Lesson Plan Template
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Grade: 4th

Subject: Science

Materials:
- Four games of *Survive the Quake: Engineering Kit*
- Building design sheet

Technology Needed:
- Computer
- Projector

Instructional Strategies:

- ☐ Direct instruction
- ☐ Guided practice
- ☐ Socratic Seminar
- ☐ Learning Centers
- ☐ Lecture
- ☐ Technology integration
- ☐ Other (list)
- ☐ Peer teaching/collaboration/ cooperative learning
- ☐ Visuals/Graphic organizers
- ☐ PBL
- ☐ Discussion/Debate
- ☐ Modeling

Guided Practices and Concrete Application:

- ☐ Large group activity
- ☐ Independent activity
- ☐ Pairing/collaboration
- ☐ Simulations/Scenarios
- ☐ Other (list)
- ☐ Hands-on
- ☐ Technology integration
- ☐ Imitation/Repeat/Mimic

Explain:

Standard(s)
4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Objective(s)
By the end of the lesson, students will be able to design and construct a building that can withstand a level three earthquake by using the *Survive the Quake: Engineering Kit*

"I can design and construct a building that can survive a level three earthquake."

Bloom's Taxonomy Cognitive Level: Creating

Differentiation

Below Proficiency: Instead of writing several sentences on the design sheet, I will accept one or two sentences. If the design sheet is not effective for them, I will take a verbal description of their design, reasoning, and reflection. I may also modify the groups to include an above proficiency student that can help as a peer teacher. I may also provide the student with images of potential buildings to help them generate ideas and help with their contribution to the group discussion. If the directions for the design process are confusing, I will come over and re-explain the directions step-by-step, or I will have one of their above proficiency group members re-explain the instructions.

Above Proficiency: I will challenge them to write multiple sentences for their design reasoning, modifications, and reflection. If they are able to easily create a structure that can withstand a level three earthquake, I may have them add another story onto their building structure, or I may have them try and develop a structure that can withstand a level four earthquake.

Approaching/Emerging Proficiency: They will use the design sheet to record their drawing, modifications, and reflection. They will be asked to write a few sentences in the sections of the design sheet. If they are having a difficult time coming up with a structure, I may help them generate ideas by discussing potential structures with them. If that does not work, I may give them a few images that will help generate ideas.

Modalities/Learning Preferences:

- Visual Intelligence: The videos will help them get an understanding of how earthquakes cause serious damage and ways buildings can be modified to stand against earthquakes.
- Spatial Intelligence: The *Survive the Quake: Engineering Kit* materials will create a hands on experience. The students will be able to construct a building structure that can stand against a level three earthquake. They will also be able to generate the earthquake with these materials.
- Linguistic Intelligence: The design sheet will help the students translate onto paper what they are planning on creating, any modifications, and a reflection on their design. Students that learn best from writing will benefit from the design sheet.
- Interpersonal Intelligence: The students will be able to communicate their ideas with their group members. For those that work better in groups, the explore portion will help the students brainstorm ideas and create a structure. Collaboration will help them be successful.

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	• Logical Intelligence: The various tests with their structures will require the students to critically think about how to modify their design. The design sheet will also help them brainstorm potential ideas.

Classroom Management- (grouping(s), movement/transitions, etc.)
• Large Group Discussion
  • Active listeners.
  • Voice level 0 when others are talking.
• Turn and Talk
  • Everyone shares.
  • Active listeners.
• Group Work
  • Everyone participates.
  • Voice level 2.
• Using Materials
  • No throwing, stomping on, or putting in mouth.
  • Place back in container.
• Clean Up
  • Everyone helps.
  • All pieces must be cleaned up.
• Transitions
  • "One, two, three eyes on me."
  • "Come back to me in three, two, one."
  • "Hands on top, everybody stop."
• Groupings
  • Turn and talk with a partner at their table.
  • Group work with table mates.
	Behavior Expectations- (systems, strategies, procedures specific to the lesson, rules and expectations, etc.)
	• Large Group
	  • Students are expected to be active listeners.
	  • Students are required to use a voice level 0 when others are talking.
	  • Students are required to participate in the discussion.
	• Turn and Talk
	  • Students are required to be active listeners when others are talking.
	  • Students are expected to participate.
	  • Students are required to use a voice level 0 when others are talking.
	  • Students are expected to take turns talking.
	  • Students are expected to use a voice level 1 when it is their turn to talk.
	• Group Work
	  • Students are required to be active participants.
	  • Students are required to share the responsibilities, jobs, and materials with one another.
	  • Students are required to use a voice level 2 when they are working together.
	  • Students are required to fill out their own design sheet form.
	• Using Materials
	  • Students are required to use the materials in a respectful manner.
	  • Students are required to not throw and or stomp on the materials.
	  • Students are expected to share the materials.
	• Clean Up
	  • All students are required to help clean up.
	  • Students are expected to clean up all of the pieces.
	  • Students are expected to use a voice level 1 when cleaning.
	  • Students are expected to walk around the room when cleaning.
	  • Students are expected to nicely place the materials back in the container.
	• Transitions
	  • Students are required to use a voice level 1 when transitioning from one activity to the next.
	  • Students are expected to stop what they are doing and quiet down when they are being called back.

Minutes	**Procedures**
30 minutes	**Set-up/Prep:** 1. Bring up the two earthquake videos. 2. Set out the *Survive the Quake: Engineering Kit* 3. Create the design sheet. 4. Set out the design sheet.
3 minutes	**Engage: (opening activity/ anticipatory Set – access prior learning / stimulate interest /generate questions, etc.)** a. Allow time for the students to find their desks that are placed in front of the projector. Play the video of the earthquake and buildings falling. Stop after 12 seconds. https://youtu.be/6n09H2g4ZCM 1. "What did you notice was happening to the buildings in this video?" a. Allow time for the students to respond. 2. "What do you believe would be the cause of this destruction?"

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	a. Allow time for the students to respond. 3. "Right, an earthquake is what caused this devastation. Let's think about what we know about earthquakes for a few seconds and then share out. This does not require talking, so we should be using a voice level 0." a. Allow time for the students to recall prior knowledge about earthquakes and then have them do a quick share out. Only select one or two students to share and then move on. 4. "Great answers! When we think back onto what we know about earthquakes we know that the earth's crust is moving and that causes the ground and buildings to shake. As we look at the videos, we notice that this shaking and movement causes problems. Today, we are going to try to find a solution to help prevent buildings from being damaged as bad as they were in this video. Let's look at our goal for the day. It says, "I can design and construct a building that can survive a level three earthquake." When we do today's activity, let's try to have this goal in mind."
7 minutes	**Explain: (concepts, procedures, vocabulary, etc.)** 1. "There are several natural hazards that happen here on earth like tsunamis, volcano eruptions, and earthquakes. A natural hazard is an event that is caused by the earth and not by humans. These events can cause serious damage to buildings, land, and people. There are scientists and engineers that try to stop these natural hazards from causing so much damage. People cannot stop natural hazards, but they can prepare for them and come up with ideas to cut down on the damage they cause. We are going to be engineers today. Remember our goal for this activity, "I can design and construct a building that can survive a level three earthquake." To help us brainstorm some ways we can make structures that can withstand an earthquake, we are going to watch a quick video. This video will show one way that engineers have designed buildings to stand against powerful earthquakes." a. Play the video that compares a regular building to one that has been designed to withstand an earthquake. https://youtu.be/bsprbCOPHWc 2. "What do you notice about the model of the building on the left? Remember when our friends are talking, we are expected to be active listeners. If you are talking, remember to use a voice level 2 so all can hear." a. Allow time for the students to respond. 3. "This is a building that has not been changed to stand up against an earthquake. What did you notice about the building model on the right?" a. Allow time for the students to respond. 4. "This is a building that has been changed to withstand an earthquake. How do you think these adjustments to the buildings help it stand against an earthquake? Talk with your table mates for about one minute. Let's have the oldest table member share first. Remember our expectations for table talks. Everyone should participate and if you are not talking, you should be an active listener. You may begin." a. Allow time for the students to turn and talk with one another. As they are talking, pass out the design sheet to each student. 5. "Come back to me in three, two, one." a. Allow time for the students to quiet down. 6. "Remember, when I say those phrases that means we stop what we are doing and focus on the speaker. Let's share some of our thoughts as to why the changes made to the building on the right may stand up against an earthquake." a. Select one or two groups to share their answers. 7. "These are all great answers. While we have not had severe earthquakes like other parts of the world, it is still important for us to understand how to make buildings safe. We are in buildings every day and it is important for our safety and well-being for these structures to stand up against natural hazards. That is why your group will be using one of these engineering kits to try and create a building that will last in a natural hazard like an earthquake." a. Pull out the *Survive the Quake: Engineering Kit* and show the parts of the kit. 8. "There are different sized buildings in here that you and your engineering partners can use to stack or place on the platform. Remember, your task is to create a building that will withstand a level three earthquake. You will notice that I gave each of you one of these design sheets. The first step is to draw your team's building design. The people at your table will be your engineering team. You will have approximately five minutes to draw your design in the box that is provided on this sheet. If you finish before the five minutes, you can begin identifying what pieces you will use to make your design come to life. Let's not forget our group project expectations. Everyone must be an active participant. Use a voice level 1. Be an active listener when others are talking. Are there any questions?" a. Allow time for the students to ask questions. 9. "Engineers, your five minutes starts now." a. Allow five minutes for the students to draw their designs. 10. "You have two minutes." 11. "You have one minute." 12. "One, two, three eyes on me." a. Allow time for the students to respond. 13. "Now that you have this design, you will make your design come to life by using the pieces from the *Survive the Quake: Engineering Kit.* As I said earlier, these pieces can stack on top of each other. Once you have your building created, you may test it by turning this dial. The level one is the lowest and will only shake the building a little." a. Demonstrate by turning the dial to one. 14. "The level five is the highest, so it will shake a lot." a. Demonstrate by turning the dial to five.

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	15. "Our makerspace challenge calls for you and your engineering team to construct a building that can withstand a level three earthquake. If you test it and it falls down, write about how you will change your design in the 'step 2' space. I will be walking around and asking you what works and what does not. We must be respectful of our materials; that means no throwing, stomping on, placing in mouth, and so on. You must let everyone play with the materials. If we cannot handle the manipulatives, I will take them away for a few minutes until you are ready. I also want you to remember that makerspace is a safe time for you to experiment through trial and error. There will be times where the design does not succeed and that is perfectly fine. Engineers have to take risks and sometimes the risks do not work out, but when they do, greatness happens. You can now get to work on your designs." a. Allow approximately five minutes for the students to create and test their designs. 16. "You have two minutes." 17. "You have one minute, construct your final design and pause because you will be sharing it with the class." a. Allow time for the students to create their final designs. 18. "Now that you have had time to create your building, test it, and maybe redesign it, we are going to show our structure to our friends. When we do this, you will give us the reason why you made your building like that. Remember, we must be active listeners when other groups are presenting and use a voice level 2 when your group is presenting." a. Allow each group an opportunity to share their design. Based on the outcome of their trial, you could ask them the following prompts: a. What could you change for next time? b. Was this your original design? If not, what changes did you make? c. What do you believe would happen if you gave your buildings another story? Do you think it would still be standing up? Why? d. Why do you think this design was a success? 19. "Engineers, you had some great structures. Let's turn back to our design sheet and look at 'step 3'. This is where you talk about the results of the test. You will write about if your test went well or not so well and ways you could change your design to be even better. You can fill out this section together with your table. You have about two or three minutes to do this. You may begin." a. Allow time for the students to fill out the 'step 3' section. 20. "Hands on top, everybody stop." a. Allow time for the students to respond. 21. "If you did not finish the third step, you will have a few more minutes to do that, but I want to review what we went over and how we continue to build our engineering skills tomorrow."
12 minutes (draw, create, test, reflect)	**Explore: (independent, concreate practice/application with relevant learning task -connections from content to real-life experiences, reflective questions- probing or clarifying questions)** 1. The students will be divided into groups of four. Their table mates will be their partners. Each student will receive a design sheet (see below). Everyone will have to fill out their own, but they can work on it together. The main goal is for them to draw, construct, and test their building structure to observe if it will withstand a level three earthquake (there are only five levels on the *Survive the Quake: Engineering Kit)*. 'Step one' is where the students draw their building structure. Once they have this done, they will work together as a team to use the building pieces from the *Survive the Quake: Engineering Kit.* When they have built their structure, they can test it by turning the dial on the base piece from the *Survive the Quake: Engineering Kit;* this is where 'step 2' comes in. If their structure falls, they must write about how they are going to update their design. After a few minutes, the students will create their final structure. When everyone has their building completed, we will go around the room and demonstrate to the class if their building can withstand a level three earthquake. During this time, I will prompt them with questions (see above). Once everyone has shared their structure, they must move to 'step 3' on their design sheet. Here, they must reflect on how the design process went and if their building was able to stand against the earthquake.
3 minutes	**Review (wrap up and transition to next activity):** 1. "Today, we talked about natural hazards. Can anybody describe a natural hazard or give us an example of one?" a. Allow time for the students to respond. 2. "Can people prevent natural disasters?" a. Allow time for the students to respond. 3. "Why not?" a. Allow time for the students to respond. 4. "Right. They cannot stop it because it is the earth that is making these events happen. Our main focus was on earthquakes and how engineers try to make structures that can stand up against these natural disasters. Why do you think engineers are trying to make changes to these buildings?" a. Allow time for the students to respond. 5. "Correct. By updating these structures, it can help make people that use these buildings safe. Remember our goal? It says, "I can design and construct a building that can survive a level three earthquake. You just showed me that you are engineers and can use your critical thinking skills to help you design a structure that can stand against an earthquake. How can you apply what we talked about today to real world problems?" a. Allow time for the students to respond. 6. "Great! Tomorrow, we are going to continue being engineers by making a larger version of your building design. Now, you are required to clean up your stations. Remember your expectations; all of the materials must be put away and everyone

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	must help. Once this is done, you are going to hand in your design sheets and get ready for music. Great work today, engineers."

Formative Assessment: (linked to objectives, during learning)

- **Progress monitoring throughout lesson (how can you document your student's learning?)**

During our group discussion, I will be able to observe how a few students are comprehending the information. As the students are working on their structures, I will walk around and ask them about their design. I will also be able to look at their design sheets to observe how they are developing their ideas and how they are comprehending the information. The design sheet that the students are working on will be my main formative assessment and is a form of documentation that I could share with parents. If a student is having a difficult time transferring what they know onto the design sheet, I will just have them give an oral explanation. I will assess them in the three areas just like on the design sheet. They will have to tell me about their design, how they made changes to it, and what the end results were. For this student, I will grade them with a checklist only, not the design sheet. To challenge above proficiency students, I may ask them to elaborate on 'step 3' of the design sheet. I can differentiate this by giving them a verbal prompt, and I will explain that I want this answered in the 'step 3' section. Along with their reflection for this section, I will challenge them to critically think about how they could modify the structure to stand up against a level four or five earthquake.

Summative Assessment (linked back to objectives, END of learning)

After creating the structures and testing them against an earthquake, the next day will require the students to create a larger model of a building using blocks, connectors, and other materials. On the third day is when I will give my summative assessment. For this assessment, the students will compare their first structure (described in this lesson) and their second structure (a larger model of a modified building). They will compare which solutions and modifications were more beneficial to reduce the damage of a natural hazard. The students will have to explain in essay format how they are comparing the two structures, which solution was best, and their reasoning as to why that solution worked.

Reflection (What went well? What did the students learn? How do you know? What changes would you make?):

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Design Sheet

Step 1: Draw your building design.

Why did your team choose this design?

_____

_____

_____

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Step 2: Write about any changes your team made to your original design after testing it.

Step 3: Reflect on how the testing of your building went. Did your building stand up during a level three earthquake? What changes would you make in the future to help keep your structure up during an earthquake?