

“Full STEAM Ahead”
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Full STEAM Ahead

II. Nine teachers at Kershaw Elementary school participated in the Full STEAM Ahead professional development. These nine teachers were excited about this opportunity as our district has recently made STEAM a focus through the implementation of Discovery Education training and resources. This professional development helped these teachers develop a basic understanding of what STEAM is, and what it isn't, as they began to transform how they teach. These nine teachers included three third grade teachers that each teach all subject areas - ELA, math, science, and social studies, one fourth grade and fifth grade teacher that also teach all subject areas, two fourth grade teachers and two fifth grade teachers that are departmentalized so that one teaches ELA and social studies while the other teaches math and science. During the Full STEAM Ahead professional development, we focused mainly on math and science content areas.

III. While we focused a little on developing a 5E Lesson plan with the ELA and social studies teachers, the majority of our planning was with math and science due in part to my role in the building being the instructional technology and math coach. We used the [South Carolina College and Career Ready Standards for Mathematics](#) and the [South Carolina 2014 Science Standards](#). We used a variety of grade level standards to meet the specific needs for each grade level teacher participating in the professional development including third grade, fourth grade, and fifth grade standards. For a list of the specific standards covered in our professional development, see Appendix A.

IV. For the Full STEAM Ahead professional development project, I set out to educate teachers on the development of the 5E Lesson plan in order to help them fully develop each component of their classroom instruction. I also wanted to share NASA resources that could be used for current and future content that they would be teaching in the classroom. I wanted to help them effectively plan for the engagement, exploration, explanation, elaboration, and evaluation elements of their lessons by also effectively utilizing the resources available to them.

V. Prior to beginning our professional development, teachers participating completed a pre-survey to provide me with insight into their levels of understanding of STEAM and how that transfers to classroom learning and instruction. Questions on the pre-survey included:

- What is STEAM to you?
- Have you implemented STEAM into your classroom before?
- Do you feel like you were successful?
- How comfortable are you with using technology?
- How comfortable are you with introducing new technology/ideas to your students?
- Do you think that integrating STEAM into your instruction would be beneficial to your students? Why or why not?

In reviewing the results of the pre-survey I learned a great deal about what my teachers thought about STEAM and their mindset on implementing new things into their classroom. To review some of the teacher responses to the pre-survey questions, see Appendix B.

VI. The professional development for Full STEAM Ahead consisted of one 30 minute after school meeting with all grade level teachers participating as well as two 8:00am-10:00am half day planning days with individual grade level teachers. During the after school meeting, I introduced the 5E Lesson plan template through a Google Slides presentation (the link to the presentation can be found in Appendix D). We talked about the importance of each of the 5E elements and had conversations about what each element in the 5E lesson plan might look like in their current classrooms now versus what we would like them to look like as we grow in our STEAM implementation. Teachers left this meeting with a basic understanding of the lesson model. When they came to their first half day planning, we looked at the content areas that our second nine weeks district pacing guide would focus on and began to dig into those math and science standards. We chose one unit to focus on and began planning a lesson using the 5E template. We also looked at NASA resources as well as resources collected from other Endeavor courses that may be helpful during those particular units. The third grade teachers focused on matter. The fourth grade teachers focused on planets and constellations. The fifth grade teachers focused on force and motion. Teachers then took what we planned and implemented it into their classrooms. I was available to help them in their implementation if needed. During the second half day planning with individual grade level teachers, we reviewed the lesson that was taught and discussed the effectiveness of the 5E template and NASA resources. Teachers also took a post-survey.

VII. Third grade teaches will focus on heat and matter. Students will research ice cream recipes and work in groups to create an original recipe. They will come up with their own measurements and use the double bagged with ice method to freeze their ice cream. Students also will use materials that they believed would make good insulators to create an ice box to keep their ice cream frozen. Students will taste each groups ice cream and then collect data as to which ice boxes kept the ice cream frozen the longest. Students will compare the recipes and learn the importance of measuring. They will also learn that some materials are better insulators than others. The teachers will use videos and pictures from PBS Design Squad as well as Discovery Education to engage the students in the activity. They will explore through their ice cream and ice box creations. They will explain what they learned to their group members as well as other groups in the classroom. They will elaborate on what they learned through Nearpod lessons and class discussions. While they will eventually be evaluated on heat and matter through Google Forms, the teachers will use a rubric assessing the 4C's (collaboration, communication, creativity, and critical thinking) as well as initial discoveries of heat and matter through the ice cream activity.

Fourth grade teachers will focus on planets and constellations. Students will be engaged through Virtual Reality headsets that allow them to “visit” outer space. Students will explore the planets and their distances from each other through the research they begin following the VR activity as they explore NASA’s Eyes resource. They will create books of the planets in which they will have to provide facts of each one. Students will use their books to explain what they learned about the planets in their discoveries. They will be able to elaborate on their learning through Nearpod lessons on planets and constellations. Teachers will use rubrics to evaluate the student’s books and will eventually assess the unit through Google Forms.

Fifth grade teachers focused on force and motion. Students were engaged through Virtual Reality headsets that allowed them to “ride” a roller coaster. They also used images and videos from the NGSS Phenomena website as well as Discovery Education to introduce the unit. Students participated in speed races with Hot Wheels cars and boards so that they could test the speed at different heights. They researched the development of rollercoasters and created a survey to find out what elements of roller coasters are most popular. Students then got the opportunity to use styrofoam tubes and duct tape to make their own roller coasters. They were able to explain their learning through journals and FlipGrid videos of the Hot Wheels experiment and the roller coaster creations. They used Nearpod to elaborate on their learning and include a little direct instruction from their teachers. Students were assessed on their experiments and buildings through rubrics and will eventually be evaluated on the force and motion unit through Google Forms.

*Lesson plans for 3rd and 5th as well as pictures from 5th can be found in Appendix C.

VIII. Resources that were introduced through this professional development were from NASA as well as others learned from previous Endeavor courses. Third grade was introduced to the engineering design process as they worked to create their own original ice cream recipe and build a cooler that would keep their ice cream frozen for as long as possible. They also used PBS’ Design Squad videos to introduce heat and matter. Fourth grade was introduced to NASA’s Eyes resource so that they can view the planets in space. Fifth grade was introduced to PBS’ Design Squad as they discovered force and motion. All grades also utilized the NGSS Phenomena website to use images to help engage their students as well as Discovery Education’s resources. Discovery Education was included in this professional development as a resource due to our district’s investment into a partnership with Discovery as our district focuses on our STEAM initiative. Through the introduction of each of these resources, all grade levels were able to add a variety of tools to their toolbox for future planning.

IX. Following the Full STEAM Ahead professional development, the teachers that participated shared their experiences at a faculty meeting so that other teachers in the building learned about the 5E template and resources used as well. This helped to spread the desire and openness of STEAM integration to those still hesitant. I learned through the post-survey that the teachers that

participated in the professional development grew in their understanding of STEAM and in their confidence of implementing new things in the classroom. To review some of the teacher responses to the post-survey questions, see Appendix B.

X. I believe that the professional development was successful. Teachers were able to effectively plan a 5E lesson and utilize one new resource in their classroom instruction. They were able to develop a deeper understanding of STEAM and how it can be integrated into grade level content areas instead of through meaningless activities unrelated to state standards. Teachers have made adjustments to how they view their classroom. Before the professional development, teachers did the talking. Now, students are doing more of the talking, allowing them to be more engaged in the learning.

The professional development can relate to several articles we have read throughout the course. Lustick's article on the perceptions of effective professional development sticks out to me as it focuses on elements that help to make the PD beneficial. The article mentions active learning, which I included into my professional development by allowing the teachers the opportunity to play through the resources provided. I also had them work together to develop their lessons. Lustick also talks about relevancy. This professional development was relevant to my teachers as this is a huge focus now in my district. Our new superintendent has made STEAM a focus for all grades as we work to prepare our students to be successful into today's world. Also, the idea of "one size fits all" is not an effective method when it comes to professional development. This is why I created two different environments for my project. Teachers met as a whole to learn the basics of the 5E lesson plan and resources available, but they met in individual grade levels as we planned because each grade level need is different.

Sato's article on leading with purpose also comes to mind. Teachers and students need a purpose for their learning in order to make it meaningful. My teacher's purpose for this professional development was to grow professionally in the area our district is moving as well as to increase student engagement and success. The article talked about how leadership is grounded in the work of the classroom instruction but guided by the desire to improve student learning through a variety of avenues. My teachers have a passion for teaching and helping our students succeed. The 5E lesson plan and resources provided in this professional development provided them a variety of avenues in which they can lead students to reach their fullest potential.

Teacher responses from the professional development were very positive. I believe that not only will my teachers use these lessons again, but they will use the model of these lessons to create similar learning opportunities for students in other units of study. I believe that my teachers appreciated the one-on-one help as they worked to implement something new in their classroom. I believe that helped them grow confidence in not only themselves, but also their students as they will continue to challenge their students in ways they would have never considered before. I believe that my teachers "fear" of moving Full STEAM ahead has been alleviated some now through this process.

XI. Appendix

Appendix A

- Standards covered during the Full STEAM Ahead Professional Development Project

Third Grade:

South Carolina Science Standards

- 3.P.2A.1 Analyze and interpret data from observations and measurements to describe and compare the physical properties of matter (including length, mass, temperature, and volume of liquids).
- 3.P.2A.2 Construct explanations using observations and measurements to describe how matter can be classified as a solid, liquid or gas.
- 3.P.2A.3 Plan and conduct scientific investigations to determine how changes in heat (increase or decrease) change matter from one state to another (including melting, freezing, condensing, boiling, and evaporating).
- 3.P.2A.5 Define problems related to heat transfer and design devices or solutions that facilitate (conductor) or inhibit (insulator) the transfer of heat.

South Carolina Career and College Ready Math Standards

- 3.MDA.2 Estimate and measure liquid volumes (capacity) in customary units (i.e., c., pt., qt., gal.) and metric units (mL, L) to the nearest whole unit.
- 3.NSBT.1 Use place value understanding to round whole numbers to the nearest 10 or 100
- 3.NSBT.2 Add and subtract whole numbers fluently to 1,000 using knowledge of place value and properties of operations
- 3.NSBT.5 Compare and order numbers through 999,999 and represent the comparison using the symbols $>$, $=$, or $<$.

Fourth Grade:

South Carolina Science Standards

- 4.E.3A.1 Develop and use models of Earth's solar system to exemplify the location and order of the planets as they orbit the Sun and the main composition (rock or gas) of the planets.
- 4.E.3A.2 Obtain and communicate information to describe how constellations (including Ursa Major, Ursa Minor, and Orion) appear to move from Earth's perspective throughout the seasons.
- 4.E.3A.3 Construct scientific arguments to support claims about the importance of astronomy in navigation and exploration (including the use of telescopes, astrolabes, compasses, and sextants).

South Carolina Career and College Ready Math Standards

- 4.NSBT.3 Use rounding as one form of estimation and round whole numbers to any given place value.
- 4.MDA.4 Create a line plot to display a data set (i.e., generated by measuring length to the nearest quarter-inch and eighth-inch) and interpret the line plot.

Fifth Grade:

South Carolina Science Standards

5.P.5A.1 Use mathematical and computational thinking to describe and predict the motion of an object (including position, direction, and speed).

5.P.5A.2 Develop and use models to explain how the amount or type of force (contact and noncontact) affects the motion of an object

5.P.5A.3 Plan and conduct controlled scientific investigations to test the effects of balanced and unbalanced forces on the rate and direction of motion of objects.

5.P.5A.4 Analyze and interpret data to describe how a change of force, a change in mass, or friction affects the motion of an object.

5.P.5A.5 Design and test possible devices or solutions that reduce the effects of friction on the motion of an object.

South Carolina Career and College Ready Math Standards

4.MDA.1 Convert measurements within a single system of measurement, customary (i.e., inches, feet, yards, ounces, pounds, seconds, minutes, and hours) or metric (i.e., centimeters, meters, kilometers, grams, kilograms, milliliters, liters) from a larger to a smaller unit.

Appendix B

- Pre/Post Survey Results - Nine teachers took the survey. Some answers were the same among teachers, so there may not be nine responses for each question.

What is STEAM to you?

PRE

- Science, technology, engineering, arts, and math investigations
- Activities that incorporate science, math, technology, and the arts
- Hands on learning across the curriculum
- Integrating

POST

- Steam is student led discovery where students work to solve problems.
- Students come up with a problem and then use the STEAM process to solve the problem. The final products should include science technology art math
- STEAM is another tool to kept students fully engaged
- Students come up with a problem and then use the STEAM process to solve the problem. The final products should include science technology art math
- A way of teaching that incorporates many aspects of the curriculum.

Have you implemented STEAM into your instruction before?

PRE

- Very little STEAM based instruction that applied to my standards. We have built items, like boats, etc for STEAM but nothing that applied to my standards.
- Somewhat - students had a problem that had to be solved. They used science, math, technology and arts to have a finished product.
- Peer groups completing lessons hands-on with or without technology
- No

POST

- Yes, prior to PLC instruction, I thought steam meant you had to build something. However, I have since learned that STEAM is student led discovery and can incorporate any or all of the components. My Steam activities now are more standards based.
- Yes, students used the design process to solve a problem they came up with still incorporating STEAM. It is busy and sometimes loud in the classroom.
- The students are able to work in small groups in longer and are able to create and present their learning differently
- Yes, students used the design process to solve a problem they came up with still incorporating STEAM. It is busy and sometimes loud in the classroom.
- Yes, more science and math together instead of separate

Do you feel like you were successful?

PRE

- I felt like those engineering activities were successful, but I do not feel like they helped my students grow in their understanding of grade level standards/skills.
- Somewhat. I didn't always use the process correctly or give students time to reimagine and redesign.
- I think the students learn how to manage groups and new material well.
- I am not sure.

POST

- More because I am using Steam more frequently and more open to multiple ways to solve a problem.
- More Students take ownership of the work.
- I notice the lessons become shorter when I'm not totally modeling. They can figure things faster with their peers. I'm having to find ways to extend the lesson.
- More Students take ownership of the work.
- mostly, kids enjoyed it more and didn't realize they were learning

How comfortable are you with using technology?

PRE/POST

- Most teachers felt like they were between a 3 and 5 on a scale from 0-5 in their level of comfort.

How comfortable are you with introducing new technology/ideas to your students?

PRE/POST

- Most teachers felt like they were between a 3 and 5 on a scale from 0-5 in their level of comfort.

Do you think that integrating STEAM into your instruction would be beneficial to your students? Why or why not?

PRE

- Yes because it builds an excitement for learning and a new way of learning.
- Yes, students will become better problem solvers
- I think it will be beneficial to all students to allow meaningful engagement
- Yes, it's the future

POST

- Yes. Students tend to understand concepts better when they do the work instead of me doing the work and presenting it to them.
- Yes, they are excited about learning
- I think it's beneficial to extend the lessons and make the next lesson interesting.
- Yes, they are excited about learning
- Yes, it's a new mindset for them and me

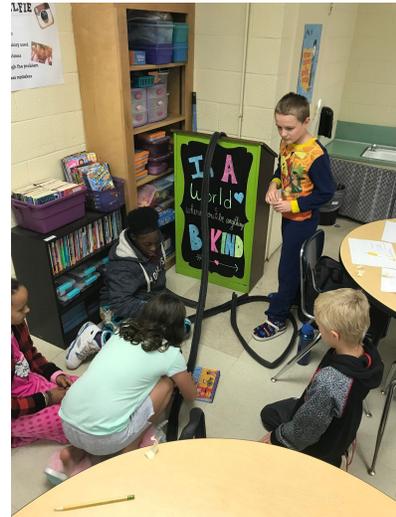
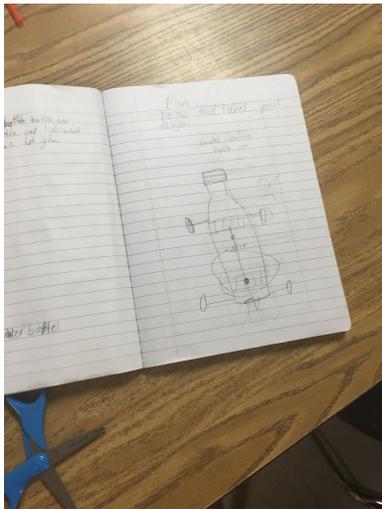
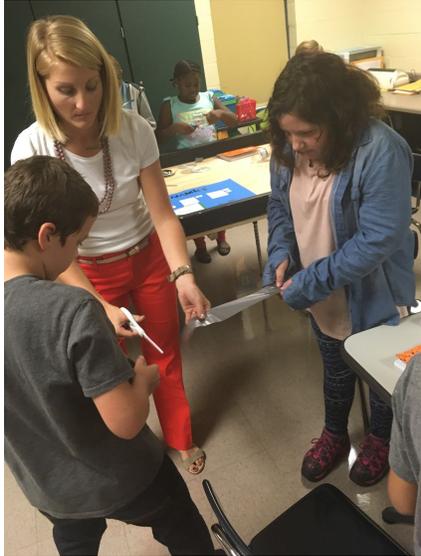
Appendix C

- Classroom Activities/Units with Assessments

Below is an outline of the 5E's developed in the fifth grade unit as well as pictures. They are still in the planning process, but the link for the 3rd grade lesson is also below. Fourth grade is not as far along, so they are not included here.

5th Grade:

Engage - Hook the kids!	Design Squad Balloon Joust (Science & Engineering) GIF Phenomenon: Linked Below (Writing Responses)
Explore - Research and Learn	Nearpod PhEt: Forces and Motion Lab (Science & Technology) Nearpod PhEt: Motion and Energy Skate Park Nearpod: Contact and NonContact Forces Thinglink Flocabulary - Force Flocabulary - Motion Flocabulary - Gravity Article - Friction Article - Force 3 Act Task Final Lap (Math, Science)
Explain - Put together and share what you learn	Flipgrid (Technology) - Joust, Balloon Car, & Roller Coaster RUBRIC Toonytool Image Build a World Cloud
Elaborate - Build and Put together	Design Squad 4 Wheel Balloon Car (Science & Technology) Math - Measuring items and distance, Data
Evaluate - Assess	Roller Coaster (Engineering & Art) Math - Time, Measure Length of hills, Data Google Assessment Escape Room



Pictures 1-4 are of 5th graders participating in an engineering design challenge. They had to build cars powered by balloons to see who could get their car to go the farthest.

Pictures 5-6 are of 5th graders building their styrofoam roller coasters after their study of force and motion.

[Third Grade Lesson Link](#)

Appendix D

- [Link to Google Slides 5E Lesson presentation](#)

XII. Participants

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