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DOWNLOAD PROJECT INFO AT EDUCATIONFUND.ORG

STEAM & Beyond:

Applied Scientific Expression Through the Arts

STEAM activities motivate students to present a culturally authentic performance

Student requests to participate will pour in for this in-depth STEAM project that demonstrates how science, technology, art, and culture work in tandem to improve interest and motivation to learn. Students delve into topics about sound creation, musical notes, how various musical instruments work, music from other cultures, the engineering methods used to create live music, the math involved in manipulating and assembling materials, and more. As a capstone activity, students use the musical instruments and costume elements they created to present a culturally authentic performance for their peers. Throughout the project, students begin to understand that math and a mastery of scientific principles are used in the engineering process to creatively apply technology to communicate and express themselves through art. The result of their efforts is tangible, useful musical instruments. Their music will serve as an enduring touchpoint that reinforces the value of having an educated mind.

"This project addresses my students most commonly asked question, 'Why?'"

WORKSHOP INSTRUCTION – WHAT TEACHERS LEARN

Integrate multiple disciplines into STEAM activities
Use Performing Arts to anchor a STEAM module
Ideas for incorporating music education into STEAM instruction

STUDENTS

Adaptation: All grade and achievement levels, can be implemented with large or small groups
Students who participated: Grades K-5, ages 5-10, 30-300 students, met 1 or 2 times per week

MATERIALS & RESOURCES

Materials: Bins or boxes to hold materials, rubber bands, zip ties, popsicle craft sticks, glue, tape, various types of crafting papers, beading thread beads, crafting bells, crayons, markers
Resources: The Internet, media center, guest speakers and performers

ABOUT THE TEACHER

Dr. Ekaterina Belyakova has taught 22 years with Ph.D. in Education. She is a past Teacher of the Year for her school. Her students have won numerous local and state awards for the Performing Arts. Ekaterina has received several grants from The Education Fund. This is the 2nd year she has used this project. This year, several community organizations provided valuable assistance.

To register for this workshop, visit www.educationfund.org

STANDARDS

SCIENCE
SC.3.P.10.2 Recognize that energy has the ability to cause motion and create change

MUSIC
MU.3.S.3.2 Play melodies and layered ostinato, using proper instruments, techniques on instruments

VISUAL ARTS
VA.3. F.1.1: Manipulate art media and incorporate a variety of subject matter to create imaginative artwork.

MATHEMATICS
MAFS.3.N.F.1.1 Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size1/b

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Applied Scientific Expressions Through the Arts

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Description of The Project:

Visual and performing arts help us to be engaged in learning about the science and technology behind performing multi-cultural music with Musical instruments (drums). Students will go through an educational process (instruction, modeling, directing, researching, designing, creating, applying, refining, performing, and reflecting) as they learn about sound creation, musical tones, and how various musical instruments work. They will inquire the engineering method to invent, and use the math and science to manipulate and assemble materials. As a capstone activity, students will use the musical instruments they created to present a culturally - authentic stage performance.

Course Outline

Big Idea: Identity and World Cultures

Unit: World Cultures and Music

Project 3: Musical Instruments and Cultures

Grading Period: 3rd 9 weeks

Grade level: 3rd

Standards:

- MU.3.H.1 Through study in the arts, we learn about and honor others and the worlds in which they live (d).
    - MU.3.H.1.1 Compare indigenous instruments of specified cultures.
    - MU.3.H.1.3 Identify timbre(s) in music from a variety of cultures.

Goals and Objectives:

- Expose children to the arts of different cultures through creative expression by using the STEAM approach
    - The students will craft musical instruments for imaginative and creative self-expression
    - The students will experiment and will have a blast applying their creativity to modeling, designing, and exploring different cultures
    - The students will identify and compare instruments from different cultures
    - The students will learn about and honor the diversity of world cultures

Learning Outcome:

- The students gained an understanding of how artists employ expressive features of art, and relationships of art elements, to communicate and direct viewers toward understanding their artwork.
- The students explored the ways that art can reveal individual and cultural values and beliefs, as well as challenge those values and beliefs.
- The students summarized 3rd nine week knowledge through STEAM lesson
- The students created art work

Setting up the classroom for the STEAM lesson:

1. Introduction to the lesson – use whole class setting
    - Review previous knowledge
    - Set goals, objectives, and expectations
    - Check for the understanding
    - Clarify the desired end-state
2. STEAM lesson - divide the class into small groups
    - Provide: rubric, supplies, working materials, and worksheets

Briefly remind and review with the students:

- STEAM lesson requirements (rubric, ethic for team work)
- Prerequisite knowledge (music sheet, science guide)
- Engineering design process
- Engineering testing questions

Prerequisite for the STEAM Lesson

Introduce students to different components of the project (See appendix A)

5.0 STEAM Lesson – Music

Description:
In the music lesson we learned:

- Music Instruments produce sounds
- Sound is a result of vibrations
- The slower the vibration the lower the pitch, and vice versa

We can evaluate the sounds in a many ways:

- One of the ways to evaluate the sound is to observe the sound's pitch
- The pitch can be high or low, depending on the speed of the vibrations
- Use a sound analyzer app to determine rather a vibration a slow or fast
    - Since we know that fast vibrations are related to high-pitched sounds, and slow vibrations are related to low pitch sounds, we can than determine which type of the pitch the drum has
- Build a drum with a high pitch.

Detailed 5.0 STEAM Lesson (See appendix B)

After the STEAM Lesson

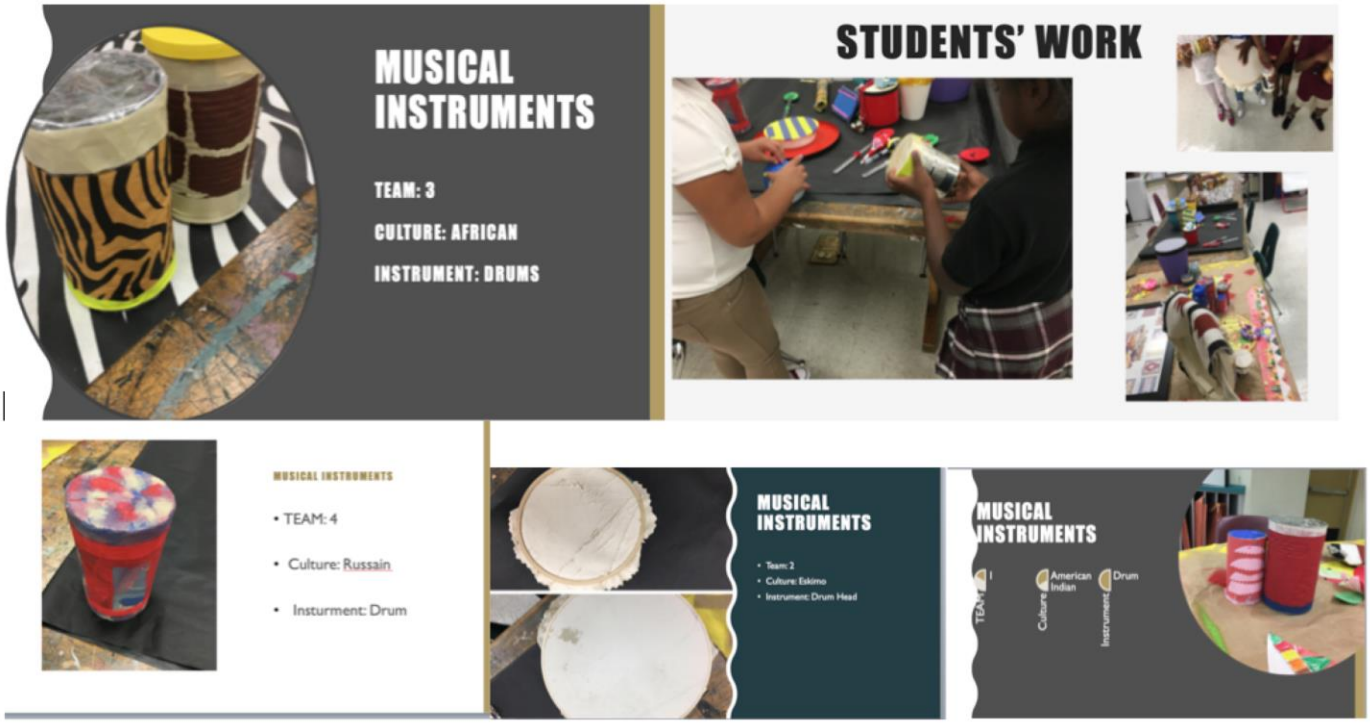
After you build your instrument, create a musical piece in relation to the culture you chose:

- Find music from the culture of your choice
- Your musical piece should be at least 30 seconds, but no longer than one minute
- Choose to create a solo, duet, or ensemble piece (*You can choose to work on your own, with your partner, or in a small group*)

Resource List:

- **Drum Materials:**
    - Glues (various types)
    - Tape (various types)
    - Buckets, cans, and/or jars (various sizes)
    - Cardboard, poster board, and/or cardstock (for making drum heads)
    - Wood dowels and/or pvc pipe sections (for making mallets)

- **Students' Work:**



Appendix A

World of Folk Music & Cultures

Research the culture of your choice to create own musical instrument and performance.

- Culture/Country: _____
-
- Facts:
  - Continent:
  - Music/Musical Instrument(s):
  - Cultural traits:

- Create a Poster

Sound and Musical Instruments

1. Watch the video, link: https://www.youtube.com/watch?v=yMLTF_0PAQw&vl=en
2. Experiment with different objects to explore sounds
3. What is "pitch?"
4. How can the pitch be changed?
5. Write the conclusion of your findings:

   - Rulers with different lengths: _____
   - Bottles with different levels of water: _____
   - Voice: _____
   - String instrument: _____
   - Xylophone: _____

Sound and Pitch

Leaning About Pitch

Type of pitch:	**Not Definite** • Percussion instruments like the drum or tambourine	**Absolute** • Tuned instruments like the piano or guitar
Nature of pitch	**Low Pitch** • Something that sounds deep or soft	**High Pitch** • Something that sounds elevated or piercing
Pitch In music • Measured by ear • Compare sounds to middle notes like C (260 Hz) • Use a Tuning App	**Low pitch** • Lower than middle C	**High pitch** • Higher than middle C
In Physics/Science • Measured by Hertz • Middle C is 256 Hz • Audible sounds range from 20 Hz to 20,000 Hz	**Low pitch** • An audible note that is vibrating less than 260Hz Hz by sound waves vibrates at 260 times a second or less, the slower the vibration the lower the sound	**High pitch** • An audible note that is vibrating more than 260 Hz by sound waves vibrates at 260 times a second or more, the faster the vibration the higher the sound

Science Guide Card

State of Matter	Solid	Liquid	Gas
Definition	Has its own shape, has volume and mass	Takes a shape of its container, has volume and mass	No shape of its own, has no "fixed" volume, but has mass
Examples	Ice cube, book, ruler,	Water, oil, ink, soda	Helium in balloon, clouds, exhaled breath

Engineering Design Process

ASK	What is the Problem? How have others approached it? What are your constraints?
IMAGING	What are some solutions? Brainstorm Ides Choose the best one
PLAN	Draw a diagram Design your prototype Make a list: o Materials that you will need o Steps you will take
CREATE	Follow your plan Create Test it!
IMPROVE	What works? What doesn't? What could work better?

STEAM Rubric

Name: _____ **Class: _____**

Self Evaluation

	Unsatisfactory Effort (0 points)	Effort Needs Improvement (1 point)	Satisfactory Effort (2 points)	Outstanding Effort (3 points)
I contributed to the team work				
I exhibited scientific thinking				
I maintained a positive attitude				
I completed the building task				
I reflected on my work				

Team Evaluation

	Unsatisfactory Effort (0 points)	Effort Needs Improvement (1 point)	Satisfactory Effort (2 points)	Outstanding Effort (3 points)
My team worked well together				
My team displayed problem-solving skills				
My team had a positive attitude				
My team completed the building task				
My team discussed and reflected on our work				

Teacher Evaluation

	Unsatisfactory Effort (0 points)	Effort Needs Improvement (1 point)	Satisfactory Effort (2 points)	Outstanding Effort (3 points)
Student cooperated with the team				
Student exhibited scientific thinking				
Student maintained a positive attitude				
Team completed the building task				
Student reflected on the work				

Appendix B

5.0 STEAM Lesson – Music

Objectives and Activity Description:

Science:

- SC.3.P. 8.3: *Compare materials and objects according to properties such as size, shape, color, texture, and hardness*
- The students experiment with different objects to cause different motions to create changes in sounds, and compare materials.

Technology:

- No standards (*See SAMR model*)
- The students learn how to create a PowerPoint presentation as a group and share it with others

Engineering:

- No standards (*See Engineering Design Process*)
- The students build drums to create specified types of sounds (high pitch sound), then test them, and make improvements as needed.
- Problem: Build a drum that is at least 3 inches high, but no more then 30 inches tall. Design the drum that will produce a high pitch.
- While you build your drum go through drum pitch factors:
    - Size
    - Thickness and material type
    - Air to create a vibration (open or closed bottom)
    - Drum head tension
- Test your drum – use a sound analyzer app

Art:

- MU. 3 C.1 *Cognition and reflection are required to appreciate, interpret, and create with artistic intent*
    - MU. 3 C.1.2. *Respond to a musical work in a variety of ways and compare individual interpretations*
- The students use the instruments that they individually designed and created to make music that accompanies recorded folk songs. Students will take turns performing for their peers, and make comparisons

Math:

- MAFS.3.MD.2.4 *Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.*
- The students use tools to measure their constructed musical instrument. (*For example, rulers will be used to measure dimensions*)

Science

Classifying the Material

Task: Put materials into the groups. Classify each of your instruments' materials as a solid, liquid, or gas.

Directions: Place materials into categories using your test card as a guide.
Categorize all of the materials that you will be using.

Material:

Group 1	Group 2	Group 3

Questions:

1. What properties do the materials in the first group have in common?

2. From what group did you use the most materials? Why?

Technology

Follow the Steps:

1. Take a picture of your instrument
2. Upload the picture to the computer
3. Open MS PowerPoint presentation
4. Choose the slide pattern
5. Insert the picture
6. Add the title, team #, culture, instrument
7. Save your work

** See Example of Students Work (Power Point Presentation)*

Engineering

Directions:

- Reflect on the Engineering Process:
    - I will build a: _____
    - Problem (see parameters): _____
    - Plan (see drum pitch factors):
        - 1.
        - 2.
        - 3.
        - 4.
    - Prototype (sketch): _____
    - Testing: Go to sound analyzer app
        - Sound analyzer app result: _____
        - Low Pitch_____ High Pitch_____
    - Can your instrument produce the needed sound?
        - Yes _____No _____
    - List any changes you made or need to make.
        - _____
    - Summarize
        - _____

Art/Music

Complete this form after you have done your project.

- Did you create a solo, duet, or ensemble? _____
- What culture did you research? _____
- What type of instrument did you build? _____
- Why does the size of a drum affect its pitch? _____

Peer Evaluations

Group	Culture Portrayed	Artistic Intent 1 to 10	Individual Interpretation 1 to 10	Positive comments What did you like about the performance?
1				
2				
3				
4				

Math

Measure your instrument to the nearest quarter of an inch.

Measure	Inches	Parts of Instruments
Height		
Diameter		
Circumference		