**Simple Machines Mini Museum**

Design Thinking for 3rd Grade

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**Project Overview**: In third grade,we learn about simple machines as part our science curriculum. The purpose of this lesson is to give students an authentic reason to become an expert on a selected simple machine: they will design a way to demonstrate how it works to an audience via a mini museum exhibit. We’ll create prototype displays, and refine these prototypes through feedback from peers and observation of focus groups. After a few iterations of design, students will present a final product for a larger audience to enjoy.

**Background Knowledge**: Students should have some informal background knowledge about simple machines before this lesson, as we all use various simple machines every day. They will also come with background knowledge in museums – most have visited many types of museums with their families. We also schedule a few field trips to museums earlier in the year, thinking ahead to this project.

**Utah Core Standards for Third Grade:**

**Language Arts:**

Reading: Informational Text 1 – 5, 7, 9

 Writing: 2.a, 2.b, 2.d, 5 - 8

 Speaking and Listening 1.a – 1.d, 3

**Science:**

 3.1.a, 3.1.b, and 3.1.c

**Resources:**

*Explore Simple Machines!: With 25 Great Projects (Explore Your World)* by Anita Yasuda and Bryan Stone

*How Do You Lift a Lion? (Wells of Knowledge Science Serie*s) by Robert E. Wells

EdHeads Web Resource: <http://www.edheads.org/activities/simple-machines/>

Museum of Science + Industry Chicago: <http://www.msichicago.org/online-science/simple-machines/activities/simple-machines-1/>

Bill Nye Episode on Simple Machines: <http://www.youtube.com/watch?v=0LnkviArKBA>

**Part 1: Building Background and Empathy**

**Overview**: Introduce simple machines, interview museum expert, reflect on what makes a good museum experience, interview Kindergarten teacher.

**Learning Objectives:**

Students will learn the basics of simple machines, and develop empathy with their audience through information provided by their teacher.

**Preparation**:

* Find examples (actual object, or just a picture) of each of the six simple machines. Examples could include:
	+ wheel and axle--windmill, fan, globe
	+ Inclined plan--roller coaster, stairs
	+ wedge—scissors (the blade part), chisels
	+ screw—wood screw, bottle top
	+ pulley--flag pole, window blinds
	+ lever--seesaw, door
* Make arrangements with another teacher for an audience for exhibits. We’re using kindergarteners, but any age audience can work.
* If available, contact an expert from a local children’s museum. If a local expert isn’t available, consider arranging a Skype interview with an expert.
* Make arrangements for students to interview a Kindergarten teacher.

**Materials**

* Simple Machine examples – levers, inclined planes, etc.

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| **Activity** | **Time** | **Description** |
| Introduction to Simple Machines | 45 minutes | * Begin KWL chart on Simple Machines by filling in “K” column with what students already know. Student are aware of hundreds of items in their daily lives that qualify as simple machines, but will probably not realize what type of machine they represent.
* Introduce the six main types of simple machines: lever, pulley, screw, inclined plane, wheel and axle, and wedge. As you introduce each, show an example, and have the students draw a sketch of the example on their Six Simple Machines worksheet. (Appendix A) Then, have them explore the classroom for other examples of the simple machines you just identified.
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| Interview a Museum Expert (if possible) | 45 minutes | * Make arrangements to interview an expert about Museums. Brainstorm ahead of time with the students about what questions might be important to ask. If your conversation needs more direction, focus on the essential question: “What is the purpose of a museum, and what types of exhibits are successful in that purpose?” Have students recall past trips to museums, and make a class list of “Things That Worked” and “Things that Didn’t Work.” This might help generate interview questions.
* After the interview, summarize the information generated by the students and by their interview with the expert, into Museum Design Principals in project journal.
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| Interview a Kindergarten Teacher | 45 minutes | * Interview a Kindergarten teacher about the ways in which his/her students learn best, and the types of learning activities their kids enjoy.
* Based on this information, create a “User…needs a way to…because” statement. Example: “Highly active kindergarteners need a way to learn about simple machines though a hands-on experience because they learn better that way.”
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**Part 2: Define and Research**

**Overview**: Define task of creating museum exhibits. Divide students into groups, assign groups a simple machine, and give them time to research it.

**Learning Objectives:** Students will research simple machines and develop a way to demonstrate that knowledge to others.

**Preparation**: Locate research materials for students.

**Materials**:

* Books on simple machines
* Web resources

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| **Activity** | **Time** | **Description** |
| Research and Discovery | 45 minutes | * Put students in working groups
* Assign a Simple Machine to each group
* Students use internet and library resources to learn about their simple machine, and notice how others demonstrate its use
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**Part 3: Ideate**

**Overview**: Brainstorming and designing our exhibits

**Learning Objectives:** Students will ideate through brainstorming to generate ideas on how they will present their simple machines as a museum exhibit.

**Materials**:

* Chart Paper (one sheet per group)
* Markers
* Sticky Notes (one small pad per student)

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| **Activity** | **Time** | **Description** |
| Ideate | 30 minutes | * Teach Brainstorming Protocol. The following “4 Rules of Brainstorming” have served students well in the past:
	+ Go for quantity
	+ Don’t Judge
	+ Encourage wild ideas
	+ Add to others – “yes, and…”
* Students brainstorm on how they’re going to create their mini-museum exhibits.
* Give each student a small pad of sticky notes. Instruct them to write their ideas on the notes, then stick them to the chart paper.
* Start with a time limit, but adjust as needed.
* After the time is up, each student gets “two checks and a star.” First, they will mark a check on their two favorite ideas. They must vote for two different ideas, and at least one must not be their own. Then they put a star on their favorite wild idea – one we could never actually do, but has some kind of appeal.
* After this time, ask students to reach consensus on which idea they will pursue. If they cannot agree within their groups, address strategies for reaching consensus as appropriate. (vote, group discussion, etc.)
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**Part 4: Prototype and Feedback**

**Overview**: Receive expert and peer feedback on prototype exhibits.

**Learning Objectives:**

**Students will:**

* Collaboratively build prototypes
* Share their prototypes and receive feedback from peers and experts

**Preparation**: Gather prototyping materials.

**Materials**: Prototype material possibilities:

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| * Cardboard
 | * Toy Cars
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| * Legos
 | * Rubber Balls
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| * Rulers
 | * Blocks
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| * Popsicle sticks
 | * Tape
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| * Markers/crayons
 | * Playground Equipment
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| * K’Nex
 | * String
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| **Activity** | **Time** | **Description** |
| Prototype | 45 minutes | * Remind students of design principles learned when they interviewed museum expert. Reference design journal.
* Discuss prototyping process: To build a low resolution, low commitment concept of their design.
* Allow students time to develop a prototype exhibit with their group, using prototyping materials made available in classroom.
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| Peer Feedback on Prototypes | 60 minutes | * Students will present their prototypes to the class.
* Other students will use a modified Tuning Protocol to submit feedback:
	+ After group presents, the rest of the class has 5-6 minutes to comment to each other about what they really liked. If they have any concerns, they’ll phrase them with the following: “I wonder what would happen if…” then suggest their change. During feedback, the presenters may not comment or explain.
	+ After feedback, the presenters have one minute to respond to any new ideas they’ve heard, or things they’ve realized.
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| Prototype Rework | 30 minutes | * Students will modify their prototypes based on the feedback they received. Some groups may require more time if they are making major changes about their exhibits.
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| Kindergarten Focus Group | 60 minutes | * Students will set up their prototype exhibits, and anticipate how kindergarteners will experience them. How will we know an exhibit is successful?
* Pick a metric to measure to answer that question. Ideas of what to observe might include: length of time spent at exhibit, count smiles, where kindergarteners went first, etc.
* Develop an observation sheet to record that data about the Kindergarteners’ experience.
* Focus group of kindergarteners (4-8 students) will come in, and students will observe and record kindergarteners’ interactions with their exhibits through whatever metric they’ve chosen.
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| Data Analysis | 45 minutes | * Students will look at the data we gathered, and draw conclusions. Were their exhibits effective? What changes could we implement to make them more effective? How will we know if those changes worked?
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| Prototype Rework | 15-20 minutes | * Students will modify their prototypes based on the observational data.
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| Kindergarten Focus Group #2 | 60 minutes | * Students will observe a new group of kindergarteners experiencing their exhibits, again recording data. Did their changes make any difference?
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| Last prototype rework | 30 minutes | * If needed, students have a last chance to make any prototype changes.
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**Part 5 (optional): Final Presentation**

**Overview**:

* **Learning Objectives:** Students willfinish exhibits, and display for audience.

**Preparation**: Arrange for space inside school to display exhibits, and times for other students or members of the community to visit.

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| **Activity** | **Time** | **Description** |
| Final Exhibition | 60 minutes | * All kindergarteners are invited to come experience exhibits set up as a mini-museum. Students enjoy showing off their exhibits and teaching the science.
* If time and opportunity permit, invite other grade levels and parents to come experience exhibits.
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