Professional Development Final Report:

Advancing STEAM Integration in the Elementary Grades

Developing Themes in the Content Areas

NASA Endeavor Project

STEM Leadership Seminar

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Abstract

How do we encourage teaching that creates stimulating and inspiring classrooms, where students engage in problem-solving and use their creativity and imagination to address interesting and important subjects, and where teachers push students to continue learning long after the exam is over? (Boykin & Noguera, 2011, p. 175) Every year educators stress over the limited time available to teach required skills and concepts. Unfortunately, too often there is little time possible to create, invent, and learn together. The goal of this workshop is to encourage teachers to make STEAM projects part of their classroom environment. Educators will have an opportunity to identify curriculum connections to STEAM. Time will be spent working collaboratively on creating exciting challenges that inspire learning.

Workshop Focus

The program emphasized bridging STEAM activities to grade level curriculum content and identifying connecting themes. Educators opened the presentation by discussing the issues that inhibit them from introducing the design process to students. The most common problems involved a lack of time, funding, and the need for professional development. However, every participant had a desire to bring STEAM to their students. Each activity supported the New York State Standards for kindergarten through fifth grade. The workshop included three "hands-on" experiences that incorporated science, mathematics, engineering, social studies, literacy, and the arts. Participants left the session with strategies and materials to make STEAM part of their day.

Participant Information

The Westchester Teacher Center sponsored a STEAM Conference on March 14, 2019, at Manhattanville College, Purchase, New York. The event began at 8:00 a.m. with a keynote speaker and ended at 3:00 p.m. with a closing discussion. More teachers and administrators had experience at the elementary level than upper grades. Approximately one-hundred educators from ten districts from Westchester County registered for the conference. During the STEAM presentation forty participants sat at round tables and formed teams of six people. Each team moved about the room gathering ideas and collecting materials. Everyone participated with enthusiasm and competed in design-based projects.

Standards

NGSS

[1-PS4-1 Waves and Their Applications in Technologies for Information Transfer](#)

Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

1-PS4-4 Waves and Their Applications in Technologies for Information Transfer

Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.

1-PS4 Waves and Their Applications in Technologies for Information Transfer

[4-PS3-2 Energy](#) Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

[4-PS3-4 Energy](#) Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

[4-PS4-3 Waves and Their Applications in Technologies for Information Transfer](#)

[5-ESS3-1 Earth and Human Activity](#)

ESS-3 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

New York Social Studies Framework

1.8b Oral histories, biographies, and family time lines relate family histories.
2.2 People share similarities and differences with others in their own community and with other communities.
3.10b World communities have needs, wants, and limited resources. To meet their needs and wants, communities trade with others. Technological developments in transportation and communication have influenced trade.

4.6c Improved technology such, as the steam engine and the telegraph made transportation and communication faster and easier. Later developments in transportation and communication technology had an effect on communities, the State, and the world.

4.2 Native American[*] groups and the environment

5.1 Early peoples of the Americas

3.3 Geographic factors often influence where people settle and form communities.

2.8 Communities face different challenges in meeting their needs and wants.

K.9a A need is something that a person must have for health and survival, while a want is something that a person would like to have.

2.1 By discussing different types of housing (apartment, single-family house, etc.) and the proximity of houses to each other, students will understand the term "population density" and how it applies to different communities.

3.9b People in communities have various ways of meeting their basic needs and earning a living.

4.2a Geographic factors often influenced locations of early settlements.

5.2b Complex societies and civilizations adapted to and modified their environment to meet the needs of their people.

Students will compare how the Mayas, Aztecs, and Incas adapted to and modified their environment to meet the needs of the people, examining the clothing, farming, shelter, and transportation systems for each.

**Common Core State Standards for English Language Arts**

⬚

1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

a. Come to discussions prepared, having read or studied necessary 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. Ask and answer questions to demonstrate an understanding of a text, referring explicitly to the book as the basis for the answers.

 1. Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

2. Determine the main idea of a text; recount the key details and explain how they support the main idea.

 3. Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Summary of Project

The purpose of this project was to identify connecting themes within curriculum areas for the integration of STEAM. Throughout the year, educators are continuously trying to keep up with the demands of the Common Core Curriculum. It seems whenever curriculum changes occur, the result is an increase in content. Between required curriculum and testing, there is little time for enrichment. Today's children need opportunities to think creatively, share ideas, and work together to solve problems. Bringing STEAM into the classroom is the path for students to learn and practice essential 21st-century skills.
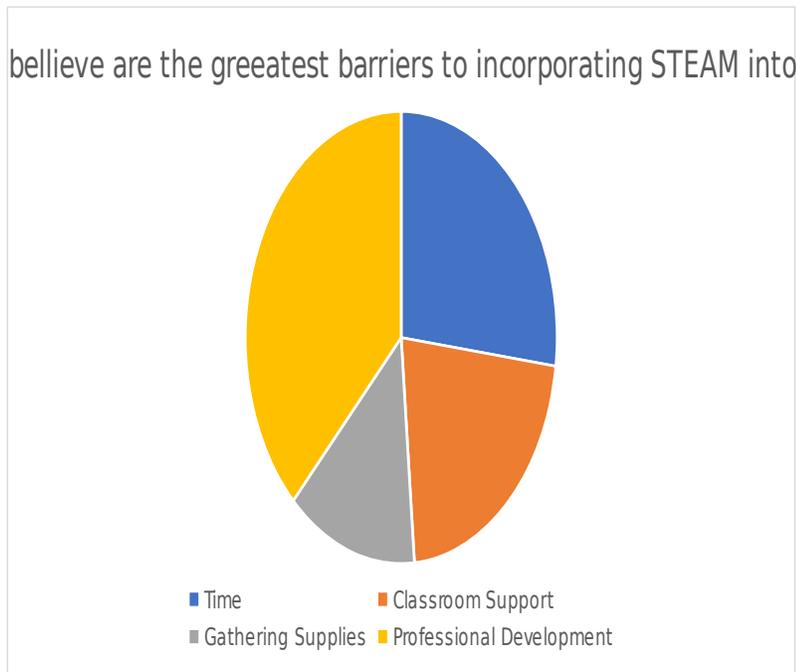
Pre-workshop Survey

1. Do you presently include STEAM activities in your class?

2. What subjects do you feel connect best with the design process? Circle your choice.

   Literacy   Social Studies   Mathematics   Science

3. Do you feel STEAM, STEM, or Makerspace can engage and promote student learning?

4. What do find is the most significant barrier to incorporating STEAM activities into your classroom?

5. What resources do you feel are needed to initiate STEAM activities with your students?
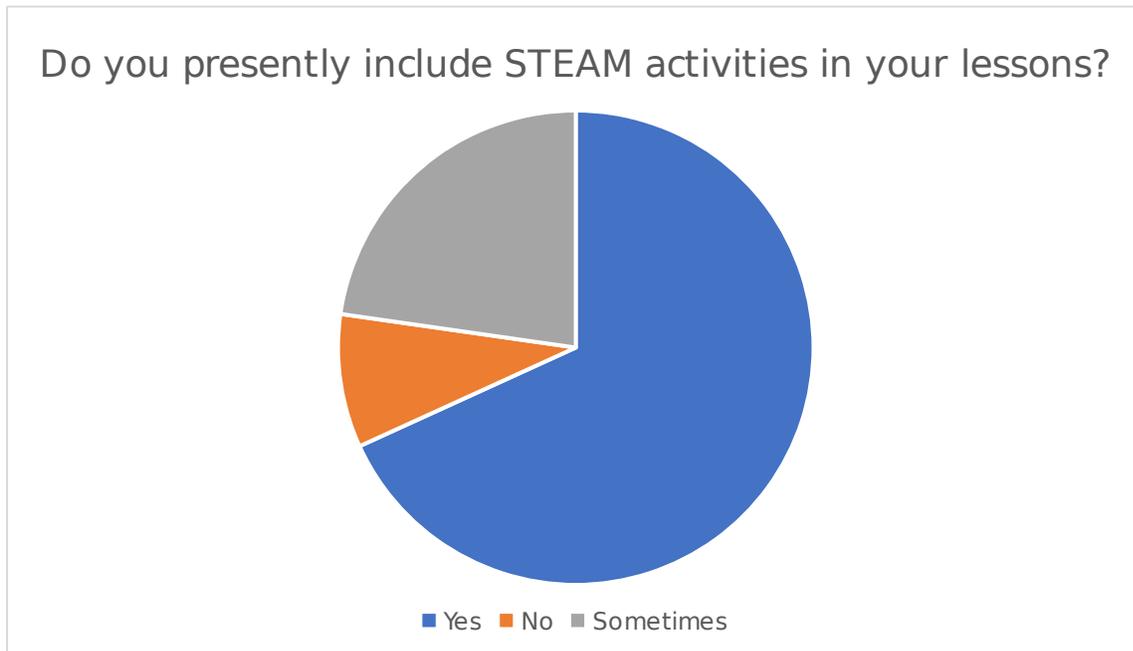
## What subjects do believe connect best with the design process?

Literacy ■ Mathematics ■ Science ■ Social Studies
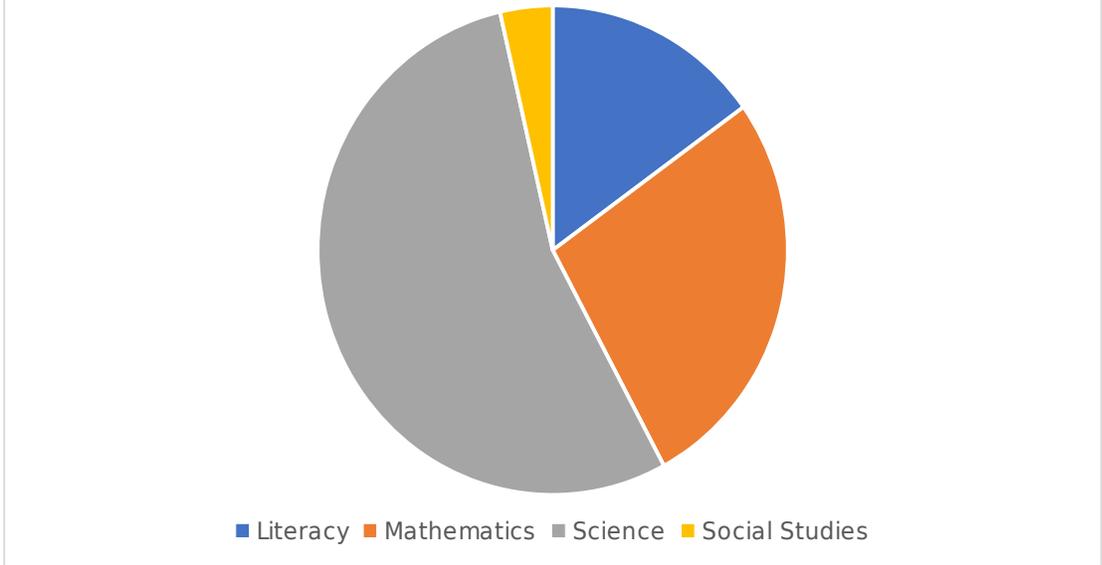
What do you bellieve are the greeatest barriers to incorporating STEAM into you lessons?

■ Time ■ Classroom Support
■ Gathering Supplies ■ Professional Development

Description of Professional Development

The session began with a pre-workshop survey and brief discussion about bridging

STEAM to the elementary classroom curriculum. It was interesting to hear that most teachers

desired professional development and time to plan with their colleagues. The focus of the

program was to establish a comfort level and provide simple activities for the participants to

begin a STEAM initiative in their schools. The first slide stated that STEAM benefits both

teachers and students.
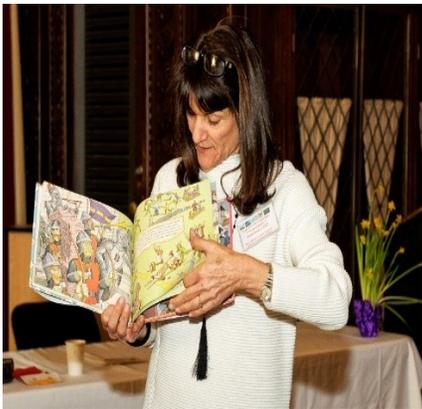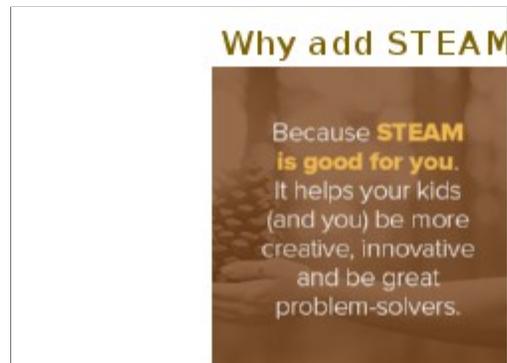
Participants listened to the book <u>The Marshmallow Incident</u> which linked literacy, social

studies, mathematics, engineering, and science. After reading the story, groups identified

curriculum connections and moved into a design challenge. The "hands-on" experience

prompted great discussions and sparked new ideas. The teachers participated in a Catapult

Challenge that reflected the main idea of the story. The audience discussed the potential of using

this project to teach simple machines, force and motion, and energy. Literacy skills included

cause and effect, plot, vocabulary, and theme. Also, government, citizenship, and supply and

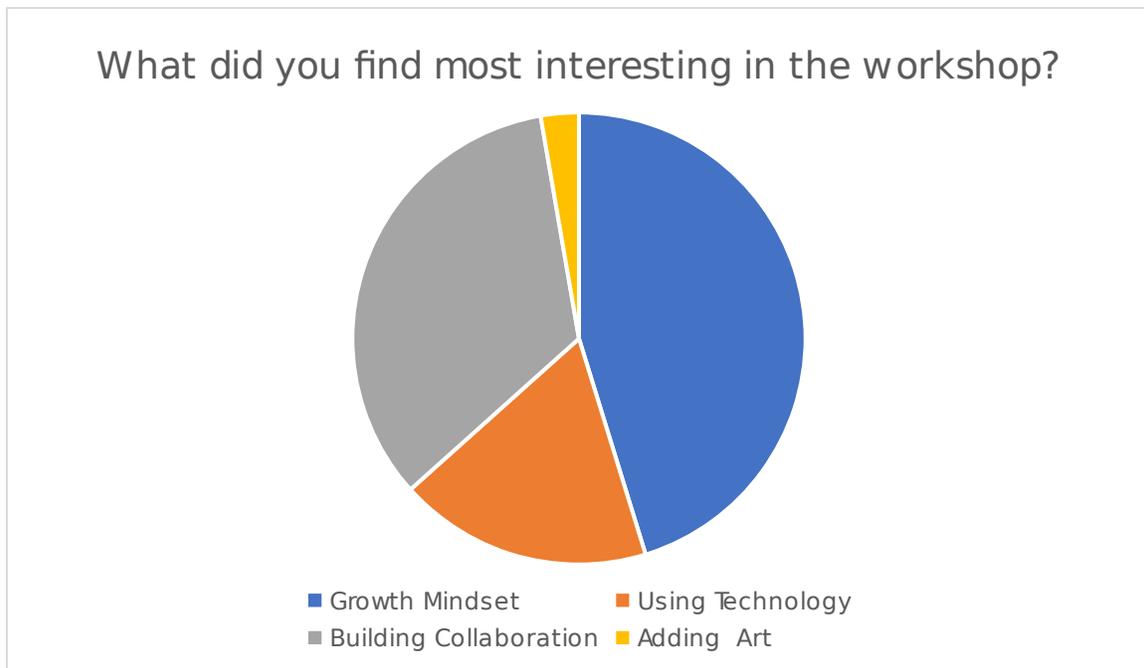demand were social studies concepts that connected to the activity.

The Story of Jumping Mouse was the second book chosen for the workshop. This Native

American Legend connected food webs, habitats, ecosystems, and landforms in a beautiful tale

about friendship. After reading the story, groups used graphic organizers to create dialogue. The

participants learned how to construct a puppet theater with PVC pipes and cardboard. Finally,

each team selected materials to build a puppet of one character from the story. They practice

their dialogue using Screencastify and the completed puppet. The result was a collaborative

work of art that encompassed writing, readers theater, puppetry, engineering, and technology.

Everyone was engaged and inspired to discuss other stories where STEAM enhanced learning.
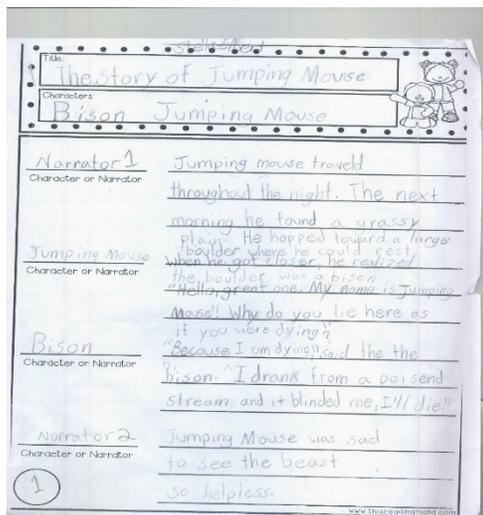
Post- Conference Survey

1. Do you feel better prepared to introduce STEAM to your students?

2. Did you get any new ideas from this workshop?

3. Which curriculum area would you feel confident in embedding a STEAM activity?

4. What other STEAM areas would you like addressed in future workshops?

5. Would you be interested in joining a STEAM Professional Learning Community?

What did you find most interesting in the workshop?

- Growth Mindset
- Using Technology
- Building Collaboration
- Adding Art

The results of the first post-conference question were interesting. The workshop began with a short video explaining the difference between a Growth and Fixed Mindset which was new to many educators. https://www.bing.com/videos/search?q=what+is+a+growth+mindset+turtle&&view=detail&mid=C97D86F802978BE30ABBC97D86F802978BE30ABB&&FORM=VRDGAR In the film, the tortoise, who has a growth mindset, embraced obstacles as an opportunity to improve. While the hare who had a fixed mindset, relied on his past experiences to be successful. After the video, the group discussed the need to praise our students' efforts rather than the product. It is important that students know that if you are not good at something this moment, with additional effort and practice, you may be good at it in the future.

Teachers realized, they too, need to have a growth mindset when introducing STEAM to their students. If a student knows more than us, we must celebrate and share their expertise.

Do you feel better prepared to introduce STEAM to your students?

■ Yes ■ No ■ Somewhat
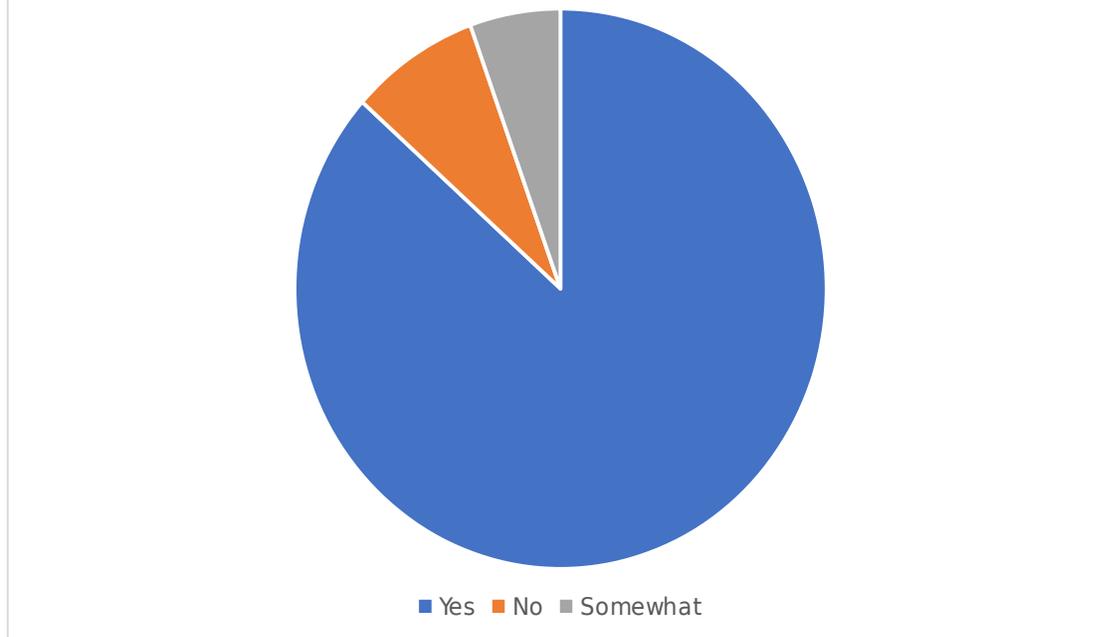
The outcome of the second post-conference question was inspiring. The majority of educators felt more comfortable incorporating STEAM into their classroom. Many requested additional professional development opportunities that provides "hands-on" learning in STEAM. Teachers were excited to identify connections for activities within their content areas. They understood that STEAM could introduced science, math, and social studies concepts and were comfortable beginning with simple challenges.
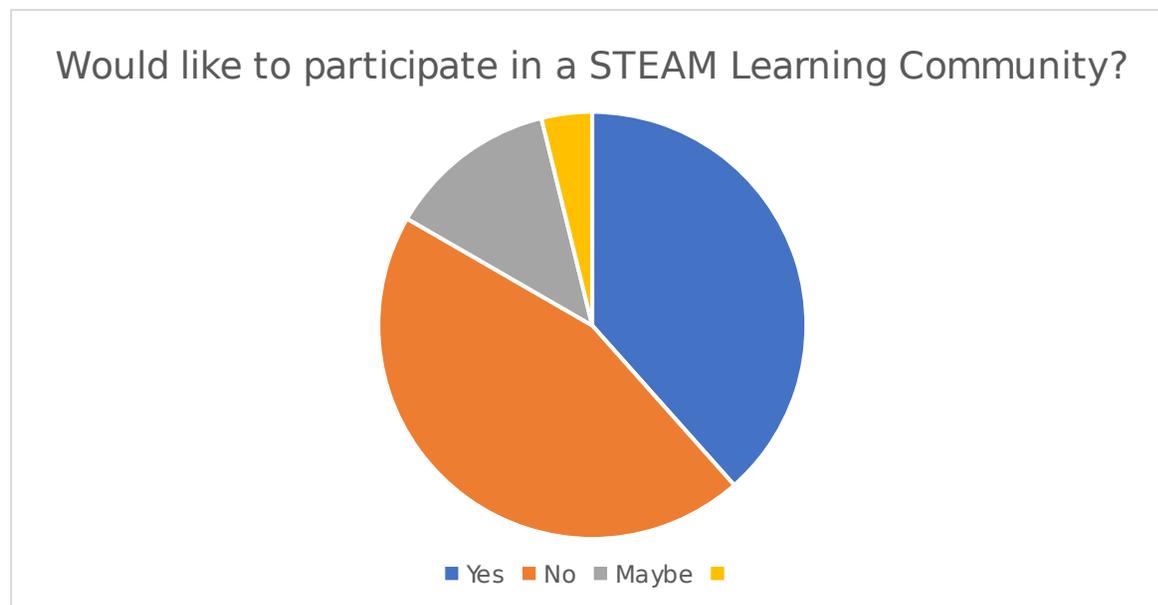
The results and comments from the third question reflected the lack of time and other obstacles instructors incur. It was rewarding that a good number would like to participate in a STEAM Professional Learning Community. Keeping the activities fun, uncomplicated, and less costly, inspired the participants to engage in STEAM activities. Unfortunately, there are never enough hours in a school day. Although, everyone agreed we must be continuous learners and work together to stay current.

Analyzing data from the workshop, convinced The Central Westchester Teachers' Center to continue building a STEAM initiative in Westchester County. A number of participants added their contact information to the post-conference questionnaire indicating an interest to initiate a STEAM Professional Learning Community at the elementary level.

Survey Results and Pedagogy

While walking around the room, it was apparent the teachers were engaged and enjoyed working with their peers. There was a sense of collegiality, communication, and collaboration among the groups. Everyone was motivated to complete the challenges and share their success. Teams reflected on what did not work with their designs and revised final products.
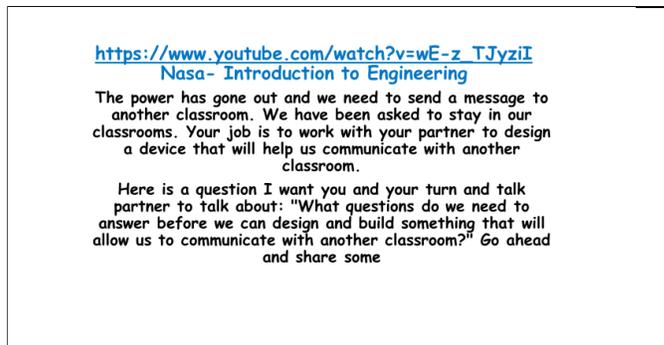
Groups spoke about time management, the lack of funds, and a need for training. Throughout the program questions and concerns were discussed and addressed. It was agreed that every activity will not turn out as expected nor does it have to be completed. Often students will continue working on a project during their free time.

Specific rubrics, evaluations, and grades are not necessarily required. Materials can easily be supplied by students or funded by local grants. Collecting paper towel rolls, string, tape, pipe cleaners, newspaper, and glue guns are a great way to start. Finally, as a recommendation teachers should use the internet as a resource for locating excellent STEAM projects, activities and challenges.

NASA Resources

A NASA clip, *Introduction to Engineering*, was included in the workshop. The video explained that engineers start with a question and think of ways to find solutions. They plan and focus on what they are making. Once they build a product, it is tested and improved. The short video was a proper introduction to the workshop.

https://www.bing.com/videos/search?

q=nasa+what+is+an+engineer+video+kids&&view=detail&mid=3DC4EB5551C0504977D83D

C4EB5551C0504977D8&&FORM=VRDGAR

Nasa for Educators was an incredible website to use as a reference throughout the

program. The site addressed a multitude of topics that were relevant to teachers and students at

every grade level.

The material was initially produced for NASA by the National Institute of Aerospace as

part of the NASA eClips™ activity. The packet for Educators and Students, Grades K-5, is

available in electronic format at the NASA eClips ™.

www.nasa.gov/nasaeclips.

https://www.nasa.gov/pdf/716282main_EDC_Design_Packet_K-5.pdf

The NASA Educator Resource Center provides educators with materials, lessons, videos,

and activities to use with their students. There is such an abundance of great resources that

teachers were advised to visit the site and search for materials that will enhance the curriculum.

https://www.nasa.gov/audience/foreducators/best/edp.html

https://www.nasa.gov/audience/foreducators/k-4/index.html

NASA Sci Files consists of one-hour instructional programs for students in grades 3

through 5. Teachers were impressed with the series because it integrates mathematics, science,

and technology through Problem-Base Learning. Creating PBL lessons is a goal of educators

who want to bring their students 21st-century skills. The resource is free and organized by

subject, topic, and grade level. Each video can be saved in Google Classroom, assigned to students, and connected to assignments.

https://www.knowitall.org/series/nasa-scifiles

   Nasa Kids' Club is a site that provides games for children pre-k through grade 4. The games support standards in science, technology, engineering, and mathematics.

   On this site, you will find games of various skill levels for children pre-K through grade 4. The games are related to NASA activities and focus on Earth, space, and rockets. They support national education standards in science, technology, engineering, and mathematics.

https://www.nasa.gov/kidsclub/text/extras/Game_Descriptions_National_Standards.html

Impact of the NASA Endeavor STEM Certificate Program

   Each course has been inspiring, the readings informative, resources excellent, and content impressive. Creating 5 E units has become a priority when planning lessons. It has been apparent that beginning lessons with an engaging experience builds curiosity and generates an excitement for learning.

   Extending from *Methods in STEM* to the STEM Leadership Seminar, the instructors have been supportive, knowledgeable, and experts in their fields. It has been a privilege to communicate and collaborate with many dedicated educators along this path. As continuous learners, our students are fortunate to have teachers who want to bring best practices to their classrooms.

   In addition, Reciprocal Teaching and using literature to teach science has become a daily practice in the classroom. Students look forward to being Clarifiers, Questioners, Predictors, and Summarizers. As a result, they read more carefully, work cooperatively, support group members,

and communicate with a purpose. These strategies have converted the classroom from a

teacher-centered environment to one that is student centered.

Readings

There are many readings that were inspiring throughout the program. *Observing Literacy*

Practices in History Classrooms by Jeffrey D. Nokes (2010), supported literature as a vital

component in the social studies classroom. The use of textbooks for information and notetaking

was no longer considered a best practice. Identifying appropriate literature both fiction and

nonfiction should be utilized to enhance social studies themes and concepts.

Reading and Writing to Learn: Literacy and Science Integration in 4th Grade

Classrooms (Flushman 2016) was an excellent article. According to Flushman, "Students benefit

from more extended periods of reading and writing while engaging in the scientific

investigations to help them grapple with these new conceptual understandings." With the

addition of STEAM activities to language arts, social studies, and mathematics, lessons

stimulated student learning and became relevant. Allotting extra time for content and projects,

improved stamina, increased interest, and promoted in-depth problem solving.

Conclusion

The workshop was a success on many levels. The participants were inspired to

incorporate STEAM into their curriculum. Teachers relaxed about introducing STEAM to their

students; however, some concerns were funding and a lack of professional development

opportunities. Collegiality was evident through the many great conversations, and exchange of ideas among the participants.

After the workshop completed, teachers continued to brainstorm opportunities where STEAM activities would enrich their lessons. It was apparent through the closing discussion and great questions; the group thought the learning experience was valuable and were excited to share activities with their students. It is my opinion that many will introduce STEAM to their classes upon in the near future.

<h3 style="text-align:center">Participant Contact Information</h3>

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Workshop Summary Slide