**Lesson 3: Research Types of Playgrounds & Introduction to RFP**

In this lesson, students will research ideas to build the SPPA. Then reflect on the Request for Proposal (RFP) to identify how to incorporate their design design ideas based on the criteria and constraints of the project. Students will them use the Proposal template and example to begin drafting a proposal to the RFP.

**Learning objectives:**

* Students will research types of playground designs.
* Students draft a proposal for RFP. *(Incorporate criteria of RFP into design/prototype to maximize the energy stored or transformed by utilizing the features of the area provided by the community.)*

**Lesson standards (NGSS, CCSS, CTE):**

**NGSS MS ETS1-1** Evaluating competing design solution using a systematic process to determine how well they meet the criteria and constraints of the problem.

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

**NGSS MS ETS1-3** Analyze data from test 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.

[CCSS.ELA-LITERACY.W.7.7](http://www.corestandards.org/ELA-Literacy/W/7/7/) Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

[CCSS.ELA-LITERACY.RST.6-8.4](http://www.corestandards.org/ELA-Literacy/RST/6-8/4/) Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

**Soft skills:**

Think creatively, Work creatively with others, Communicate clearly

**Locally and/or personally relevant for students:**

Middle school students learn best in collaboration with their peers/team. Sharing ideas to develop a stronger design.

**Connections to career and educational pathways:**

In this lesson, students are assigned a region of the map they reviewed in the previous lesson, and begin to think about how they’ll make use of the area. This connects to career pathways in architecture, civic/urban planning, mechanical and civil engineering, power generation, and green energy.

**Target Grade Level(s)**: Middle School (6th, 7th, 8th)

**Subject(s)**: Physical Science (Energy)

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**Materials:**

* Laminated Class Copies of Park Map
* Proposal of Template
* Exemplar of Proposal
* Extra copies of the RFP
* List of possible websites
* Research NOTES student document
* Access to “Lesson 3 Playground Design Ideas”

**Time required:**

* 1-2 55-60 period (depending on how much modeling of writing a proposal the students need to experience)
  + Depends on resources available for students to do research: library vs. in class laptops vs. only physical texts/article to reference.

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| ***Focused Step in Engineering Process*: (Engineering Design Process Poster)** |
| **Ask: What’s the problem, and how have others addressed it? What are the constraints, and what are the criteria for success?**  **Research: Solutions to problem.**  **Imagine: Brainstorm possible design solutions.**  **Plan: Make diagrams/sketches of designs.**  **Create: Build designs and test them.**  **Improve: See what works and what doesn’t. Repeat steps as necessary to optimize the design.** |

**Lesson preparation:**

* Provide class with some website with links to possible sources of playground designs.
* Copies of Proposal Template & Proposal Exemplar
* Copies of Research NOTES Student Document, (or draw outline on board for students to copy into notebook)
* Teacher should have laminated class copies of the “map”/community area.
* Access to images of: Lesson 3 Playground Design Images

**Considerations**:

* Access to computers/internet (could students use their phones?)

**Grouping of students for instruction:**

Students should research independently in order to think and brainstorm, in with their teams review the RFP & proposal template.

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

Research and brainstorm solutions for a given area to maximize stored or transformed energy.

**Understanding the Problem**

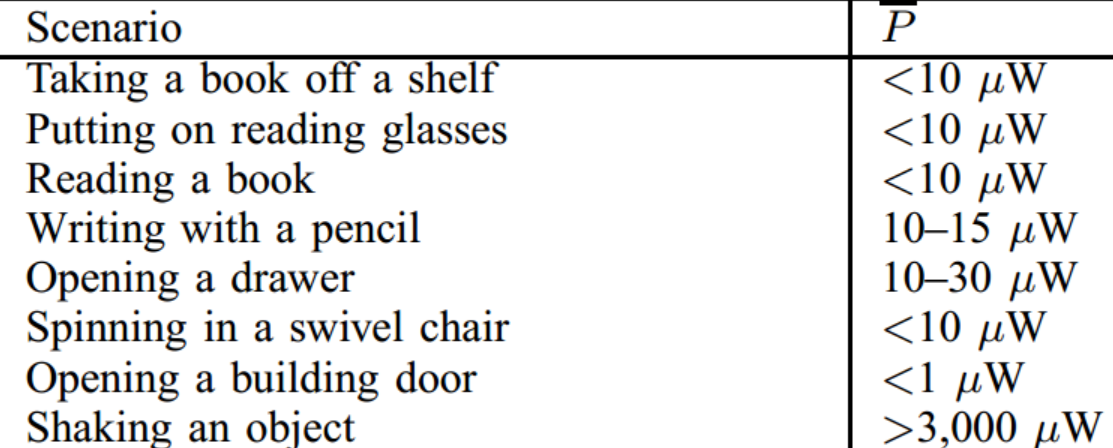
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| **Teacher** | **Student** |
| **Part 1:** Students will research types of playgrounds. | |
| Warm-Up  1.Ask students to take out energy transfer sheets that they created yesterday.  2. Pick up ‘Research NOTES’ & tape into Science Journal.  3. Show short clip on “Music Research Playground’s Project: <https://www.uml.edu/News/stories/2016/EcoSonic-Playground.aspx>  4. Ask students to discuss with their team how many energies they saw present, then write out the energy transfers   * Teacher can make accommodations by providing paper templates of energy transfers occurring to encourage practice or independent accountability.   *Teachers should be looking for kinetic to sound, but also the presence of thermal energy as students in video strike the “instruments”*  Inform class that they will begin researching possible examples of playgrounds that transfer energy from community members to energy that can be used immediately or stored.   * Provide images for students to look at (see “Lesson 3 Playground Design Ideas”) * Provide possible links on class website or on paper. * Mention Criteria for Success - to identify 2-3 possible ideas that support their energy transfers AND criteria of RFP. (i.e. needs two people interacting, accessible to all people)   Teacher may need to model how to take notes on ideas using the  For example: (See “List of Possible Websites”)  **On Becoming a Playground Designer: tell your story!**  <http://www.play-scapes.com/play-design/resources/on-becoming-a-playground-designer-tell-your-story/>  **Playground Ideas – Do it Yourself.**  <http://www.playgroundideas.org/build-a-playground/on-your-own/?gclid=Cj0KEQiAt9vEBRDQmPSow-q5gs8BEiQAaWSEDg-emsC_1jJyG6ZE708-Y46QYqEq-KzYHvDIrFsILxcaAtHB8P8HAQ>  Teacher provides list of websites.  Divide the research up - each person takes 3-4 websites to view, and then share back with the group.  This may require 30-45 min of research.  Exit ticket/Reflection: Teacher asks students to identify possible obstacles/issue/constraints to implementing some design ideas. | Students, sitting with their teams/group, take out energy transfer ideas from yesterday.  Students set up Notebook for the day to conduct research.  Students watch video  Students verbally share or write down their answers.  In whole class discussion - students share their list of energies, as well as energy transformations and transfers  Students begin researching ideas for their SPPA on computers - using the websites provided by teacher.  Students turn to: ‘Research NOTES student document’  Student independently research different playgroup ideas & record ideas as either a drawing, list or a description in their notebook, using the Research NOTES student document’  Identify possible obstacles to playground ideas.  Students sketch out or list possible design ideas to take back to their group. |
| **Part 2:** Students draft their proposal for the RFP (½ day) | |
| Warm-up:  1.Ask students to pick up Examples of Proposal, RFP & Proposal Template.  2. Ask students to reread Problem Statement. (on power point)  3. Introduce form RFP, connect how this relates to real life  Ask students to highlight the criteria and constraints that match the problem statement, then circle new information  Place Proposal Example on Document Camera.  Help them think about their solution design and begin filling in parts of the Proposal draft.  Teacher asks students to begin completing sentence stems in the proposal template.  Ask the the students to compare the Proposal template and the example of the board.   * Ask students to identify expectations of the written proposal? * Ask students to identify what information will be expected to be included in the proposal * Students write out in the template requirements/criteria (to practice how to collaborate on a document.   **Next Steps**: *Begin design process, filling out engineering design sheets/packet (e.g. filling out criteria and constraints, materials ideas, and problem in their own words) sketching out individual ideas, that then share with a group.* | Required Papers are passed/picked up.  Students take out problem statement, and silently reread.  Students independently read or group reads aloud RFP.  Students begin highlighting criteria and constraints that match the problem statement, then circling new information such as deadlines, requires TWO people to operate.  Student begin rough outline/draft of proposal.  Students look at the handout & and look up to the example.   * Students notice (e.g. responses are typed, in a formal voice, a description of the design) * Students notice that an explanation of how the design works, how it returns energy to the park etc * Students compare their list to the requirements/criteria from Lesson 1 in their Science Journal. |

**Accommodations:**

* ELL/IEP (students who read below grade level standard):
  + Students are provided images of different playgrounds.
  + Provide video footage with subtitles or just videos of different playgrounds
  + Provide words for students to conduct their own research: Playground/design/interactive etc.
* ELL/IEP: Proposal has sentence starters embedded in document.
  + Pair students together with only one computer to create atmosphere of collaboration

**Extensions:**

* Students completed closed reading on provided articles about current technology of generating energy from human bodies:
  + <http://www.popsci.com/environment/article/2009-01/harvesting-energy-humans>
  + <https://www.extremetech.com/extreme/135481-will-your-body-be-the-battery-of-the-future>
* Students both store energy (potential) for the town as well a use some energy to go back into the park.
* Joules conversion could be an extension.
  + Teacher begins class with exposure to energy calculations. Provide handout/powerpoint slide with examples of energy generation from body movements. (refer to attached)
  + Background Information:
  + <http://www.popsci.com/environment/article/2009-01/harvesting-energy-humans>
  + <https://www.extremetech.com/extreme/135481-will-your-body-be-the-battery-of-the-future>
  + Teacher informs students that they will use this data to help them estimate how much energy they think their SPPA will generate.
  + Direct students to estimate the average weights of different community members (small children vs teenagers vs adults), and estimate how much energy their SPPA will generate - using the data table.



**Assessment:**

* Students will have visited 4-10 websites for ideas.
* Students will have identified motions that generate the most energy and incorporate into their design
* Read over/highlights RFP - constraints vs. new information

**References/Resources:**

* Lesson 3 Playground Design Ideas
* Energy conversion Sheet (Energy generated from human motion)
* Exemplar of Proposal
* Copies of RFP
* Refer to websites embedded into lesson.