STEM to STEAM

How the Sciences and Arts work together to enhance creativity and innovation
Welcome!

While you are waiting for this webinar to begin, please type in the chat:

Your name:
Your school:
Your position:
Who We Are

Jeanine Nakakura
- State STEM Resource Teacher
- DOE Science Teacher since 1987
- Biology, Physics, Science Resource Teacher

Hope Espinda
- State STEM Resource Teacher
- DOE Resource & Classroom Teacher since 1993
- K-6 Elementary, K-6 Science Coach, Hawai‘i Writing Project Consultant

Leslie Hamasaki
- State STEM Resource Teacher
- DOE Science Teacher since 1997
- National Board Certified Teacher
Desired Outcomes
(Learning Targets)

• Review STEM
• Become familiar with STEAM
• Develop understanding of why STEM/STEAM education is important
• Provide examples of STEAM in the classroom
Webinar Reminders

- Close all other applications on your computer.
- Please make sure to mute (red) your microphones and keep them muted unless otherwise instructed.
- Please ask all questions through the chat box.
- Make sure your chat box is set for “Everyone.”

Questions will be addressed during Q & A.

This session will be recorded.
Improving and advancing Science, Technology, Engineering and Mathematics education to prepare all students for the opportunities and challenges in our changing world.
Goals of the Hawaii STEM Learning Strategy & Network

• Transform and revitalize the teaching and learning of science and mathematics in grades K-12 by purposefully integrating technology and engineering with science and mathematics.

• Significantly increase the number of public school graduates who pursue STEM-related careers or attain two- or four-year degrees in STEM fields.
Goals of the Hawaii STEM Learning Strategy & Network

• Increase STEM-foundational academic achievement and STEM learning opportunities for all students.

• Cultivate partnerships to expand and strengthen STEM education.
STEM Education

• Integrates the study of Science, Technology, Engineering and Mathematics

• Uses Scientific Inquiry and Engineering Design as unifying themes
STEM Education

• Emphasizes *21st-Century Skills*
  ◦ Critical thinking and problem solving
  ◦ Communication
  ◦ Collaboration
  ◦ Creativity and innovation

• Highly *rigorous* and *relevant* learning
Why STEM?

Learning high-level skills in context (RIGOR, RELEVANCE) + Making connections: cross-curricular, social, neural... (RELEVANCE) + Working together to build and share knowledge (RELATIONSHIPS) = Longer-lasting learning + Preparation for post-secondary opportunities
What is STEAM?

- **Science**
- **Technology**
- **Engineering**
- **Arts**
- **Mathematics**
What kind of art(s)?

(arts)--- subjects of study primarily concerned with the processes and products of human creativity and social life...

---Oxford American Dictionary

Image: http://www.flickr.com/photos/madekla/4278163564/
Other Variations of STEM

• **STREAM**
  • Science, Technology, Reading, Engineering, Arts, Math

• **STEAM GLASS**
  • Science, Technology, Engineering, Arts, Math, Geography, Language Arts, Social Studies

*They are basically the same—*
*all involve integration of content areas!*

*(Maximizing connections and sensory experiences)*
Question

Was Leonardo da Vinci an artist, scientist, or engineer?

Explain your answer.

(Please type your answer in the chat box.)
Painter, Sculptor, Scientist, Engineer, and Inventor

The Renaissance figure who some view as the personification of STREAM:

*Leonardo da Vinci*, the Italian painter and sculptor who also made a name for himself as a *scientist, engineer, and inventor.*

Leonardo da Vinci

• Carried a drawing pad with him at all times
• Drew constantly and sculpted models out of clay
• Collected everything—flowers, leaves, pieces of wood

Spent hours observing:

- Movement of birds’ wings in flight
- How a frog’s legs allowed it to leap so far
- Water running in a river which lead to a fascination with sciences like biology, botany, and geology

Leonardo da Vinci

“Leonardo did not compartmentalize his interests. To him, all knowledge was related. What he could learn in one field would help shed light on others. This attitude allowed him to cross-fertilize ideas in unusually creative ways. He thought of architecture, for example, as related to human anatomy. Buildings resembled bodies; the more he could learn about anatomy, the better an architect, or “building doctor,” he would be.”

Connection between the Arts & STEM Fields

“Nobel laureates in the sciences are seventeen times likelier than the average scientist to be a painter, twelve times as likely to be a poet, and four times as likely to be a musician.”

"The transition from the Middle Ages to the Renaissance included revolutions in the arts as well as the sciences. Clearly, something about art brings out creativity and innovation in ways different from but complementary to the sciences.”

Why is STEAM worth doing?
Congressional Hearing

https://docs.google.com/file/d/0B-s0EJGhaNBCOWtIRW9KYkFFYTQ/edit
Why is STEAM worth doing?

Rep. Suzanne Bonamici  D-Oregon, 1st District
Hillsboro, Astoria, McMinnville

- Many of her constituents express the importance of STEAM education
- Innovative companies across her district like Nike and tech giants like Intel rely on employees with a mind for science, but an eye for design

Richard Templeton, CEO of Texas Instruments

“it is one thing to have numbers and concepts, but if they cannot be brought together and visualized and turned into a product, it’s knowledge that will not lead to productive things.”

Congresswoman Bonamici Asks about the Importance of STEAM Education. http://www.youtube.com/watch?v=GU425V3NSkE
True or False?

1. Students who take more art classes have higher SAT scores.

2. Low-income kids who participated in arts education were 3x more likely to have high attendance than those who didn’t.

3. Children who practiced a specific art form developed attention skills and improved general intelligence. Training their attention and focus also leads to improvement in other cognitive domains.

4. Arts Integration techniques, which use multiple senses to repeat information, cause more information to be stored long-term—as opposed to short-term—memory, and may actually change the structure of the neurons.
The research compendium *Critical Links* has identified 6 major types of benefits associated with study of the arts and student achievement:

1) Reading and Language Skills
2) Mathematical Skills
3) Thinking Skills
4) Social Skills
5) Motivation to Learn
6) Positive School Environment

[Deasy, Richard J., “Don’t Axe the Arts!.” National Association of Elementary School Principals, Volume 82, Number 3 (January/February 2003).]
Holistic Learning

• Supports whole child
• Stimulates senses
• Deeper, *more meaningful learning*
• Multiple Intelligences—addresses diverse learning styles
• *Integrated*—allows many entry points for the learner
• Teachers do not transfer knowledge and skills to students in parts (learning not piecemeal)
• Learner *reflects on experiences* and interactions w/environment to build complex, systematic understanding of world
“Georgia Tech’s Parag Chordia believes music is a universal part of human culture, and his research shows music education can inspire greater interest in math, physics, and computer science.”
Creativity can be nurtured

Robert Root-Bernstein and his wife, Michele, co-authors of *Sparks of Genius*, conducted extensive research into the minds of inventive people and showed that creativity can be encouraged and enhanced through the exercise of thinking tools.

Without exercising this other half of the brain with its ability to foster creativity it atrophies just as failure to do physical exercise does for other parts of the body.

How can I incorporate STEAM in my classroom?

Image: http://www.texample.net/tikz/examples/feynman-diagram/
Ikebana

ˌiˈkeɪˌbænə

• Noun

• the art of Japanese flower arrangement, with formal display according to strict rules.

Oxford American Dictionaries
HCPS III Standards Gr. 4

Science Strand: Life and Environmental Sciences
Topic: Unity and Diversity
SC.4.5.3: Describe how different organisms need specific environmental conditions to survive

Fine Arts Strand: Visual Arts
Topic: How the Arts are Organized
FA.4.1.1: Use the elements and principles of art and design, such as emphasis, proportion, complementary colors, positive and negative space, and depth, to communicate an idea or mood.

Career & Technical Education Strand: Technological Design
Standard 1: TECHNOLOGICAL DESIGN: Design, modify, and apply technology to effectively and efficiently solve problems
Common Core Math Standards Gr. 4

Measurement and Data

Geometric measurement - understand concepts of angle and measure angles.

4.MD.5: Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement.

Ikebana

**Science:**
- parts of plants (stem, bud, leaf)
- types of plants
- catalog plants on campus
- grow plants on campus

**Technology:**
- electronic journal (Edmodo) to document learning
- virtual ikebana website:
  
Ikebana

**Engineering:** design an arrangement that can be easily transported

**Art:** form and function

**Math:** measurements, ratios, fractions, angles, and other aspects of geometry

**Language Arts:** reading diagrams in books and following steps; writing down what they learn in their ikebana journal; vocabulary words (supple, oasis, harmony)
Ikebana

• It is calming and takes focus, planning, and pragmatism.

• They will have to prepare ahead, look at possibilities, and know where to cut branches for balance (center of gravity).

• Ikebana takes concentration, observation, and making decisions to reach desired results.
Ikebana at Aiea Elementary
Ikebana at Aiea Elementary
Students are addressing elements common to both architecture and Sogetsu Ikebana, including lines, angles and organic asymmetry. The workshop demonstrates how design terms like 3D form, space, dynamic, balance and fluidity apply to both architecture and ikebana.
Spalding House

2411 Makiki Heights Drive
Honolulu, HI 96822
Interview with Aaron Padilla

- https://vimeo.com/61307384
The Tally
Mole Poster
To No End/Show Your Work
Lesson Idea

- What does infinity look like?
- How could it be represented in a work of art?

Infinity is when something never ends.
Textile 10101
Binary Code Weaving
The lower lip usually touches or sits on line GH and is approximately halfway between the nose and the chin. The mouth is wider than the nose and the corners of the mouth line up with the eyeballs.
Common Core Math Standards Gr. 8

• Domain: Expressions + Equations
• Cluster: Understand the connections between proportional relationships, lines, and linear equations.
• Code 8.EE.5: Graph proportional relationships, interpreting…
HCPS III Standards Gr. 6-8

**Fine Arts Strand: Visual Arts**
Topic: How the Arts are Organized
Benchmark FA.6-8.1.1 Create an original integrated art product or performance and explain how this process enhances a specific art work

**Science Strand: The Scientific Process**
Topic: Science, Technology, and Society
Benchmark SC.8.2.1 Describe significant relationships among society, science, and technology and how one impacts the other
Egg Heads
Faces and Places
STEAM Lesson Example
HCPS III  Fine Arts Standards Gr. 9-12

Fine Arts Strand: Visual Arts

Standard 1: Understand and apply art materials, techniques, and processes in the creation of works of art and understand how the visual arts communicate a variety of ideas, feelings, and experiences.

Topic: How the Arts are Organized

FA.9-12.1.1: Create original works of art using a variety of visual arts materials, techniques, and processes.
The Shape of Things
Greg Tang’s intuitive approach to teaching combines poems and playful illustrations to inspire kids to embrace the challenges of problem-solving. Math will never be the same!

MATH and ART HISTORY?
Of course! Best-selling author Greg Tang knows that kids need to develop a variety of skills in order to think creatively when it comes to problem-solving. With Math-terpieces, the fifth in his acclaimed series of mind-stretching math challenges, Tang creates his most revolutionary learning environment yet.
Greg Tang MATH-terpieces

https://docs.google.com/presentation/d/1uUQyLscCljsbin53GrJcKX_ZCv3alCk5LTBq7skOsbk/edit#slide=id.p
Science Concepts via Art
Science Concepts via Art

60 seconds in a Minute
...1 Hippo... 2 Hippo...
...1 second... 2 second...

60 minutes in an Hour

12
9
6
3
0

4 hours in a Day

All Magnets have a North + South pole.

North + South are attracted to each other

North + North repel each other

South + South repel each other

How are you?
long time no see!

I don't know you.
Nor do I!

Get away!
Ahh!
Art with Science Concepts
Annual Poster and Cover Contest

- Any public or private school student, grades 6-12, may enter.
- Submission Deadline is Friday, February 15, 2013 by 4:00 p.m.
- Download the Chevron Poster & Cover Contest Entry Form for 2013

Encouraging students to think artistically about science and engineering is the main goal of the Hawaii State Science and Engineering Fair Poster and Cover Contest. Any public or private school student, grades 6-12, may submit one self-designed (original) poster.

The first place winner of the 2012 Poster and Cover Contest was Von Dickens Ulsa of Farrington High School. He received $300 and his design, featured below, will be on the cover of the 2012 HSSEF program booklet. His teacher, Tess Pereira, received a $25 gift certificate for art supplies.

The second place winner, Serena Le of Punahou School, was awarded $200. Her teacher, Anna Monaco, received a $25 gift certificate for art supplies.

http://hawaiiacademyofscience.org/hssef/poster/
Dance vs. PowerPoint

www.ted.com/talks/john_bohannon_dance_vs_powerpoint_a_modest_proposal.html

View from 4:15-6:00
HCPS III Fine Arts Standards Gr. 6-8

Fine Arts Strand: Drama and Theatre

Standard 3: Understand and apply the skills of acting, design, and technical theatre and understand the role of drama in various cultures throughout history

Topic: How the Arts Communicate

FA.6-8.3.5: Demonstrate how theatre can be used to communicate concepts from another content area
Examples from beyond the classroom

- Camouflage for US soldiers inspired by painter Abbott Thayer
- Pacemaker by Earl Bakken based on metronome
- Medical stents and vehicle airbags inspired by origami
- Steve Jobs from Apple described himself & colleagues as artists

STEM to STEAM

Tomorrow’s innovators are artists and designers

- STEAM is a pathway to increase U.S. economic competitiveness.

- Art + Design provide real solutions for our everyday lives, distinguish American products in a global marketplace, and create opportunity for economic growth.

- Design is increasingly becoming a key differentiator for technology startups and products.

http://stemtosteamp.org/take-action/
"After a certain high level of technical skill is achieved, science and art tend to coalesce in esthetics, plasticity, and form. The greatest scientists are always artists as well."

—Albert Einstein

Big Idea

STEM and STEAM both involve best practices such as:

- integration
- collaboration
- critical thinking
- creativity
- project-based learning
Resources

• LiveBinder site with resources:

http://www.livebinders.com/play/play_shared_binder?id=251388
My STEM Hawaii

https://sites.google.com/site/hawaiistem/home

Welcome to My STEM Hawaii

mystemhawaii.org

How to use the Hawaii STEM Portal
Review of Today’s Agenda

Overview of STEM & STEAM

- What is STEM and STEAM?
- Why STEM? Why STEAM?
- What does STEM/STEAM look like in the classroom?

You should now have a:

- Familiarity with STEM and STEAM
- Understanding of why STEM/STEAM education is important
Acknowledgements

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  - Greg Tang, author of MATH-terpieces
  - Janet Tran, UH Architecture student
Any Questions?