Proposal for Professional Development

STEM Leadership Seminar

SCED 545 - Spring 2022

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The title of my STEM professional development is What will replace the International Space Station?

I selected this topic because hearing about the space station being decommissioned got me thinking about what will replace it. I thought about how the whole 6th grade team could create an interdisciplinary unit that we could all work on together and do this every year until it actually happens. Using the NASA websites, the team would create units that involve the students deciding what would replace the International Space Station.

My professional development topic integrates NASA assets and/or content from the Endeavor courses by using the websites that NASA and NASA JPL to create a unit of study for the students. Other ways that my professional development will incorporate content from my Endeavor's courses is through the understanding of what makes a professional development have an impact on student learning. My plan is to work towards having a project based learning unit that involves all subject areas, including the students' unified arts teachers. In future years, it would be amazing to have the students talk to the few astronauts that are able to work out on the International Space Station. We could also take virtual tours of the ship using NASA resources.

My proposed audience will be my sixth grade team. These teachers are three of the English Language Arts and Social Studies teachers and two others will be Mathematics and Science teachers. Altogether we teach around 170 students. I teach in a rural community in a building of about 700 students 6th - 8th grade.

The STEM concepts and learning goals that I will address are:

CCSS Colorado State Standard - HS - Standard 3 Earth and Space Science

b. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. (HS-ESS3-4) *(Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use [such as for urban development, agriculture, and livestock, or surface mining]. Examples for limiting future impacts could range from local efforts [such as reducing, reusing, and recycling resources] to large-scale geoengineering design solutions [such as altering global temperatures by making large changes to the atmosphere or ocean].)*

1. Students can answer the question: How do humans change the planet?
2. ESS3:C Human Impacts on Earth's Systems: The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.

Cross Cutting Concepts:

1. Stability and Change: Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. Feedback (negative or positive) can stabilize or destabilize a system.
2. Connections to Nature of Science: Science is a Human Endeavor. Science is a result of human endeavors, imagination, and creativity.

Prepared Graduates:

11. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's surface processes interact.

Grade Level Expectation:

11. Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies.

Evidence Outcomes:

Students Can:

a. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity. (HS-ESS3-3) *(Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.) (Boundary Statement: Computational simulation is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.)*

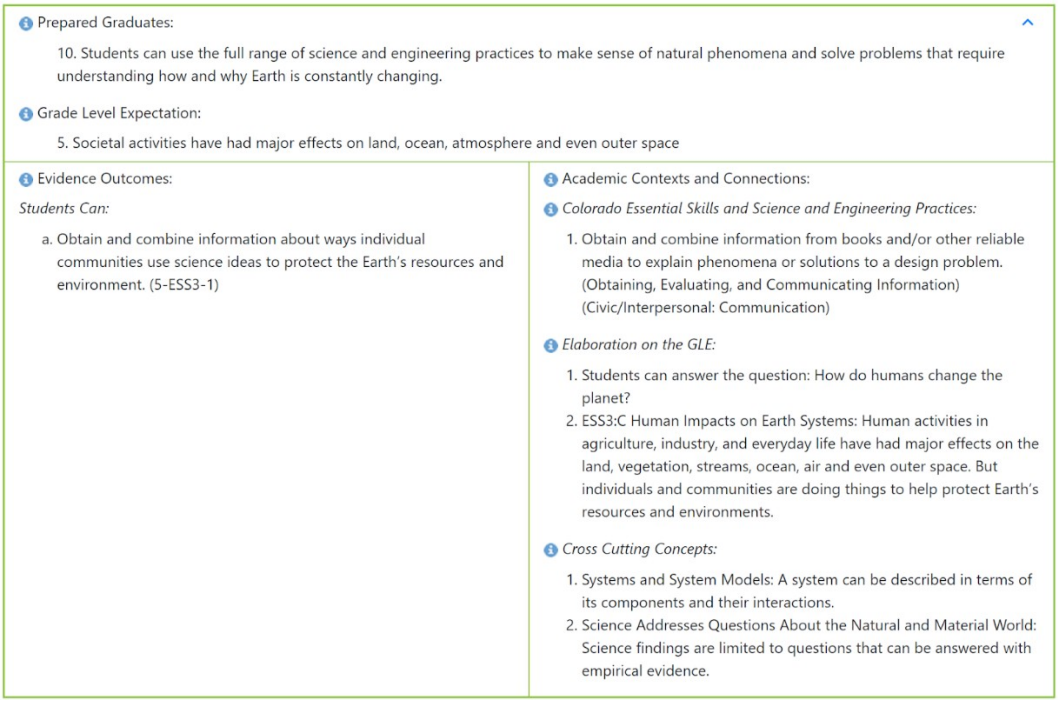
Academic Contexts and Connections:

Colorado Essential Skills and Science and Engineering Practices:

1. Create a computational model or simulation of a phenomenon, designed device, process, or system. (Using Mathematics and Computational Thinking) (Entrepreneurial: Critical thinking/Problem solving)
2. Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations. (Constructing Explanations and Designing Solutions) (Civic/Interpersonal: Global/Cultural awareness)

Elaboration on the GLE:

Fifth Grade, Standard 3. Earth and Space Science



Prepared Graduates:

10. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.

Grade Level Expectation:

5. Societal activities have had major effects on land, ocean, atmosphere and even outer space

Evidence Outcomes:

Students Can:

a. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. (5-ESS3-1)

Academic Contexts and Connections:

Colorado Essential Skills and Science and Engineering Practices:

1. Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (Obtaining, Evaluating, and Communicating Information) (Civic/Interpersonal: Communication)

Elaboration on the GLE:

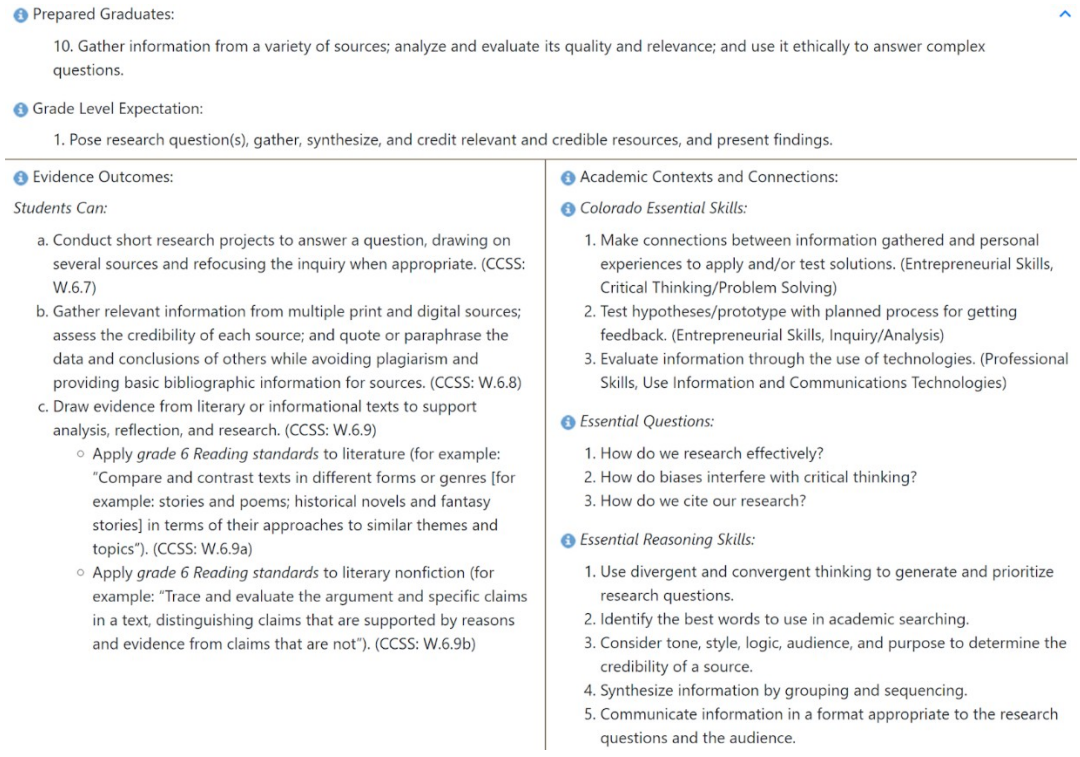
1. Students can answer the question: How do humans change the planet?
2. ESS3:C Human Impacts on Earth Systems: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

Cross Cutting Concepts:

1. Systems and System Models: A system can be described in terms of its components and their interactions.
2. Science Addresses Questions About the Natural and Material World: Science findings are limited to questions that can be answered with empirical evidence.

Reading, Writing, and Communication for 6th Grade

Sixth Grade, Standard 4. Research Inquiry and Design



Prepared Graduates:

10. Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.

Grade Level Expectation:

1. Pose research question(s), gather, synthesize, and credit relevant and credible resources, and present findings.

Evidence Outcomes:

Students Can:

a. Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate. (CCSS: W.6.7)
b. Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (CCSS: W.6.8)
c. Draw evidence from literary or informational texts to support analysis, reflection, and research. (CCSS: W.6.9)
    - Apply *grade 6 Reading standards* to literature (for example: "Compare and contrast texts in different forms or genres [for example: stories and poems; historical novels and fantasy stories] in terms of their approaches to similar themes and topics"). (CCSS: W.6.9a)
    - Apply *grade 6 Reading standards* to literary nonfiction (for example: "Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not"). (CCSS: W.6.9b)

Academic Contexts and Connections:

Colorado Essential Skills:

1. Make connections between information gathered and personal experiences to apply and/or test solutions. (Entrepreneurial Skills, Critical Thinking/Problem Solving)
2. Test hypotheses/prototype with planned process for getting feedback. (Entrepreneurial Skills, Inquiry/Analysis)
3. Evaluate information through the use of technologies. (Professional Skills, Use Information and Communications Technologies)

Essential Questions:

1. How do we research effectively?
2. How do biases interfere with critical thinking?
3. How do we cite our research?

Essential Reasoning Skills:

1. Use divergent and convergent thinking to generate and prioritize research questions.
2. Identify the best words to use in academic searching.
3. Consider tone, style, logic, audience, and purpose to determine the credibility of a source.
4. Synthesize information by grouping and sequencing.
5. Communicate information in a format appropriate to the research questions and the audience.

NGSS Engineering Design

Students who demonstrate understanding can:

MS-ETS1-1. **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**

MS-ETS1-2. **Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

MS-ETS1-3. **Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**

MS-ETS1-4. **Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

- The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

ETS1.B: Developing Possible Solutions

- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Connections to MS-ETS1.A: Defining and Delimiting Engineering Problems include:
Physical Science: MS-PS3-3
Connections to MS-ETS1.B: Developing Possible Solutions Problems include:
Physical Science: MS-PS1-6, MS-PS3-3, **Life Science:** MS-LS2-5
Connections to MS-ETS1.C: Optimizing the Design Solution include:
Physical Science: MS-PS1-6

Articulation of DCIs across grade-bands:
3-5.ETS1.A (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3); **3-5.ETS1.B** (MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4); **3-5.ETS1.C** (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4); **HS.ETS1.A** (MS-ETS1-1),(MS-ETS1-2); **HS.ETS1.B** (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4); **HS.ETS1.C** (MS-ETS1-3),(MS-ETS1-4)

Common Core State Standards Connections:

ELA/Literacy -	
RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1),*(MS-ETS1-2),(MS-ETS1-3)*
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). *(MS-ETS1-3)*
RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2),(MS-ETS1-3)
WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ETS1-2)
WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.(MS-ETS1-1)
WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research. *(MS-ETS1-2)*
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.*(MS-ETS1-4)*
Mathematics -	
MP.2	Reason abstractly and quantitatively. *(MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4)*
7.EE.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *(MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)*
7.SP	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. *(MS-ETS1-4)*

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

My materials address classroom activities that can be replaced by condensing several disconnected units into one big unit that covers all educational and learning areas.

My session will be about an hour in length with a follow-up meeting with each of the teachers. To advertise my professional development, I will create an email that will be sent to the teachers. I will also create time in our weekly meeting to give information for the professional development. In the future, I could see this professional development happening every year as we progress the learning and create more connections and opportunities for the students.

For the pre- and post- survey, I will ask the teachers some general questions that lead to asking them for input into the professional development that I am going to lead.

The outcome I hope to achieve with this professional development is a unified 6th grade team that uses NASA resources to round out the education of students. I hope to build an interest in creating a project-based learning unit that all teachers would be interested in creating and using every year.

I will follow up with the teachers by meeting with them and having them complete the post survey on how effective they felt my professional development was, what they thought went well, what areas they thought I could improve, what, if anything, they think they will use in their classrooms.

The data collection I will use will be the surveys and the individual conversations that I have. These surveys will be collected using Google Forms and the conversations will be recorded with anecdotal notes.