

Relaunching STEM Week

**A Professional Development Session on Bringing NASA STEM Resources into the
classroom using the 5E Lesson Planning Method**

By Jennifer Pearrow

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I. Title of Project

Relaunching STEM Week

II. Curriculum Topics, School Name(s), Number of Educators, Grade Level(s)

The main topic of this resource was STEM with a focus on science and the engineering design process including some math skill utilization. The professional development allowed participants to learn how to apply the 5E lesson model and collaborate on grade-level appropriate methods of evaluation. Two educators from Lyford Middle School participated, with Max Ortiz from 8th grade and Ramiro Rodriguez from 6th grade. Two educators currently working locally due to the pandemic but teaching globally also participated, Glenn Pearrow from the Department of Defense Education Activity teaching 12th grade for Kaiserslautern High School and Jolene Pearrow teaching 5th grade for Kaiserslautern Elementary School while currently living in Harlingen, Texas. A local homeschool educator, Lora Martinez, also participated, having experience teaching her two sons from 1st-8th grade so far.

III. Standards Addressed

Texas Essential Knowledge and Skills (TEKS)

6th Grade

Strand (C) Force, motion, and energy. Energy occurs in two types, potential and kinetic, and can take several forms. Thermal energy can be transferred by conduction, convection, or radiation. It can also be changed from one form to another. Students will investigate the relationship between force and motion using a variety of means, including calculations and measurements.

6.11C Describe the history and future of space exploration, including the types of equipment and transportation needed for space travel.

8th Grade

Strand (C) Force, motion, and energy. Students experiment with the relationship between forces and motion through the study of Newton's three laws. Students learn how these forces relate to geologic processes and astronomical phenomena. In addition, students recognize that these laws are evident in everyday objects and activities. Mathematics is used to calculate speed using distance and time measurements.

8.6C Investigate and describe applications of Newton's three laws of motion such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.

IV. Summary of Project

My professional development session aimed to show educators how to apply the 5E lesson model to a NASA STEM resource to enable them to bring new experiences related to science content into their classrooms in an engaging manner. I chose to make use of the recent resurgence in interest in manned space travel by using a rocket testing activity from the NASA

educator resource NASA STEM Forward to the Moon. I selected this topic because it covers a variety of skills that are necessary throughout secondary science in Texas with several different activities that could be used as a weeklong STEM project or enrichment throughout a school year. The district I serve in used to have a week devoted to STEM activities with groups of children from each campus coming together to do STEM activities, so I believed this resource could be a good place to start developing ideas. My professional development session was meant to help restart the idea of using STEM in the classroom and bring back STEM Week in the future after time to plan and develop content that aligns vertically and targets necessary skills. Educators outside of my district also benefitted from the professional development, even though future collaboration on a long-term goal related to my district may not occur, they can take the idea to their colleagues as well.

V. Pre-questions Survey List

Do you have experience with the 5E model of lesson planning?

Have you ever used a STEM project or resource in your class?

Have you ever taught the engineering design process in your class?

What content areas do students struggle with during a typical year?

How often do you collaborate with other educators for your classroom lessons?

VI. Brief Description of the Actual Professional Development Training

The professional development session started with a period of time to allow time to complete the pre-survey if they had not completed it when they received their invitations. During that time, we also shared basic introductions so the educators could be more familiar with each other for later collaboration in the session. I introduced myself and the NASA Endeavor program and how that has influenced my teaching and leadership in my classroom and district. After assessing their prior knowledge of the 5E model, we went over the purpose and basic outline of the 5E model using resources on the NASA eClips Teacher Toolbox website. Participants were asked to relate the steps of 5E lessons to their past experiences and lessons, allowing them to see that they had the skills needed but may need to restructure their lessons to be more effective.

After defining and discussing the 5E method, I demonstrated the ideas by showing them how I had applied the 5E model to a NASA STEM resource, the Forward to the Moon activity called Heavy Lifting. Participants were linked to the resource and NASA educator website which has many helpful videos and demonstrations of the activities that they could make use of later. Each one opened the Heavy Lifting Activity and were provided a sample lesson plan I produced that breaks down the resource using the steps of the 5E model. We went over the resource and how each participant could relate the activity to content they teach in a typical year.

For each step, we stopped and collaborated on what was provided, what I had done to apply 5E, and how they could modify the same ideas to be more specific to their grade level and content. Participants were encouraged to take notes within the sample lesson to expand the activities and ideas for future use. For the Engagement step, participants were asked to search for engaging content videos from the NASA eClips website where many student-created videos are available. The Evaluate step was left vague to spur independent ideas for how they would evaluate student

learning and success on this activity, with several personal ideas prepared in advance to inspire and add on to their ideas. Each educator had new ideas and perspectives on how to apply the lesson to their grade level and content area using the 5E model.

After demonstrating the 5E model applied to one lesson, participants were given time to peruse the other resources from the activity and NASA's website of searchable resources for educators so they could collaborate and share their ideas for the development of more 5E lessons using NASA resources in the future. Participants were given a follow up survey to define how the professional development session impacted their classroom.

VII. Brief Outline of the Activities in the Professional Development Session

1. Introductions and Pre-Survey (10 minutes) – I introduced myself and the NASA Endeavor program and purpose of the professional development session. Educators introduced themselves to the group.
2. The 5E Model (20 minutes) – I explained the benefits of the 5E model and introduced the basic premise of each step using the NASA eClips Teacher Toolbox [The 5E instructional Model](#) and a blank 5E template was provided that I was given in the NASA Endeavor Methods of STEM Education course for teachers to use for future lesson planning.
3. Applying the Model (40 minutes) – Educators were linked to the NASA STEM [Forward to the Moon](#) Activity Guide and opened the Heavy Lifting Activity. A sample 5E Lesson plan was provided for participants to see how the 5E model could be applied to the Heavy Lifting activity as a template for them to expand upon with their own ideas. I walked participants through the lesson and how each step of the 5E model was applied and some of the basic premises of the engineering design process that is embedded in the activity. Feedback was elicited from the participants for how they could modify the lesson segments for their own needs to allow the group to collaborate on a more engaging lesson focused on their content goals.
4. Exploring NASA Resources (10 minutes) – Participants were linked to the NASA Educator [Resource Search](#) website and allowed to search for a lesson related to content they will teach later this year. Educators had the goal of finding an activity they could use for part of a 5E lesson, such as an engagement piece. Participants shared links to one resource they found and gave a brief explanation of why they picked it and how they could use it for a 5E lesson.
5. Conclusion and Feedback (10 minutes) – I reviewed the benefits of using the 5E model and NASA educational resources in the classroom. We went over the ideas the group had collaborated on and made goals to try something new when possible this school year. Participants were given a post-survey to complete and return.

VIII. What NASA mission data or Endeavor resource did you include?

NASA STEM [Forward to the Moon](#) Activity Guide

NASA eClips Teacher Toolbox [The 5E instructional Model](#) explained step by step

NASA [eClips](#) Engagement Video resources

NASA Educator [Resource Search](#)

IX. Follow-up Activities & Post-questions Survey List

Although interest was indicated, the COVID-19 pandemic has prevented much of my ability to host follow-up activities at this time. Participants were provided with a post-survey to detail the outcome of their experience and any future plans for implementation.

Questions on the Post Survey included:

Do you plan to make use of the 5E method, the engineering design process, or NASA resources for lessons in the future?

Were the NASA Forward to the Moon Activity resources useful for your grade and content area?

Do you see ways to connect NASA resources to content skills needed for student success in your course?

What are some barriers to using the methods and activities demonstrated in your classroom?

Would you like to collaborate on STEM lessons for your classroom at a future date?

X. Outcomes. Final Data Collection and Analysis

a. Survey Results/Comment on the content included in the project

The educators that participated in this professional development session had a wide range of content areas and grade levels, but all five responded that they saw value in using the activity in their classrooms to cover content they have to teach. All of the educators had experience teaching science and the math necessary for science content but had not used a NASA STEM resource in the past. All five indicated they could use activities from the Forward to the Moon resource to enhance content they are required to cover in the grade they work with. Each educator planned to use NASA resources, including those found in the search tool, to find future lesson ideas.

b. Survey Results/Comment on the pedagogy in the project

The focus of the professional development session was the 5E model, but just three of five educators planned to try to use the 5E method for future lesson planning. The remaining educators expressed that they would keep it in mind but had too much to think about this year to make any changes immediately. Two educators, my school colleagues, expressed interested in further professional development opportunities to continue learning more about the opportunities available through NASA education resources. Four of five also indicated barriers to making use of STEM resources in the classroom including administrative support, content implementation timetables, and testing requirements. The homeschool educator saw fewer barriers to implementation because they had complete freedom and control of their scheduling and content delivery methods.

c. Was your professional development successful? Why or Why Not?

I think for a first attempt, my professional development was somewhat successful. I was unable to meet my goal of reaching all the science teachers in my district to begin a collaborative effort to revive the STEM Week activities of the past. However, I did connect with my direct grade level colleagues to bring STEM back to the middle school, so that is a start towards my goal. They have indicated interest in continuing to collaborate on STEM activities that create meaningful experiences for our students that also meet the required content curriculum goals. All the educators that attended expressed positive outcomes and feelings overall, which shows I had some degree of success. I will continue to reach out to my participants and recruit further educators for my future outreach and development opportunities.

d. How did this project relate to the readings? Cite two examples.

1. Cheung, R., Reinhardt, T., Stone, E., & Warren Little, J. (2018, November). Defining Teacher Leadership: A Framework. *Kappan*, 100(3), 38-44.

This project related to the process of becoming a Science Teacher Leader as outlined in the profile by Cheung et al. on defining teacher leadership. In this professional development, I made use of collaborating with others to improve science instruction, provided resources for effective science instruction, modelled effective science instruction, and advocated in service of effective science instruction (Cheung et al., 2018). I believe I worked within the profile they presented to inform the development of my session activities and purpose. I will continue to use the framework to develop my goals as a teacher leader.

2. Desimone, L.M. (2011) A Primer on Professional Development. Phi Delta Kappa. Pages 68-71

As I developed my professional development plan, I kept in mind the core features of good professional development outlined by Desimone (2011). Professional development activities should have a content focus that includes how students will learn that content, which was addressed in my plan that focused on STEM skills and how each educator could adapt the 5E model and resources to their classroom (Desimone, 2011). We used active learning and collaboration to take new ideas and observations to apply the resource to each educator's class and redeveloped the sample lesson plan to fit their needs. We even built a temporary interactive learning community to develop the activity plans together and explore how to utilize other NASA resources in the future. The two participants who I work with directly will continue to be in my learning community so we can work together to provide more STEM opportunities to our students without sacrificing required content knowledge development.

e. Will the teacher do these activities again?

All five of my participants indicated that they would like to use the NASA STEM Forward to the Moon resources in their classrooms. The 6th grade and 8th grade teacher that I work with directly have expressed interest in further professional development and collaboration sessions to allow more STEM content to be taught in the middle school. The homeschool educator would like to use the lesson for an activity with their science club. The 5th grade and 12th grade educators

expressed that they would need to scale the plan to their students' skill levels but could see the value in implementing the resource even if it took extra planning. I plan to implement the resources in my 7th grade science class and the after-school program as well.

f. Reflection

The process of creating and delivering a professional development session allowed me to grow as a teacher leader and provided me with new perspectives for future personal growth. After connecting with my attendees and completing the presurvey, I was surprised that the educators with the most classroom experience knew the least about the 5E method. They did express that they had been using the techniques in their lessons, but not in a planned and structured manner like the 5E method. The educator with the least experience knew that their district wanted teachers to use the 5E method of lesson planning but had never actually received a professional development session on what that entailed. The homeschool educator had the most experience with STEM by attending and participating in activities hosted by local museums and organizations. By attending my professional development session, each educator learned more about the pedagogical value and implementation of the 5E lesson planning model for their classrooms. They also had the opportunity to collaborate on new ideas relating to using STEM in their content with NASA resources. Educators planned to implement the content resources shared and gained knowledge of new ways to use STEM content in their classrooms. Future follow up activities will help determine to what degree implementation was successful.

I believe that this capstone project was an excellent experience to make use of the NASA Endeavor course skills that helped me grow my knowledge and experiences to allow me to become a teacher leader and STEM advocate as I move forward professionally. I now know I have the skills and abilities needed to continue to improve student outcomes in my classroom and those of the educators I assist. I hope to have many opportunities in the future to be a STEM teacher leader including more opportunities to host professional development sessions so I can widen my area of effect and help students beyond my personal bubble.

References:

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Appendix

Contact Information:

Glenn Pearrow – glenn.pearrow@gmail.com

Jolene Pearrow – jgpearrow@gmail.com

Max Ortiz – max.ortiz@lyfordcisd.net

Lora Martinez – eyedrloramartinez@gmail.com

The 5E Lesson Plan Sample Template and NASA 5E Lesson Plan on Heavy Lifting are attached to the assignment.