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| **Fossil Excavation**  [http://ts1.mm.bing.net/th?id=H.4623219795626772&pid=1.7&w=221&h=175&c=7&rs=1](http://www.bing.com/images/search?q=fossil+dig+clip+art&qpvt=fossil+dig+clip+art&FORM=IGRE#view=detail&id=74EB58BD31037FBB0A807408BA7030EC0E301861&selectedIndex=17) | |
| **Background Information** | |
| Paleontologists are scientist who discover and dig up fossils that lived on the Earth millions of years ago. You just learned that fossils are evidence of organisms that lived long ago. Many fossils are bones of animals that were buried. Over many years, they got buried deeper and the bones and nearby soil hardened into rock. There are a variety of different fossils: cast, mold, trace, body, and amber. You can show the following videos about paleontologist prior to this challenge:  <http://www.bing.com/videos/search?q=paleontologist+fossil+dig+videos&view=detail&mid=359B737FF4C655593065359B737FF4C655593065&first=41&FORM=NVPFVR>  <http://www.bing.com/videos/search?q=paleontologist+fossil+dig+videos&view=detail&mid=17882D68AA94E354779E17882D68AA94E354779E&first=0&FORM=NVPFVR&qpvt=paleontologist+fossil+dig+videos> | |
| **Design Challenge** | |
| You are a paleontologist working at Wind Cave National Park and you are excited that your team has discovered some new fossils. There is a problem; the fossils are stuck in a cave crevice that is pretty narrow. Your job is to design a structure that is no more than 6 inches wide and 1 foot tall. Your structure needs to hold as many fossils as possible so it can be lifted out of the crevice in the air 3 feet. | |
| **Criteria** | |
| * Structure can be no wider than 6 inches * Structure can be no taller than 1 foot * Structure needs to hold as many washers or weights as possible without breaking * Structure will be lifted 3 feet * Graph the team results on the weight each structure could lift without breaking | |
| **Materials/Tools:** | |
| * Student Journals (below) * Popsicle sticks * Rulers * String or yarn * Pipe cleaners * Skewers * Straws * Cups- variety of sizes | * Tape * Glue * Dowel rods * Cardboard * Washers or gram masses * Computers to research fossil models and to watch a paleontologist dig * Other materials may be needed at students request |
| **Standards** | |
| **Science**  S3E2. Students will investigate fossils as evidence of organisms that lived long ago.  a. Investigate fossils by observing authentic fossils or models of fossils or view information resources about fossils as evidence of organisms that lived long ago.  b. Describe how a fossil is formed.  **Math**  MCC3.MD.3 Draw a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. | |
| **Assessments** | |
| * Student Journals (below) * Teacher observations | |

**Instructional Steps:**

1. Introduce the challenge by showing one or more of the video clips. Note: The link takes you to a Bing search page with several video clips. Look at these ahead of time or find your own. Let them know they will be building a prototype of a fossil excavator. Define “excavator”.
2. Take some time to investigate the available materials before the students begin to plan. Discuss what part of the excavator each material might be good for. Allow each student time to draw a picture of his/her plan and label all parts. Make sure the picture shows them using only the available materials.
3. Build the excavator.
4. As they finish building, allow for some “test runs”. Give each student/team a few washers to use as they are building to make sure their excavator can support some weight.
5. For their “official test”, have each student/team lower their excavator to the floor, load it with as many washers as they think it will lift, and raise it up a minimum of 3 feet (have a yard stick handy for this purpose). If it works, lower it and add more washers. If it breaks, talk about why it broke, where the weak spot was, and possible ways to re-engineer to address the issues. Measure how much weight or how many washers each excavator lifted and record this information. Create a class graph.
6. Allow students to spend some time discussing improvements, even if their excavator worked well the first time. How would they do it differently next time? Do they see another with a good idea that they might like to try? If it broke, what will you change? If it worked well, how can you re-engineer it to carry more weight, be more stable, be smaller but carry the same load, etc.?
7. Allow the students the opportunity to make some of the improvements they discussed. Re-test to determine if their changes improved their design. Record this information to add to the class graph.
8. Use the information on the graph to develop some “How many more” or “how many less” questions.

**NOTES:**

\*For this lesson, you may want to set up a couple of simulated crevices that are 6 inches wide (using chairs, tables, etc.) for testing purposes. The students lower their excavator into the crevice, another student loads it, and then it gets pulled up the minimum 3-foot height.

\*Working as individuals, pairs, or groups is entirely up to you.

\*While the goal is for the students to build their excavator independently, if you see a student struggling it is always a good idea to help guide their thinking. What’s going wrong? What are you trying to do? What might help fix this problem? Once they verbalize these things, you can offer a few suggestions for what might help.

\*The improvement step is very important to the STEM process. It is the step that teaches students to stick with it, “if at first you don’t succeed…” and all that. If their excavator worked great the first time, this step pushes them into a higher level of thinking about their invention. If their excavator failed the first time, this step teaches them to continue thinking, evaluate their own work, and possibly change strategies. This is what we are trying to get to transfer over to their academics.

\*Your team may decide on another “hook” or “wrap up”. Video clips, introductory activities, closing activities, etc. Totally up to you and your team. Study the lesson to decide how to break up your day.

\*Student journal pages are attached to this lesson. Feel free to alter them to suit your needs.

**Fossil Excavation Class Results**



**Name**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Fossil Excavation STEM Challenge**

**3rd Grade**



**Challenge:** You are a paleontologist working at Wind Cave National Park and your team has discovered some new fossils, but there is a problem. The fossils are stuck in a cave crevice that is pretty narrow. Your job is to design a structure that is no more than 6 inches wide and 1 foot tall. Your structure needs to hold as many fossils as possible so it can be lifted out of the crevice in the air 3 feet.

**Criteria/Constraints:**

* Structure can be no wider than 6 inches
* Structure can be no taller than 1 foot
* Structure needs to hold as many washers or weights as possible without breaking
* Structure will be lifted 3 feet
* Graph the team results on the weight each structure could lift without breaking

**Materials:**

**•** Popsicle sticks

• Rulers

• String or yarn

• Pipe cleaners

• Skewers

• Straws

• Cups- variety of sizes

• Tape and/or glue

• Dowel rods

• Cardboard

• Washers or gram masses

**1.ASK / ENGAGE: What is the problem you are being asked to solve?**

1. **IMAGINE/BRAINSTORM:** What are some possible solutions to the problem that you are trying to solve? After you brainstorm, draw and label your ideas below.

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| **Idea #1** | **Idea #2** |

1. **PLAN/DESIGN:** Share your ideas with your group and collaborate to decide on a final design plan. Draw your team’s design below and make a list of the materials that you will need to complete your design.

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| **Team Design Plan** | **Materials List** |

1. **CREATE/TEST**: Use your Final Design Plan to create and build your solution. Test your design. Did it work? Why or Why not?

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1. **EVAULATE/IMPROVE:**  How well did your design work? Did your solution solve the problem within the given constraints?

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How can you improve your design? How can you make it better? Draw and label your improved design below.

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| **Improved Design Plan** |