

Final Reflection of the 5E Model of Teaching Inquiry Science

By

Mary Driskell

Adams State University

ED 534 Multicultural Perspectives

Dr. Missy Holzer Ph.D.

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Title of Project:

Integrating 5E Inquiry Science approach lessons into the Science Classrooms

Curriculum Topics, School Name, Number of Educators, Grade Levels:

The curriculum topics covered during the professional development included: identifying and describing the components of a 5E lesson, distinguishing how the 5E instructional model supports authentic learning, and demonstrating the ability to use the 5E model by modifying or creating a content lesson.

The professional development was hosted at Sweet Springs High School, with twelve teachers attending the session; a thirteenth teacher completed the pre-survey questionnaire but was unable to attend the PD. Six of the attending teachers were from the first through sixth-grade classrooms, three from the middle school, and two teachers that teach STEM/library and art from kindergarten through twelfth grade, along with the high school special education teacher. Sweet Springs R-7 is a rural school with approximately 400 students and 47 certified staff. Sweet Springs R-7 school district is composed of one building that houses all students from pre-school to twelve grades. The mission of Sweet Springs R-7 is to provide the best educational opportunities possible to ensure that all the students become lifelong learners and productive members of society upon graduation. The steps that the school is taking to ensure that the mission is reached is by giving all students access to 1:1 device, and the school is in the process of updating all the technology in the classroom also, such as new smart boards and computers for all the teachers.

Standards Addressed:

With the wide range of class level teachers, I chose to implement the training on how to use the 5E Model of Teaching Inquiry Science on a lesson over density which could be adapted to use at many grade levels. The standards that the activity addressed included the Engineering Practices and Missouri State Standards. See Appendix A for a full list of supported practices and standards.

Summary of Project:

The goal of this professional development was to introduce the teachers to the 5E Model of Teaching Inquiry Science. The purpose of the 5E Model is to place students at the center of learning and help them construct an understanding of the science concepts. When using the 5E Model the teacher is more of a facilitator to guide student understanding. I used a simple lesson on density to guide the teachers through each step of the 5E Model. I chose this lesson because it is taught at many different levels, and I wanted an activity that was engaging and simple to walk the teacher through. This lesson incorporated many of the Engineering practices and the main goal of the 5E Model of promoting collaboration and active learning of the students by working together to solve problems and learn new concepts by asking question, making observation, and drawing their own conclusions.

Pre-question Survey List:

- How many years have you been teaching science?
- Do you have a science background?
- How familiar are you with the 5E inquiry approach to teaching science?
- Have you ever used any NASA sites in your teaching? If so, which ones?
- What science topics would you like to be covered during the PD?
- What type of professional development do you prefer? Active or passive?

Brief description of the actual professional development training:

I introduced my professional development training by emailing the staff, giving them a brief overview of the program. This included that the professional development would highlight the Endeavor program along providing them with resources that would support three-dimensional science and math teaching utilizing NASA resources. The main discussion topic will be implementing the 5E Model of Instruction that promotes active learning in the classroom.

I started the PD out as I would any of my 5E lessons. I had a video with a lava lamp playing on the smart board and bottles of oil and water sitting around the classroom on lab tables as my engagement for the lessons. Like my students, the teachers started playing with the bottles of oil and water and asking questions. After giving the teachers time to explore with the oil and water, I had them begin the experiment, the exploration part, by adding food coloring of their choice and the Alka-Seltzer tablets. They continued making observations and talking about what they were seeing and why. As the teachers worked through each step, we would discuss how they could use this in their classroom. After completing the exploration component, I played two videos over density for the explanation part of the lesson to help deepen the students understanding. After some discussion, I played another video about density to generate new questions or help answer unanswered ones and increase the student's/teacher's understanding of vocabulary related to density. The final step, evaluation I, had the teachers complete a Claim, Evidence, and Reasoning Graphic Organizer over the knowledge they gained about density during the lesson. I was surprised at how many teachers had never used the CER graphic organizer before, so I made sure that they had the information needed to implement them into their classroom also. I walked the teacher through each step of the 5E lesson as I would my students, except for stopping to answer their questions about how to incorporate it to fit their classroom needs. The purpose of doing this lesson with the teachers was to show them how easy it is to take one of their lessons and turn it into a 5E lesson.

After the profession development the teachers the participated were asked to complete an online post-survey using Google forms. I also met with four of the teachers sharing with them more resources and helping them develop their own 5E lessons, because we did not get to that part of the training due to running out of time. I have also met with the elementary principle and the fifth/sixth grade science teacher many times to help them with designing lesson to help prepare the students for the state assessment.

Brief description of each of the activities in the professional development session:

1. Sent out a letter of invitation to all elementary and middle school teachers.
2. Participants completed a pre-assessment survey via Google Forms. After receiving the surveys, I made sure to include links to lessons they asked for help within the PowerPoint I shared with them along with hard copies of lessons. I did this knowing that I would not have time to cover all the topics but wanted to ensure that they had the resources they asked for help with.
3. I started the lesson off by modeling the 5E Model of teaching Inquiry Science:
 - a. Engage: Video of a lava lamp playing on the smart board and bottle of oil and water sitting around the classroom for the participants to explore.
 - b. Explore: The participants conducted the Lava Lamp experiment making observations and discussing what was happening and why inside the bottle.
 - c. Explain: Two videos over density were played; one was over density of clay and water and the other density of wood and water. After the video's, a discussion happened comparing the results of each and why one floated and the other sunk.
 - d. Extend: A video on what is density was played to deepen the understanding of the topic and to generate more discussing and develop a correct understanding of density.
 - e. Evaluate: The participants completed a Claim, Evidence and Reasoning graphic organizer over the knowledge they gained about density during the lesson.
4. At the conclusion of the lesson a discussion about how to incorporate the 5E Model of teaching into each teacher's classroom ended the session.
5. Participants completed an online post-assessment via Google Forms.

What NASA data did you include?

I posted many different websites for the teacher to use, but one that I directed the fifth-grade science teacher to use was MY NASA data website to teach about the different spheres of Earth. I included in my presentation NASA STEM Engagement for the Seeing Sound lesson for the second-grade teachers. Other sites that I include were NASA eClips, and the Jet Propulsion Laboratory (JPL) website. I made sure when I posted the links, they took the teachers directly to lessons that they asked help in finding along with the links to the home page of each website. I also shared with them a blank outline of a 5E lesson plan template along with one that I wrote.

Post-questions Survey List:

- Did the professional development give you a better understanding of the integration of 5E into the classroom?
- What aspect of the professional development are you willing to integrate into the classroom?
- What are some ways the professional development could be improved?
- Would you be interested in participating in an interview in the coming weeks to discuss the information in more detail?

- Are there any other sources you would like for me to help you find or show you how to use?

Following the professional development, I meet with the high school special education and discussed in more detail how she can integrate the 5E model into her classroom. I have also shared more sources with the elementary teachers after they completed the post-questionnaire. I have also been working weekly with the fifth-grade science teacher and elementary principal on lessons to help prepare them for the state assessment. The elementary principal has also asked me to help the elementary and middle school teacher's work on writing their curriculum for next school year.

Outcomes- Final Data Collection and Analysis:

Survey Results/ Comments on the content included in the project:

In the post-survey five different questions were asked of the twelve participants in which all twelve responded. All the participants responded that the professional development did give them a better understanding of the integration of 5E model of learning into the classroom. All the participants also indicated that they are willing to integrate the 5E model of learning into their classroom or at least parts of it, such as more students' discovery and less teacher directions. The question on how the professional development could be improved only eleven of the twelve teachers responded to the questions. 54% thought the lesson was great! Of the other 46% the responses varied from more time, which I wish I would have had but due to other meeting that was not possible. Other responses for improvement included, going through a 5E lesson together and extension activities. 50% of the participants were interested in a follow-up interview, which I have either meet directly with them or I have shared more sources or both. Lastly, 50% of the participants asked for help finding other sources to use.

Survey Results/Comment on the pedagogy in the project:

The teacher that attended the professional development seemed to enjoy the activities that I had them doing instead of just setting and listening to me tell them how to develop a 5E lesson. Even though many of the teachers stated in the pre-survey that they preferred a passive style professional development they seemed to enjoy being up and activity, they also indicated that after it was over. With all the information and resources that the teachers are asking for help with finding and implementing that their level of pedagogy will definitely improve. I know that for me it has improved from just developing this professional development

Was your professional development successful? Why or Why Not?

Overall, the professional development on integrating 5E inquiry science lessons into the science classroom was a success. Many of the teachers stated how they liked the hands-on activities and how it leads to more student lead lessons over the teacher lead. Since the professional development I know a few of the teachers have used some of the NASA lessons in their classroom, an example who be the use of My NASA Data lessons over the different spheres of the earth for fifth grade. One of the ways the professional development was the most successful is that it has allowed for me to become a source of information for the elementary teachers that prior to the PD did know me or the connection to sources that I have and are more than willing to share. After this PD I have also talked with the elementary principal about doing more next year. Some ways that the PD could have been improved was having more time. I had planned to spend half the time walking the teacher though the density lesson and then the other half collaborating with them on making their own lesson or finding already made lessons for them to use in their classroom. Unfortunately, walking the teachers through the lesson and technical difficulties everything I had planned did not happen. One of the main changes I would make is giving them a blank 5E outline to complete while doing the lesson over density. Fortunately, I have worked with some of the teacher since the PD to help them find lesson and go over in more details how to write a 5E lesson. I did however post a sample copy in the presentation I shared with them.

How did this project relate to course readings?

Jenkins, A.A. & Yoshimura, J. (2010). Not Another Inservice! Meeting the Special Education Professional Development Needs of Elementary General Educators. *Teaching Exceptional Children*, 42(5),36-43.

The five steps that Jenkins and Yoshimura listed in the article for planning and delivering a professional development help in the development of my professional development. The five steps from the article are building readiness, conducting planning, implementing training, and allowing for implementation and maintenance (Jenkins & Yoshimura, 2010). When preparing the professional development, I tried to ensure that I keep these guidelines in mind to provide the teachers with the skills they need to meet the needs of all their students.

Marshbank, A. (2018). 5 ways to be a good teacher leader. SmartBrief.
<https://corp.smartbrief.com/orginal/2018/02/5-ways-be-good-teacher-leader>

Since reading Marshbank and article and conducting my professional development, I have tried to be more purposeful in my interactions with other teachers at school. I have always been willing to help if asked, but lately I have tried to ask others if they need help from anything in the classroom to helping at the track meet. Also, since my professional development I have definitely become a source of information for anything science related for the elementary teachers. After reading this article and taking this class hope that is quality I continue to build.

Will the teachers do these activities again?

I know that some of the teachers are already using some of the sources that I shared with them during the professional development. I know that not of them will be using all the steps of a 5E model lesson, but if they learned something from the professional development and if it helps makes their job easier with having learned about new sources that have great lessons that are fully developed then I think they will continue to use the information that I shared with them. With the writing of new curriculum this year and next I hope to continue helping them develop 5E model science lessons.

Reflection:

After hosting this professional development, I realized how much help the elementary teachers need in teaching science, and I hope to do more professional developments next year to help them be more successful in their teaching. This fact showed up in my final question on my post-survey about needing help with finding sources or wanting more help, and all but two of the teachers asked for more help and gave me topics they would like help with teaching. I have been working on sharing lessons with them both from NASA and other sites. My hope is that the with the combination of teaching methods and learning activities that I shared with the teachers that it has help them to become stronger teachers.

- A. Standards used in the unit
- B. Links to PowerPoint used for professional development
- C. Resource links used in the training
- D. Teacher Contacts
- E. Pre- and Post-Survey Data

Work Cited

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Wild, F. (2019, July 24). *The Astro-not-yets: Sound on a string educator guide for grades K-2*. NASA. Retrieved April 17, 2023, from <https://www.nasa.gov/stem-ed-resources/the-astro-not-yets-sound-on-a-string-educator-guide-for-grades-k-2.html>

YouTube. (2021, April 12). *What is density? | science for kids*. YouTube. Retrieved April 17, 2023, from <https://www.youtube.com/watch?v=1HJkEVOZbTM>

Appendix A: Standards used in unit

Missouri Learning Standards: Grade –Level Expectations

Kindergarten Science

K.ETS1.A.1- Ask questions, make observation, 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 took.

First Grade Science

1. ETS1.A.1- Ask questions, make observation, 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 took.

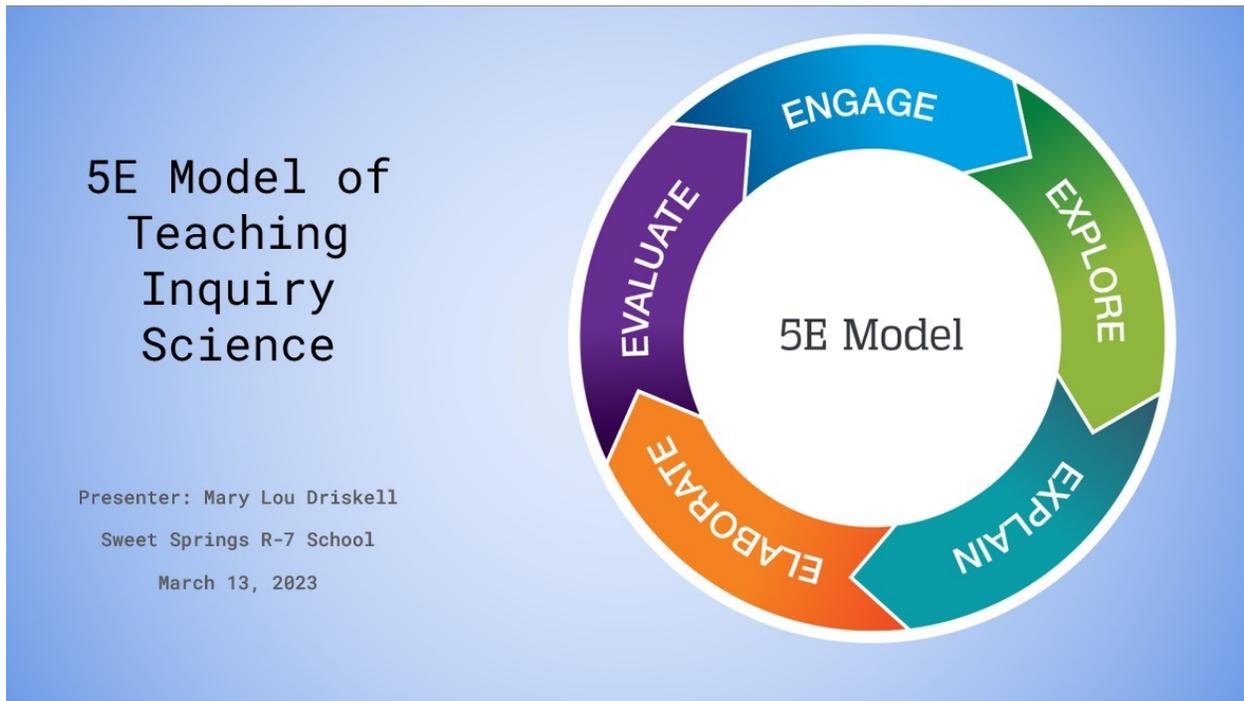
Second Grade Science

2. PS1.A.1. – Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

<p>Students who demonstrate understanding can:</p> <p>K-2-ETS1-1. 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.</p>		
<p>The performance expectation above was developed using the following elements from the NRC document A Framework for K-12 Science Education:</p>		
<p>Science and Engineering Practices</p>	<p>Disciplinary Core Ideas</p>	<p>Crosscutting Concepts</p>
<p>Asking Questions and Defining Problems Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.</p> <ul style="list-style-type: none"> Ask questions based on observations to find more information about the natural and/or designed world(s). Define a simple problem that can be solved through the development of a new or improved object or tool. 	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> A situation that people want to change or create can be approached as a problem to be solved through engineering. Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem. 	
<p>Connections to K-2-ETS1.A: Defining and Delimiting Engineering Problems include:</p> <p>Kindergarten: K-PS2-2, K-ESS3-2</p>		
<p>Articulation of DCIs across grade-levels:</p> <p>3-5.ETS1.A ; 3-5.ETS1.C</p>		
<p>Common Core State Standards Connections:</p> <p>ELA/Literacy—</p>		

<u>RI.2.1</u>	<u>Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (K-2-ETS1-1)</u>
<u>W.2.6</u>	<u>With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-1)</u>
<u>W.2.8</u>	<u>Recall information from experiences or gather information from provided sources to answer a question. (K-2-ETS1-1)</u>
<i>Mathematics —</i>	
<u>MP.2</u>	<u>Reason abstractly and quantitatively. (K-2-ETS1-1)</u>
<u>MP.4</u>	<u>Model with mathematics. (K-2-ETS1-1)</u>
<u>MP.5</u>	<u>Use appropriate tools strategically. (K-2-ETS1-1)</u>
<u>2.MD.D.10</u>	<u>Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (K-2-ETS1-1)</u>

Appendix B: Links to PowerPoint used for professional development



5E Model of Teaching Inquiry Scier

Appendix C: Resource Links used in the training

<https://www.acs.org/education/resources/k-8/inquiryinaction/fifth-grade/density-clay-water.html>

<https://www.acs.org/education/resources/k-8/inquiryinaction/fifth-grade/density-wood-water.html>

<https://www.youtube.com/watch?v=1HJkEVOZbTM>

https://nasaclips.arc.nasa.gov/resources/guides#Full_Guide_grades_K-5_Our_World

<https://www.jpl.nasa.gov/edu/teach/>

<https://www.nasa.gov/stem-ed-resources/the-astro-not-yets-sound-on-a-string-educator-guide-for-grades-k-2.html>

<https://mynasadata.larc.nasa.gov/>

https://www.nasa.gov/stem/nextgenstem/commercial_crew/index.html

<https://www.nasa.gov/stem-ed-resources/seeing-sound.html>

<https://docs.google.com/document/d/1AcPU5JpkMAjIRjcJVIsUH5vtgvFkmCJ2tJLqN5RhE20/edit?usp=sharing>

Appendix D: Teacher Contacts:**The teachers who attended the professional development:**

Kim Scott- fifth and sixth grade science teacher – kscott@sweetsprings.k12.mo.us

Caitlyn Eidson- second grade teacher- ceidson@sweetsprings.k12.mo.us

Cindy Heimsoth- fifth and sixth grade English Language Arts teacher-
cheimsoth@sweetsprings.k12.mo.us

Cheryl Huston- High School special education teacher- chuston@sweetsprings.k12.mo.us

Kim Hudson- Kindergarten – high school librarian and STEM teacher –
khudson@sweetsprings.k12.mo.us

Elizabeth Dunkle- first-grade teacher – edunkle@sweetsprings.k12.mo.us

Danielle Hollrah- first-grade teacher- dhollrah@sweetsprings.k12.mo.us

April Miller- junior high math teacher- amiller@sweetsprings.k12.mo.us

Ashton Stanton- Kindergarten – high school art teacher – astanton@sweetsprings.k12.mo.us

Amy Heaper- fourth-grade math and science teacher – aheaper@sweetsprings.k12.mo.us

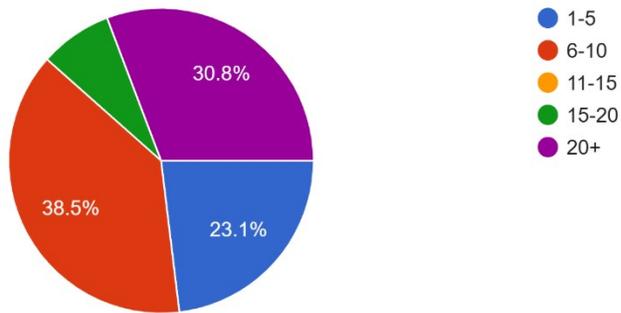
Debbie Smith- Middle School special education teacher- dsmith@sweetsprings.k12.mo.us

Amy Winston- middle school science teacher – awinston@sweetsprings.k12.mo.us

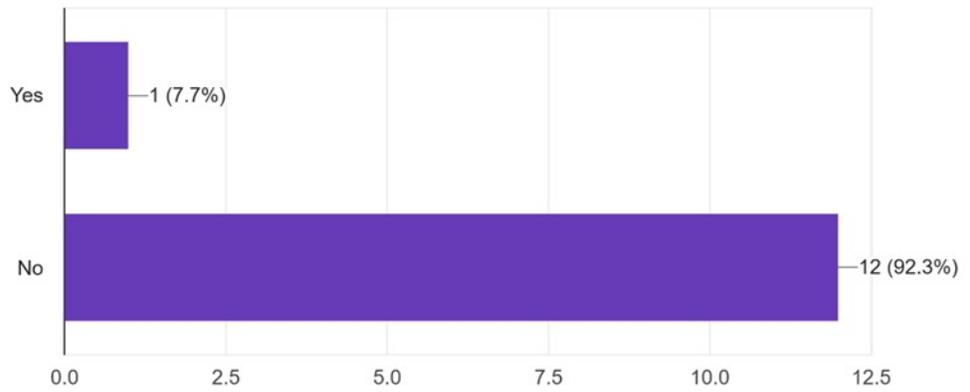
Appendix E: Pre and Post Survey Data

Outcomes: Pre-Survey

How many years have you been teaching?
13 responses

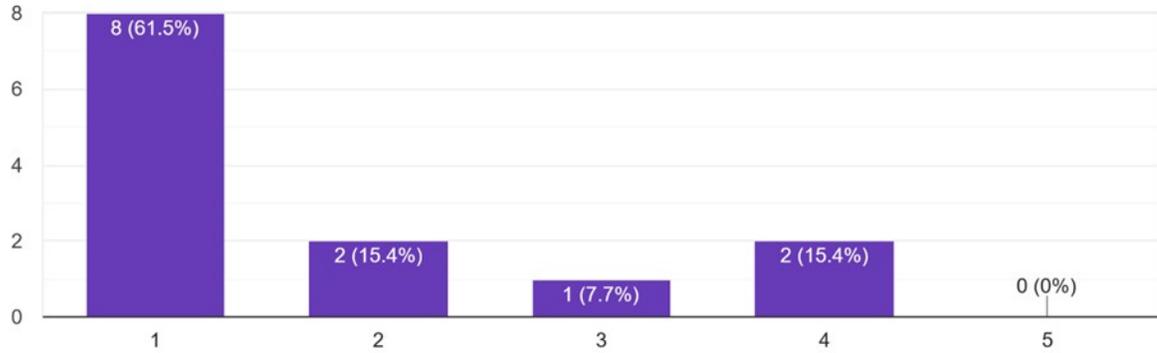


Do you have a science background?
13 responses



How familiar are you with the 5E inquiry approach to teaching science?

13 responses



Have you ever used any NASA sites in your teaching? If so, which ones? 13

responses

No

no

Yes, Moon Exploration

NASA.gov, YouTube videos related to NASA

Not yet.

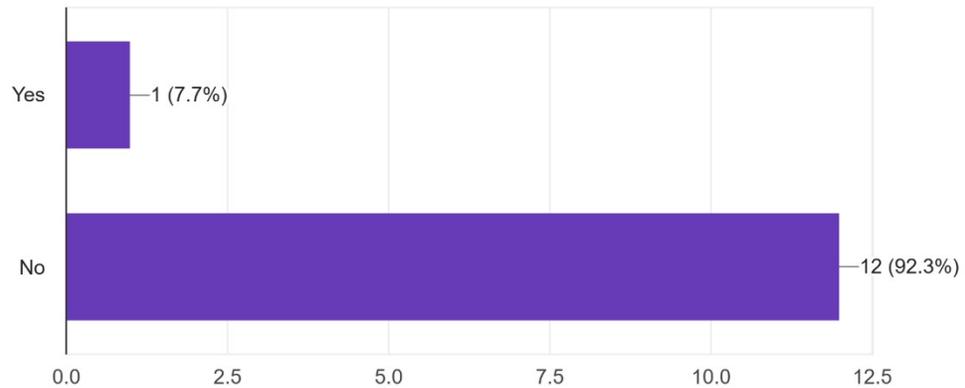
Yes, used during our planet research process.

None

No, I have not

Do you have a science background?

13 responses



What are some science topics that you would like to be covered during the PD? 13 responses

any topic

I don't know much about science, but planets are cool.

I would be interested in all science topics.

Inexpensive science activities to use with sixth graders

Energy, simple machines, forces, motion

2nd grade has had to supplement a lot for the topics of motion/vibration. We've also had to create our own labs on motion and vibration. Our science book (Science Fusion) didn't do the best job on these topics.

How to fit in science with a limited time schedule.

More hands-on learning for Sun, moon & stars.

STEM

doesn't matter

Science for middle school age. Solar System

Life Skills Practical science

Force and motion

What type of professional development do you prefer?

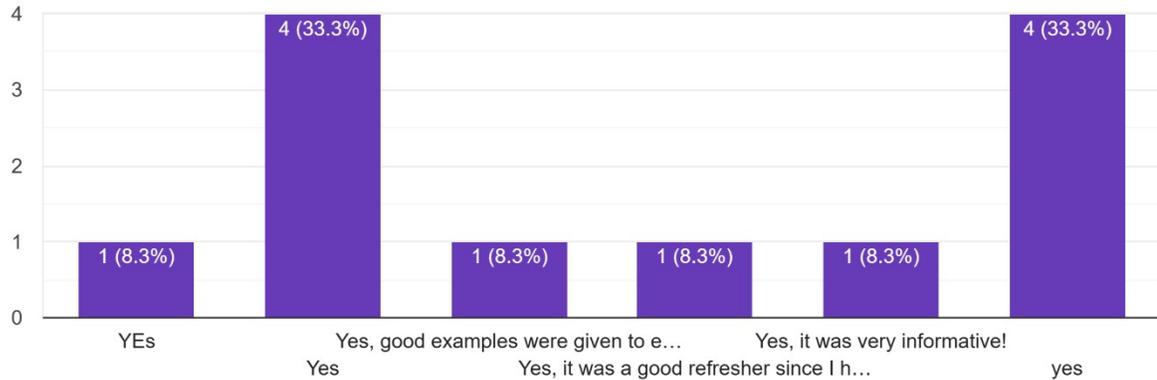
13 responses



Post-Survey

Did the professional development give you a better understanding of the integration of 5E into the classroom?

12 responses



What aspect of the professional development are you willing to integrate into the classroom? 12 responses

Exploring more

The 5E Lesson Format

more student discovery instead of teacher-directed

Engagement

hands on exploration

I would like to do more hands-on science, where they are able to explore before the lesson.

The 5 Es

All of it. Can't wait to integrate this into my classroom.

Encouraging my students to think by asking them questions

More hands-on student lead

Using hands-on learning

I especially like connecting any type of exploration and hands on activity to the lesson.

What are some ways the professional development could be improved? 12

responses

We could have had time to make a lesson together.

There were some technology difficulties, but this wasn't your fault. Maybe more time to view the links provided.

it was great

More Time

n/a

As teachers going through it, I would have liked to have a 5E lesson plan for that specific lesson with me to see how to write it and how to apply it at the same time.

Hands on was awesome! I loved the examples given out as well.

None, maybe an extension activity.

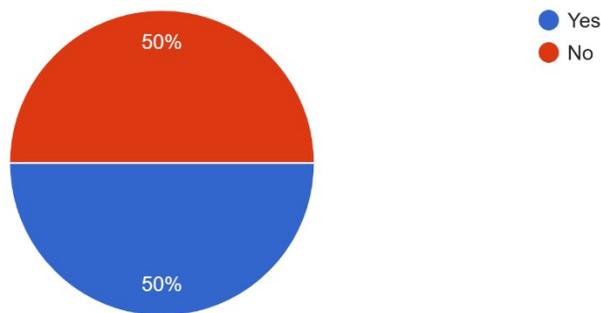
It was great

She did an excellent job.

Great variety of information was given. Technical difficulties were experienced, but to no fault of the teacher.

Would you be interested in participating in an interview in the coming weeks to discuss the information in more detail?

12 responses



Are there any other sources you would like for me to help you find or show you how to use how to use.

12 responses

