PROFESSIONAL DEVELOPMENT FINAL REPORT: INTEGRATING STEM INTO THE VIRTUAL CLASSROOM

STEM Leadership Seminar

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I. Title:

Integrating STEM into the Virtual Classroom

II. Curriculum Topics, School Name, Number of Educators, Grade Levels

K12 Iowa Virtual Academy (IAVA) is a virtual school affiliated with the Clayton Ridge Community School District located in Guttenberg, IA serving student in Kindergarten through 12th grade. The school provides a homeschool feel with the support of licensed educators to approximately 500 students ages 5-18. The curriculum at Iowa Virtual Academy is provided by K12 and materials and lessons are updated to align with the Common Core Standards.

All students are sent a computer, printer, textbooks and any other materials they should need to complete the curriculum. Some lessons are done online through the student's Online Learning System (OLS) account. Every student has a learning coach that provides most of the instruction during the school day. Every learning coach is sent guides to teach the curriculum and has their own account in the online learning system to log attendance for their child. Every day the students are required to attend a live class connect with their teacher to receive instruction for a licensed educator and the extra support they need in math and ELA.

The participants from Iowa Virtual Academy included the Head of Schools, the Operations Manager, the Secretary, the K-12 Family Support Liaison, the K-12 Guidance Counselor, the K-8 SPED teacher, the 9-12 SPED teacher, two 7-12 ELA teachers, one 7-12 math teacher, the 5-6 teacher, the 4th grade teacher, the 7-12 social studies teacher, the 7-12 science teacher, and myself, the K-3 teacher.

III. Standards Addressed

I selected a broad topic of integrating STEM into the virtual classroom because the educators I work with do not integrate STEM into their classroom currently, so they are new to the idea. Plus, being virtual teachers makes it difficult to come up with creative ways to integrate STEM activities that replace or work with the current classroom lessons. Since nearly every teacher in our school teaches either different grade levels or subjects, I chose to implement a training that was not subject or grade specific. Instead, I focused on introducing many different STEM resources to the staff and ideas/strategies on how to integrate STEM into the virtual classroom. See Appendix 1 for a full list of supported practices and standards.

IV. Summary of Project

The goal of the PD was to increase educator awareness of the STEM resources available and expose teachers to the possibility and excitement of STEM in the virtual classroom. I presented many different resources from NASA and my Endeavor courses to the IAVA staff so they would have many to choose from and feel like the possibilities were endless for what they could integrate into their classroom. I shared Scratch and the programs I have coded and how I used those with my classes. I introduced MIT App Inventor, NOAA, NOAA for Kids, Surf Net Kids,

flipped lessons, NASA, NASA Search, NASA Kids Club, NASA simulations, NASA Science, and online PHET simulations. I also showed overviews of some STEM lessons I have included within my virtual classroom. I also presented a few ideas on how I could see some of the resources being used within their virtual classrooms.

V. Pre-Question Survey List

STEM Pre-Survey

1) How much do you know about STEM/STEAM?
   (A great deal, A lot, A moderate amount, A little, None at all)
2) How interested are you in implementing STEM activities within your classroom?
   (Extremely interested, Very interested, Somewhat interested, Not so interested, Not at all interested)
3) Are you familiar with NASA resources?
   (Yes or No)
4) Have you implemented STEM activities within your classroom already?
   (Yes, No, If so, how did it go?)
5) Do you think your learners will be interested in STEM activities?
   (Extremely interested, Very interested, Somewhat interested, Not so interested, Not at all interested)
6) Do you think your learners will be engaged in STEM activities?
   (Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely)
7) What areas of STEM are you interested in learning more about?
   (Science, Technology, Engineering, Mathematics, Art)
8) What do you think are the benefits of STEM within the classroom? (fill in the blank)

VI. Professional Development Training Description

I began the Professional Development by thanking the staff for being a part of my presentation and asked them to keep an open mind because I know they all have extremely full plates with the number of subjects and grade levels we all teach so STEM is not their biggest concern right now. I addressed some of the answers I saw within the Pre-Survey answers and told the teachers I really tried to include a variety of resources that could be applied to all grade levels and many subjects so that there was something for everyone within the PD.

I presented all the different resources and showed the projects I had made with Scratch programming. I introduced MIT App Inventor and briefly described what the purpose is and how it could be used with in the virtual classroom. I covered the websites for NOAA, NOAA for Kids, Surf Net Kids, NASA, NASA Search, NASA Kids Club, NASA simulations, NASA Science, and online PHET simulations. While covering every website resource I showed the staff data, images, topics covered in each website, and lessons, activities, and games available through the websites too. I also wanted to share how I had implemented some STEM activities within my virtual classroom and challenges, struggles, and success I had. I showed brief PowerPoints I had used within my STEM lessons and briefly described the purpose and how students did. I also discussed things I would do different next time and success I found. I used Flipped Lessons to introduce implementing STEM within their classroom to combat the time issue everyone has. I shared how I have used flipped lessons to record myself giving a lesson and then sent it to the kids to use as extra help/practice and how we could do the same with STEM lessons. We do not always have time to implement STEM lessons, but we could record flipped lessons, ask students

to watch them, and then they are ready for their next live class to discuss and dive in. I also included screenshots of the simulations and websites so everyone could get a good idea as to how they could use the resources within their virtual classroom.

Lastly, we ended with sometime for everyone to collaborate on ideas for how they could use the resources within their classroom. I thought this was important since we are a virtual school and nearly everyone teaches a different grade level or subject. It gave us a chance to brainstorm together and ask each other for advice on how to implement STEM within our specific grade level and subject area. We could also problem solve together if there were any concerns moving forward with an implementation idea.

VII. Activities in the Pick-up Unit

1) Participants completed a Pre-survey the week prior to our face-to-face PD.

2) PowerPoint presentation for about 35 minutes introducing STEM resources.

3) About 5-10 minutes was given for questions and time to explore resources.

4) Participants collaborated for about 15 minutes on ideas and ways themselves and others could use the STEM resources introduced to them. Fears and concerns were discussed too to help relieve any anxieties the participants were feeling about implementing STEM into their virtual classroom.

5) Participants completed a Post-survey.

VIII. NASA Data Used

The NASA Resource Search Tool was used to find many different subjects and grade level specific content to show the participants how easy it could be to find a resource they could use within an existing lesson. I wanted the teachers to know they could start implementing STEM just by using an article, image, or data within a lesson they already had wrote up to enhance that lesson. Once they were comfortable in this area, they could jump into deeper STEM implementation.

The rest of the resources I used within my PD were all from NASA Endeavor classes I have taken. Flipped Lessons, Scratch, MIT App Inventor, NOAA, NOAA for Kids, Surf Net Kids, NASA, NASA Search, NASA Kids Club, NASA simulations, NASA Science, and the Online PHET simulations were all resources I learned about in my NASA Endeavor courses.

Besides the resources above, I also showed the participants the Mars data I used within a STEM lesson I taught in my virtual classroom. In the Mars lesson my students and I used a NASA image of Mars' surface to measure the diameter of the craters. We also used articles and captions to learn about Mars as a planet so we could build a Mars community. We compared facts about Mars and Earth from NASA data to help guide our community building. I wanted everyone to see NASA data, images, articles, facts within a lesson and hear the challenges and success of it.

IX. Follow Up Activities & Post-questions Survey List

Besides the Post-Survey I sent an email about a week after the PD offering my help and support to everyone as they explore the world of STEM and begin to implement the resources, I shared with them. I reminded them of the simple ways to begin including STEM within their already

existing lessons and gave a few ideas on how the resources could fit into their content area. I also sent a condensed version of my PowerPoint presentation in case anyone needed to refer back to a resource or idea.

STEM Post-Survey

1) How much do you know about STEM/STEAM?
   (A great deal, A lot, A moderate amount, A little, None at all)
2) How interested are you in implementing STEM activities within your classroom?
   (Extremely interested, Very interested, Somewhat interested, Not so interested, Not at all interested)
3) Are you familiar with NASA resources?
   (Yes or No)
4) Have you implemented STEM activities within your classroom already?
   (Yes, No, If so, how did it go?)
5) Do you think your learners will be interested in STEM activities?
   (Extremely interested, very interested, Somewhat interested, Not so interested, Not at all interested)
6) Do you think your learners will be engaged in STEM activities?
   (Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely)
7) What areas of STEM/STEAM are you interested in including in your classroom?
   (Science, Technology, Engineering, Mathematics, Art)
8) What do you think are the benefits of STEM within the classroom? (fill in the blank)

X. Outcomes: Final Data Collection Analysis

a. Pre-Survey Results

Participants in the PD indicated 85% were not familiar with NASA resources, and 93% had never implemented STEM activities within their classroom. When answering how much participants know about STEM 21% said a great deal, 0% said a lot, 28% said a moderate amount, 35% said a little, and 14% said none at all. When asked how interested participants were in implementing STEM activities within their classroom 7% said extremely interested, 21% said very interested, 50% said somewhat interested, 14% said not so interested, and 7% said not at all interested. When asked if participants thought learners would be interested in STEM 42% said very interested, 28% thought somewhat interested, and 21% thought not so interested. Participants replied 14% very likely, 43% likely, 29% neither likely nor unlikely, 14% unlikely when asked if students would be engaged in STEM activities. What areas of STEM are you interested in learning more about? 43% science, 57% technology, 21% engineering, 29% art, 21% math. When asked what participants thought were the benefits of STEM, they said hands on, cross curricular learning, honestly I don't have time to implement STEM into ELA, lifelong learning, more collaboration with other students, making math real and not just numbers, thinking outside the box.

b. Post-Survey Results

Participants in the PD indicated 100% were not familiar with NASA resources and 79% had never implemented STEM activities within their classroom and 21% has. When answering how much participants know about STEM 36% said a great deal, 36% a lot, 29% said a moderate amount, 0% said a little, and 0% said none at all. When asked how interested participants were in implementing STEM activities within their classroom 29% said extremely interested, 29% said very interested, 14% somewhat interested, 29% not so interested, and 0% said not at all interested. 31% of participants thought learners would be extremely interested 15% very

interested, 54% thought somewhat interested, and 0% thought not so interested. Engaged in STEM activities 38% very likely, 46% likely, 8% neither likely nor unlikely, 8% unlikely. What areas of STEM are you interested in learning more about? 64% science, 64% technology, 50% engineering, 36% art, 54% math. When asked what participants thought were the benefits of STEM they said: hands on learning, increased student engagement and collaboration, cross-curricular learning, challenging and engaging for students, fun and interactive learning, solving different problems, I loved learning about the STEM opportunities that are out there and I appreciated the examples of how simple it can be. Thank you for a great presentation, I learned a lot. Thinking outside the box.

c. Was your PD successful? Why or why not?

I did not feel like my PD was successful at first because it felt like I had very little interest or support from the staff. I think I was very informative and gave them lots of good STEM resources and ideas to use within their classrooms, but I do not think many of them will take what the learned and start implementing STEM within their lessons. Even my Head of Schools didn't seem interested or like my PD was valuable and that sets a precedent for the rest of the staff. Then I started to look over the post-surveys and analyze how the answers changed from the pre-survey to post-survey. I found that overall the participants knowledge of NASA resources and STEM increased. I saw an increase in how interested and engaged participants thought learners would be in STEM too. I got a few comments thanking me for a great PD too. One participant did take one of the NASA resources and implement it within their classroom too. She didn't do a full-on STEM lesson, but she did take an article and some data from a NASA resource and she used it to enhance her lesson. This was very encouraging for me to keep encouraging others and leading PD to promote STEM. I am hopeful that I at least planted a seed and the teachers begin to see ways they could use a STEM resource to enhance the lessons they are teaching as they reflect upon their year and begin to look forward to next year.

d. How did this project relate to the readings?

Throughout completing this PD project one reading continued to come to mind. Lustick (2011, p.19) said, "...education leaders might want to reevaluate their investment of time and resources into in-service professional development or at least design workshops to acknowledge individual needs/interests, content learning, and specific goal-oriented outcomes." During my PD I continued to think it was kind of pointless because the participants were not particularly interested in what I had to say. Next time I develop a PD for my school I would really like to consider what the participants need and want. It is a little trickier to find something in common that all staff wants because we all teach different grades and subjects, but I think through a survey I could find something that would bring us all together to collaborate and use each other to build ourselves up and become better educators.

It was interesting to me to evaluate my own PD according to how I evaluate PD trainings I attend. I also used DeSimone's criteria to determine how effective my PD was. Desimone (2011) says for a quality professional development to occur there should be a content focus, active learning, coherence, appropriate duration, and collective participation. My content focus was on STEM in the virtual classroom and NASA resources. I think I had a good idea to introduce the participants to a lot of resources that are out there because everyone teaches different grades and subjects, but I also feel like my PD could have been more effective if I had just focused on one way to implement STEM through a NASA resource like Scratch. I also was so nervous and focused on just getting through the PD without passing out that I really didn't let the teachers

collaborate as much as I could have. I should have worked in an activity instead of just having time to discuss ideas and work through anxieties. I think implementing STEM into the virtual classroom needs a longer duration too. There needs to be more than one training, time for teachers to start implementing and testing the waters, and then time for us to come back together to share success and work through our struggles. The next PD I plan I want to be more coherent than this one. I tried to introduce too many resources at once and there weren't good transitions between resources or much of a way to tie them together. Lastly, I need to figure out a way to increase collective participation even in the participants that said they are not at all interested in STEM and did not care to learn about any resources. Moving forward I am going to use what I have learned from this PD experience and DeSimone's criteria to develop and plan future PD trainings to continue to motivate my school to implement STEM, use NASA resources, and improve their teaching. Professional development is meant to motivate, empower, educate, and give teachers the tools they need to become better teachers for the success of the kids.

e. Will the teacher do these activities again?

I was very discouraged at first and had no desire to implement a PD ever again, but as I was writing my final paper, I find myself reconsidering. I think even though I felt like I didn't have a ton of support I was trying to be a leader in something I care about and am passionate about and that should be enough to lead another PD to encourage other teachers to care too. It is also all about what it best for the students and since I truly think STEM is what is best for our students I will keep pushing and encouraging others to implement STEM in their own classroom. I also notice a couple teachers who seem to be becoming complacent. They always have excuses and think they are the only ones struggling with finding time or having too many preps. These teachers become set in their ways and unwilling to change and improve because it takes more work and effort. I don't want my coworkers becoming happy with the educator they are and the lessons they have taught for the last ten years and will continue to teach; I don't want this for them, our school, and most importantly, the kids.

f. Reflection

When tasked with the assignment to develop and implement a Professional Development for my school I started to think of every reason I shouldn't and couldn't. I thought being a virtual school it would be tough to give an effective PD through our classroom because teachers do not have to listen or pay attention when you cannot see or hear them. I thought it would be better for my nerves though. I ended up deciding that it would ultimately be better for me to give my PD during our face-to-face PD meeting to prepare for state testing. This however, made me nervous.

With that being said, I am glad I was pushed out of my comfort zone and it has opened a lot of possibilities and ideas for the future. I was ultimately disheartened when my computer crashed during the PD and my Head of Schools said I really didn't have to finish it if I didn't want to. I did finish but I also did not finish as strong as I would have liked because I let the negativity and poor attitude of others get me down. Instead I should have embraced this and used it to make my PD even better. In the future I am excited to be more prepared for PD and have better activities planned to get the participants interacting with each other and the resources/ideas I am bringing to the table.

Appendix List

A. Standards used in the unit.
B. Screenshot of PowerPoint Presentation used in PD
C. Examples of Past STEM lessons shown to participants in PD

D. Screenshot of Survey results

E. Links to resources used and shared in PD
F. Teacher Contacts

Works Cited

- Feldman, Barbara. "The Ocean." Surfnetkids. *Feldman Publishing*. 5 Jun. 2018. Web. 9 Jul. 2018. <https://www.surfnetkids.com/resources/the-ocean/ >.
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- Lustick, D. S. (2011). Experienced secondary science teachers' perceptions of effective professional development while pursuing National boards certification. Lowell, MA: Teacher Development.
- DeSimone, Laura M. "A Primer on Effective Professional Development." Phi Delta Kappan, vol. 92, no. 6, 2011, pp. 68-71.

Appendix A: Standards used in the Unit

- K-2-ETS1-1 Engineering Design
- Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

- MS-ESS3-5 Earth and Human Activity
- Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

- MS-PS3-5 Energy
- Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- CCSS.ELA-Literacy.L.7.3

  Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- CCSS.ELA-Literacy.L.7.3.a

  Choose language that expresses ideas precisely and concisely, recognizing and eliminating wordiness and redundancy.*
- CCSS.ELA-Literacy.SL.5.5

  Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
- CCSS.Math.Content.2.MD.A.3

  Estimate lengths using units of inches, feet, centimeters, and meters.
- CCSS.Math.Content.HSS.MD.B.7

  (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
- Estimate lengths using units of inches, feet, centimeters, and meters. (2.MD.A.3)
- Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen. (2.MD.A.2)

Appendix B: Screenshot of PowerPoint Presentation used in PD

Scratch Programming

- Alphabet Game
- https://scratch.mit.edu/projects/264126385/
- Three Question Quiz
- https://scratch.mit.edu/projects/245282610/
- There are tons of games already made that everyone can access. You can also "copy" someone's project to tweak for yourself and just credit them for the original.
- There are tutorials and videos all over the internet to help walk you through creating a program too.

NOAA
https://www.noaa.gov/

- Weather
- Climate
- Ocean coasts
- Fisheries
- Satellites
- Research
- Marine aviation
- Charting sanctuaries
- Education
- Images, maps, data, webinars,

Latest Combo: Rocket to the Moon and Mars: SLS
Student Article: What Is a Heavy Lift Launch Vehicle?
Lesson Plan: Soda-Straw Rockets
Alternative Lesson: 3…2…1…Puff! With SLS Rocket Pattern
Straw Rocket Pattern: Saturn V (PDF)
Coloring Book: SLS Coloring Book (PDF)
Miniposter: Meet the Rocket (PDF)

Latest Combo: Spacecraft for the Moon and Mars—Orion
Student Competition: NASA's App Development Challenge
Student Article: What Is Orion?
Engineering Activity: Design a Crew Exploration Vehicle
Printable Book: Orion A to Z (PDF)
Printable Coloring Book: Orion A to Z (PDF)
Infographic: Orion and Football

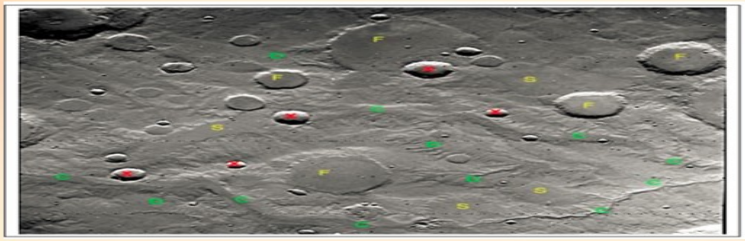
Latest Combo: Next Stop, the Moon!
News Article: NASA Unveils Sustainable Campaign to Return to Moon, on to Mars
Background Information: Earth's Moon
Classroom Activity: Roving on the Moon
Mathematics Problem: Earth, Can You Hear Me Now?
Posters: Exploration Systems Development Posters

STEM lessons found within NASA for all grade levels with all instructions and handouts.

Appendix C: Examples of Past STEM lessons shown to participants in PD

Resource 1-1

I DO…Miss. Fjone models



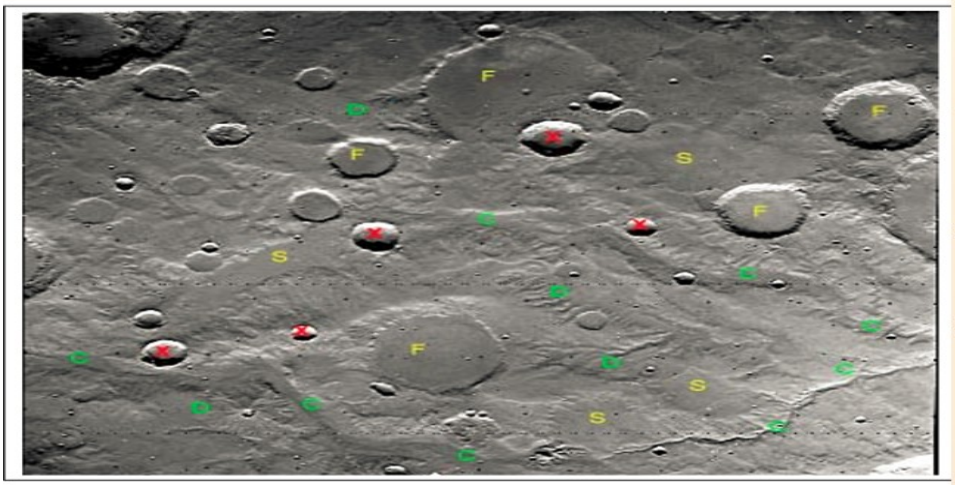
Exploring the Surface of Mars from Orbit

When the NASA Mariner IV spacecraft flew by Mars in 1965, scientists were surprised to see so many craters on the surface of this planet, which many science fiction writers had assumed was Earth-like!

The image shown above is an area on Mars called Margaritifer Sinus and was taken by the NASA Viking Orbiter in 1976. The image is 200 kilometers wide. The letters indicate different regions of interest to scientists.

Resource 1-1

We DO…



1) How many craters can you count on the surface of Mars?

2) Why do you suppose some of the craters have a red X?

3) Measure the distance between the craters.

Resource 2

Let's Build a Mars Community! ☺

- We are going to go to this website and learn about the differences between Mars and Earth. https://mars.nasa.gov/allaboutmars/facts/#?c=inspace&s=distance
- Grab a piece of paper and a pencil so you can write down a few notes. We will be using what we learn about Mars to create our own Mars community.
- Be thinking about what is different on Mars and how that would change how we would live there.
- Think about what we will need to include in our community. (houses, hospitals, schools, jobs for parents, parks, entertainment, restaurants, grocery stores, and other stores)

Guiding Questions:

- How would a community on Mars function differently than a community on Earth? Why?
- What jobs will need to be done on Mars?
- What will people do for fun, how will they be creative?
- What will your community look like?
- What types of people will live in your community?
- What community services will your community offer?

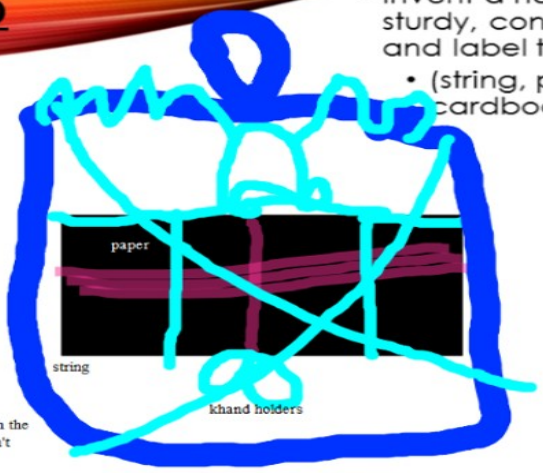
IDENTIFY THE PROBLEM

- What are the negative effects of plastic six-pack holders on the environment?

The turtle is going to die because there is a plastic bottle holder around it. Plastic is getting into our ocean and harming the ocean animals.

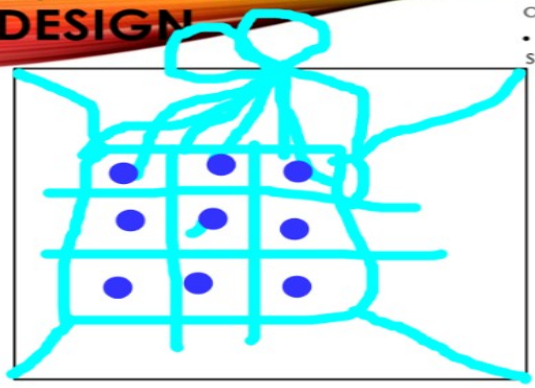
HARMLESS HOLDER BUILD

- Invent a holder for six cans that's animal-safe, sturdy, convenient, and easy to carry. Draw and label the parts of your final design.
  - (string, paint stirrers, paper, full cans of soda, cardboard, rubber band, duct tape, etc...)



wood underneath the paper so it doesn't break

TEST/EVALUATE REDESIGN



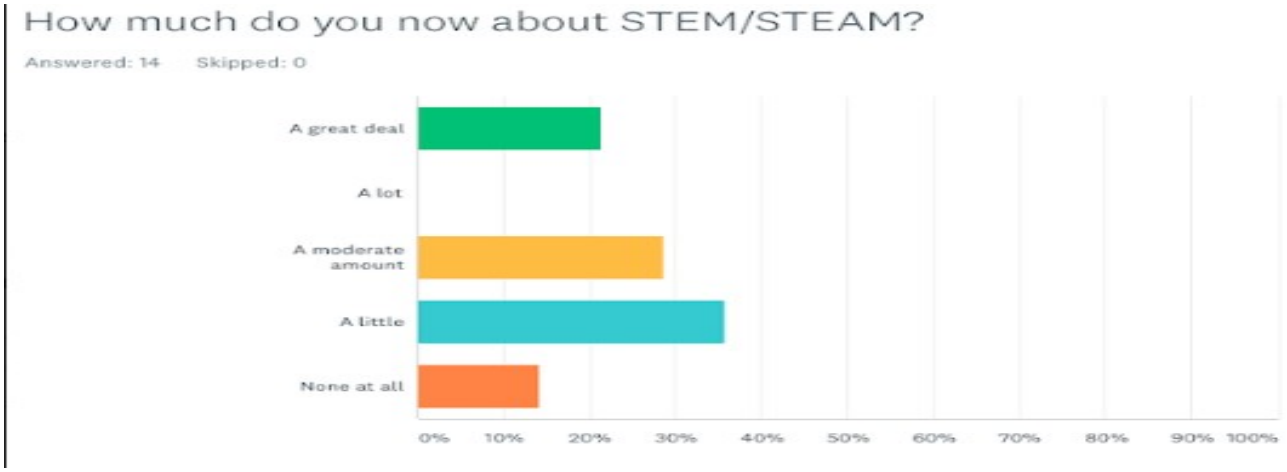
- Now that we have discussed our drawings, go ahead and make some changes to better yours.
- Invent a holder for six cans that's animal-safe, sturdy, convenient, and easy to carry. Draw and label the parts of your final design.
  - (string, paint stirrers, paper, full cans of soda, cardboard, rubber band, duct tape, etc...)

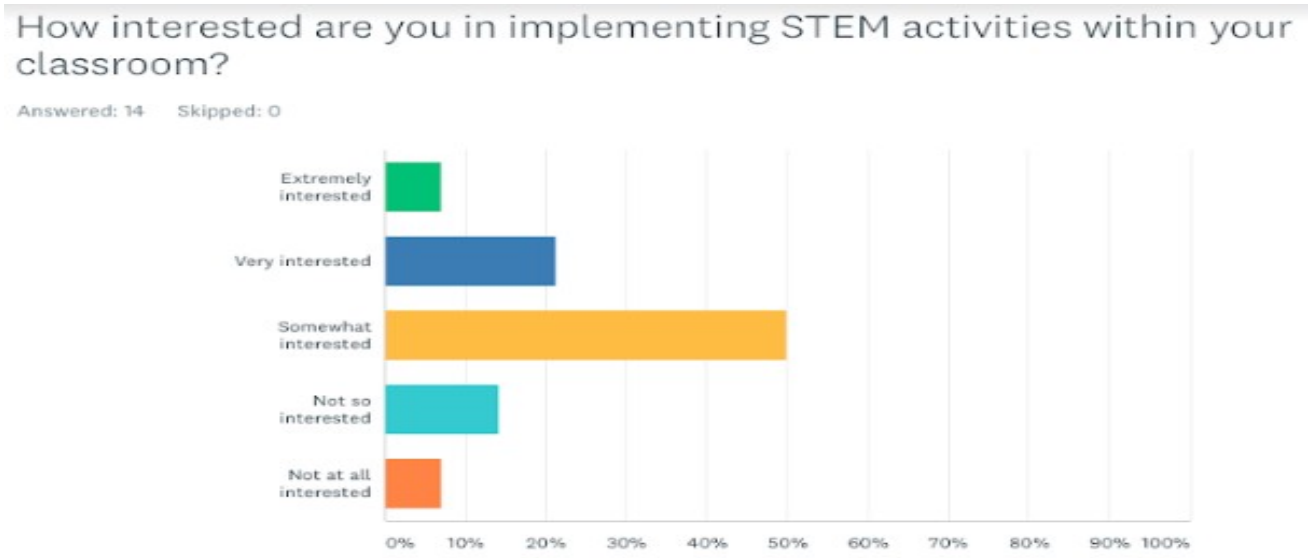
It might break, so e will use rope underneath and on the sides. This will help keep it together and tighter.

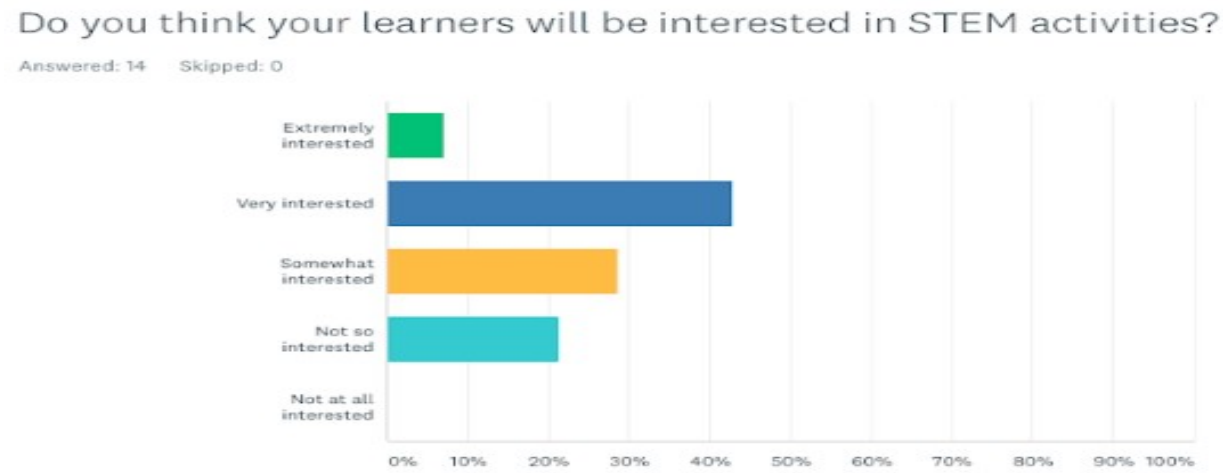
Let's recyclable materials. Our paper will disintegrtae in water and our string and rope will disintegrate with sunlight and water at certain temperatures.

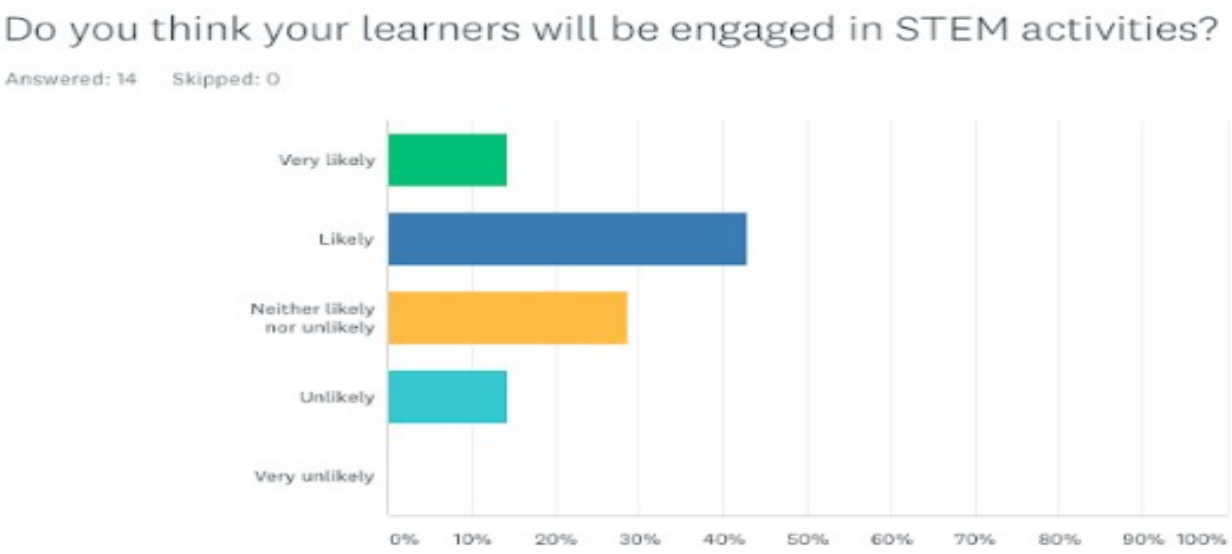
Appendix D: Screenshot of Survey Results

Pre-Survey Results

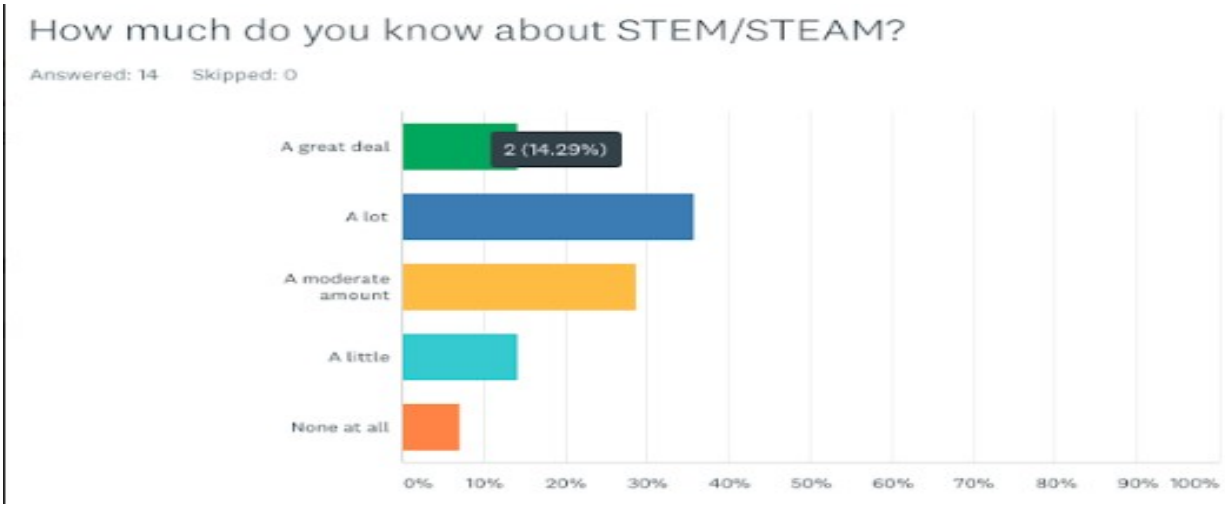


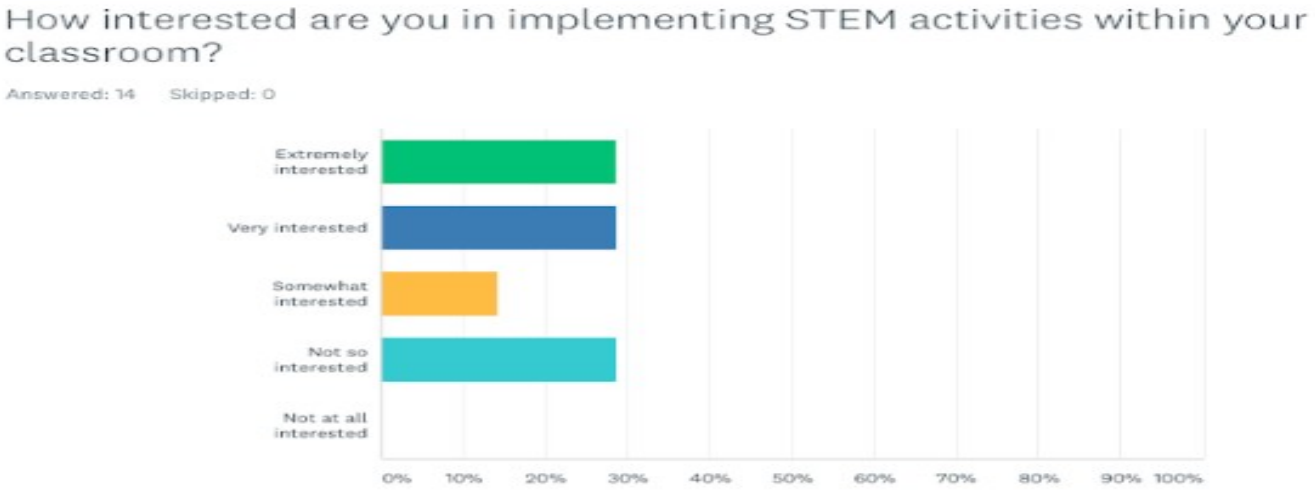






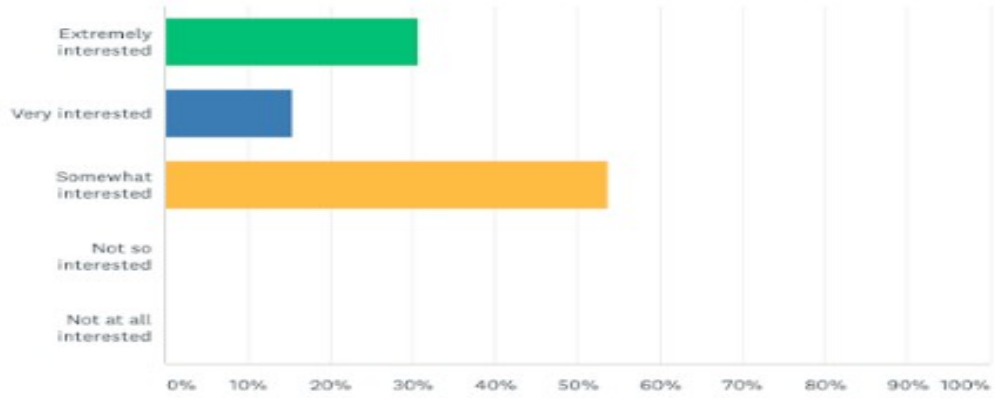
Post-Survey Results





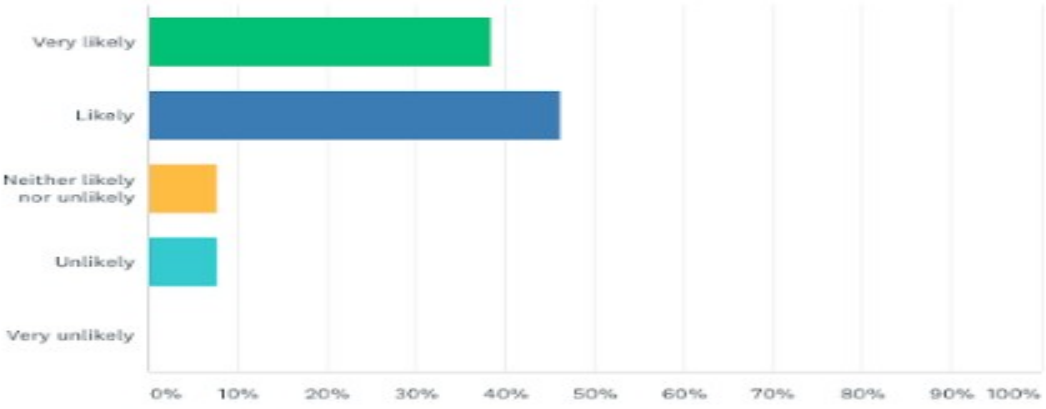
Do you think your learners will be interested in STEM activities?

Answered: 13 Skipped: 1



Do you think your learners will be engaged in STEM activities?

Answered: 13 Skipped: 1



Appendix E: Links to resources used/shared with participants in PD

Links/videos:

- **https://phet.colorado.edu/sims/html/equality-explorer-two-variables/latest/equality-explorer-two-variables_en.html**
- **https://phet.colorado.edu/sims/html/forces-and-motion-basics/latest/forces-and-motion-basics_en.html**
- **NASA Space Place - https://spaceplace.nasa.gov/**
- **NASA Science - https://science.nasa.gov/**
- **NASA Simulation - https://vesl.jpl.nasa.gov/**
- **NASA Kids Club - https://www.nasa.gov/kidsclub/index.html**
- **NOAA - https://www.noaa.gov/**
- **Alphabet Game I created on Scratch**
- **https://scratch.mit.edu/projects/264126385/**
- **Three Question Quiz I created on Scratch**
- **https://scratch.mit.edu/projects/245282610/**

- An Introduction to the Scratch Programming Language for Education
- **MIT App Inventor: Mobile Apps. Built by You.**
- **MIT app inventor Beginner Tutorials**
- **MIP app inventor main page**
- **Flipped Classroom Introduction video**

Appendix E: Teacher Contacts

Names and Contact information of Educators who attended the PD:

1. Karen Zuercher – kzuercher@k12.com
2. Emily Hanna – ehanna@k12.com
3. Brenda Oldenkamp – boldenkamp@k12.com
4. Charity Moss – cmoss@k12.com