5E Lesson Plan – Final.

Methods of Stem Education

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5E Lesson Plan – Draft.

Theme: Building Resilience when faced with natural hazards
Grade Level: 6

Time: The lesson showcased in this 5E lesson, is included in an integrated Math/Science/ Humanities unit. The unit is designed to be taught in multidisciplinary teams. Classes and core time can be adjusted and retimed based on student needs. Humanities and Math/Science Teachers jointly facilitate the classes. The current unit is 7 weeks long. This activity is an additional summative assessment that students may choose.

Standards Covered:

CCSS

R6.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

W6.7 Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

W6.8 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.

SL6.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

6MC GA4 Solve real-world and mathematical problems involving area, surface area, and volume. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

NGSS

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-ETS1-4 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.

Learning Objectives

Student will be able to:

- Apply knowledge of the Disaster Preparedness Cycle to assist them to reason critically and create innovative solutions to natural hazard resistant structures.
- Utilize the Engineering Design process.
- Apply previously gained knowledge and understanding of scientific factors related to natural hazards.
- Apply mathematical model to illuminate a problem or situation.
- Design and create models of buildings that will assist communities to lessen the impact of natural hazards.
- Take part in a gallery walk to present their designs to a collective forum of grade 6 students.

Overarching Essential question
How can a community build resilience when faced with natural hazards?

Rationale
The culminating lesson for our interdisciplinary unit # Resilience is one of several that students may choose from. In a series of short lessons over a week period students will review content, which has been gained earlier in the unit. Students will design a structure that will assist communities in reducing the impact of natural hazards, thus allowing them to recover and rebuild quicker.

This lesson provides an opportunity for students to apply knowledge gained and have this assessed with the following standards; Common Core Math, NGSS Engineering, Common Core Writing as well as Listening and Speaking. In our region, natural hazards affect numerous communities annually; as such this lesson allows students to reflect on ways in which their ideas could help communities to lessen the impact of natural hazards in turn providing an avenue for quicker recover and long-term preparedness.

Background knowledge
After exposure to the 7-week interdisciplinary unit in Math, Science and Humanities (Social Studies and English) classes, students are well versed in the natural hazards that are experienced by countries located in the Ring of Fire. In addition, they have gained knowledge and understandings related to: -

- Weather patterns

- The earths structure and boundary systems
- Current and historical data related to natural hazards
- The need for disaster preparedness, and the Disaster Preparedness Cycle.
- The Social and Economic factors that affect communities that are exposed to natural hazards.

Engage – Day 1

During the tenure of the unit, in addition to math / science concepts, students have had the opportunity to be placed and work in mixed class Book Groups. As our student population stems from a myriad of diverse backgrounds, students were sorted by reading ability and interest.

The theme of all three novels focuses on resilience and the stories were based on survival during natural hazards. The novels studied include the following:

1. *The Killing Sea by Richard Lewis*
2. *Red by Libby Gleeson*
3. *Escaping the Giant Wave by Peg Kehret*

Students will review short videos related to the disaster preparedness cycle that highlight the different types of natural hazards that communities globally may be exposed to annually (floods, tsunami's, monsoonal rains and earthquakes) and how communities work to lessen the impact.

On entering the classroom students are given a specific symbol, and asked to join the matching table group. The students then begin viewing a short video and discuss content with their table group. Each table has a different video; table groups become "experts".

Students will view the following videos: -

1. Preparedness (Click Here)
2. Response (Click Here)
3. Recovery (Click Here)
4. Mitigation (Click Here)

Once completed students regroup, and student "experts" share and discuss the content, as well as their knowledge and understanding. Students use the Norms of Collaboration during the discussion. Taking turns, speakers make claims, which are supported with evidence. Students pause to allow for questions. The role of listeners is to actively listen, seek clarity and ask probing questions. Students synthesize their understanding of the Disaster Preparedness Cycle and its importance via a journal entry in their blog. The teacher to further access student understanding uses a formative assessment by way of an exit ticket.

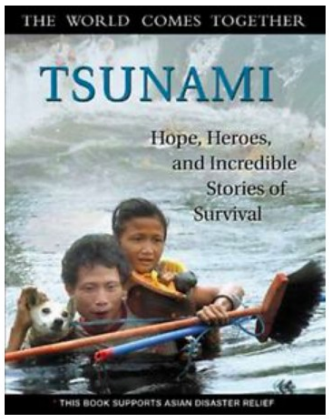
Students are asked to answer the question" How does being Disaster Prepared assist communities at risk?

Explore – Day 2
For homework, students are presented with a visual and asked to place themselves in the scene, in preparation for a quick write that will take place in Humanities class at the beginning of the next day's lesson. At the end of the quick write in their writer's journal, students have the opportunity to review, revise and edit and lastly share with their table group. Table groups vote for their favorite quick write which is then shared with the class.

Graphic Source
Bone, South Sulawesi, Indonesia
Students are seen crossing a river on a rope on their way to school, after a suspension bridge collapsed due to rain and flooding.
Photograph: Silori Images/Barcroft India

Scaffolding on the previous days lesson, students will have the opportunity to gain additional knowledge by examining a set of visuals that clearly illustrate the destruction that occurs during natural hazards. Once groups have examined all visuals they are asked to group the visuals based on concepts. For example; Desperation, Community Resilience etc.

Students are then given the opportunity to read, take notes and then join a Socratic Seminar to discuss authentic examples of communities that have shown resilience and are forced to annually recover from natural hazards. Groups use Photobooth software to record their conversation and the Norms of Collaboration to self assess their participation. Refer Appendix A for the rubric for assessment.



Resource: Tsunami; Hopes, Heroes and Incredible Stories of Survival

Explain – Days 3 - 5

At the beginning of the lesson students discuss videos and visuals from previous days, and are reminded of the overarching essential question “How can communities build resilience when faced with natural hazards”.

Next, students are asked to regroup as; - Actors, Writers, Artists or Engineers.

In newly reformed table groups, using the visible thinking strategy, “Graffiti wall” table groups are provided with an easel pad post it note and a variety of pencils and pens. Groups brainstorm and complete a graffiti wall that outlines ways in which they can help communities. A spokesman from each group shares data with the rest of the class. Again, student understanding is showcased in evidence from the spokesperson and used as a quick formative assessment.

Teacher facilitators join each group, review brainstorming data and suggest topics that might be suitable for additional research. Students are provided a great deal of latitude and agency. One such topic could be buildings designed to withstand natural hazards. Students begin research with a view to creating a prototype. A set of templates to record research data is shared to student interest groups via Google Classroom. Students are provided a timeline of 3 x 1 hour lessons to complete and collate research.

Elaborate – Days 5 – 9

After conducting research, the student engineering pairs (or triplets) reconvene in the Design Technology / Maker space area. In teams, students review and share research. Next, using the Engineering Design cycle as a guide, students begin sketching, blueprinting and sourcing materials for natural hazard resilient buildings prototype. Students are reminded to utilize knowledge gained through mathematical modeling and apply this to the building design.

The said prototypes may be constructed from materials such as cardboard etc. or designed using Tynkerkad and 3d printed. Again students are provided with a

prototyping timeline of 4 days. Students are also informed that on Day 10 that a gallery walk will occur where the prototypes will be shared within a Grade 6 forum.

Evaluate – Day 10

Day 10 is Gallery Walk day. All passion groupings have the opportunity to rehearse and move their final products to a multi- purpose room for viewing.

The natural hazard resistant prototypes are on display. On a rotating basis one member of the group remains with the prototype and explains to participants the relevant features of the model. Participants are asked to complete a rubric as well as provide feedback and suggestions for presenters.

At the end of the day, rubrics are also given to presenter's self-reflection not only on previously identified standards but also non-academic assessment such as Collaborate Constructively.

The next day, students are asked to complete an entry in their learning portfolio' s highlighting peer feedback, self-assessment connections and wonderings.

Please refer to Appendix B for Gallery Walk Rubric.

References

Corestandards.org. (2017). Retrieved April 7, 2018 from http://www.corestandards.org/Math/Content/6/G/

Phases of Disaster Preparedness. Retrieved April 7, 2018 from http://restoreyoureconomy.org/disaster-overview/phases-of-disaster/

Nextgenscience.org. (2013). Retrieved April 7, 2018 from https://www.nextgenscience.org/dci-arrangement/ms-ets1-engineering-design

Appendix A – Socratic Seminar Rubric

Standard	***Does not yet meet the standard***	***Approaching the Standard***	***Meets Standard***	***Extends Standard***
Reads text and prepares. ***Supports ideas with reference to the text.***	Does not come prepared with required materials or has not read/researched text or topic. Rarely uses textual evidence or not at all during the discussion. Does not provide any explanations of textual evidence.	Comes somewhat prepared with required materials and having previewed text or topic. Uses textual evidence several times during the discussion. Analyzes textual evidence by giving some explanations of evidence.	Comes prepared with required materials completed and having read/researched text or topic. Uses textual evidence numerous times during the discussion. Analyzes textual evidence by giving thorough explanations when evidence Is used.	Comes prepared with required materials completed with additional annotations or notes. Always uses textual evidence during the discussion. Analyzes textual evidence by comparing multiple pieces of evidence and synthesizing for meaning.
Listens respectfully to others - words, actions and body language show positive engagement.	Distracts or interrupts several times. Does not make eye contact with speakers. Rarely demonstrates awareness of discussion roles.	Distracts or interrupts a few times. Makes eye contact with some speakers. Demonstrates awareness of discussion goals.	Distracts or interrupts no more than once. Maintains eye contact with speakers. Assists other participants with discussion goals.	Never distracts or interrupts. Maintains eye contact and nods to show active listening to speakers. Takes a leadership role in guiding participants with discussion goals.
Questions and answers insightfully. (Clarifies ideas, invites others to contribute and explores new ideas).	Rarely/never asks questions. Rarely/never answers other participant's questions.	Asks some questions. Sometimes answers other participant's questions.	Asks questions that provide opportunities for further discussion. Answers other participant's questions.	Asks numerous questions that provide opportunities for deeper and further discussion. Answers other participant's questions consistently using evidence.
Uses collaborative strategies. ***Paraphrases***	Does not paraphrase the ideas of others. Does not pause to	Sometimes paraphrases the ideas of others.	Consistently paraphrases the ideas of others.	Paraphrases the ideas of others, shifting to a synthesis and asks questions to promote further dialogue. Facilitates pausing to

the ideas of others. ***Pauses to allow time for reflection.*** ***Builds of the ideas of others***	allow for “think time”. Does not build on the ideas of others or offer a differing viewpoint.	Sometimes pauses to allow for “think time”. Sometimes builds on the ideas of others or offers a differing viewpoint.	Pauses to allow for “think time”. Builds on the ideas of others or offers a differing viewpoint to further the discussion.	allow for “think time”. Builds on the ideas of others or offers a differing viewpoint to deepen the discussion.

<u>Student Self Reflection</u>

a) What were you most proud of during the Socratic Seminar? Please explain.

b) Using the rubric as a guide, what areas would you like to improve? What strategies will you use? Please explain.

c) What is one long-term goal that you have for Socratic Seminars?

Appendix B – Gallery Walk Presentation

STEM #Resilience Building Prototype Design / Gallery Walk Rubric

	Does Not Yet Meet the Standard	**Approaching Standard**	**Meets Standard**	**Extends Standard**
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	Prototype and presentation does not show a level of enthusiasm for the subject. Little evidence of engineering design process.	Prototype and presentation shows a level of enthusiasm for the subject. Some evidence of engineering design process.	Prototype and presentation clearly shows a level of enthusiasm for the subject. Clear evidence of engineering design process.	Prototype and presentation shows a heightened level of enthusiasm for the subject. Evidence that you have clearly explored external resources and applied this knowledge to the engineering design process.
Collaborate Constructively	Prototype and presentation show very little evidence of the collaborative element of this assessment.	Prototype and presentation illustrate some evidence of the collaborative element of this assessment.	Prototype and presentation clearly illustrate the collaborative element of this assessment.	Prototype and presentation clearly illustrate a heightened awareness of the collaborative element of this assessment
Apply mathematical model to illuminate a problem or situation. *Evaluate competing design solutions using a*	Design and presentation did not show evidence regarding knowledge of scientific and mathematical concepts gained through the unit Presentation did not show	Design and presentation showed some knowledge of scientific and mathematical concepts gained through the unit. Presentation showed some	Design and presentation showed knowledge of scientific and mathematical concepts gained through the unit Presentation showed knowledge of the	Design and presentation clearly showed knowledge, application and analysis of scientific and mathematical concepts gained through the unit Presentation clearly showed knowledge of the Disaster

systematic process to determine how well they meet the criteria and constraints of the problem.	knowledge of the Disaster Preparedness Cycle	knowledge of the Disaster Preparedness Cycle	Disaster Preparedness Cycle	Preparedness Cycle with a heightened level of analysis.