, and the Delaware Bay.

Activity 2 integrates Visual arts and paper mache mask s as students create a mask for a chosen endangered Delaware species.

Activity 3 integrates dance standards as students create and perform a story dance about the Delaware Bay Ecosystem.