**STEM - Integrated PBL Design**

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| **I.         ElectricaloutletandplugKILL- A WATT – BE AN ENERGY CONSERVATION AMBASSADOR** A Household Energy Conservation and Efficiency Activity  *Adapted from*: Office of Educational Partnerships, Clarkson University, Potsdam, NY  **II.        Grade Level and Subject Area:** Earth Science Grade Levels 2-12  **III.       Standards:**  **NGSS** S1. Asking questions (for science) and defining problems (for engineering)  S2. Developing and using models S3. Planning and carrying out investigations  S4. Analyzing and interpreting data  S5. Using mathematics and computational thinking  S6. Constructing explanations (for science) and designing solutions (for engineering)  S7. Engaging in argument from evidence  S8. Obtaining, evaluating, and communicating information  **CCSS: Mathematics** M1. Make sense of problems and persevere in solving them  M2. Reason abstractly and quantitatively  M3. Construct viable arguments and critique the reasoning of others  M4. Model with mathematics  M5. Use appropriate tools strategically  M6. Attend to precision  M7. Look for and make use of structure  M8. Look for and express regularity in repeated reasoning  **CCSS: ELA-Literacy** ELA 1. They demonstrate independence  ELA 2. They build strong content knowledge  ELA 3. They respond to the varying demands of audience, task, purpose, and discipline  ELA 4. They comprehend as well as critique  ELA 5. They value evidence  ELA 6. They use technology and digital media strategically and capably  **IV.       Justification Statement:** Before students can understand the principles of conservation they need to become familiar with how energy is produced, distributed and consumed. This PBL enables students to collaborate as they evaluate energy consumption as a first step in the engineering design process. Following their exploration and comprehension of energy principles they will be challenged to propose solutions to try to reduce energy consumption. In this PBL they move from "understanding the problem" and "gathering information" (problem solving) to hypothesizing and designing an engineering solution.  **V.        Measurable Objectives:***At the conclusion of this lesson, students will be able to:* 1. Calculate energy use and analyze how changing behaviors and appliances affects energy use. 2. Conduct an experiment and make comparisons based on experimental evidence.  3. Work as an engineering design team to address a problem and propose a workable solution.  **VI.       Total Time:**Two Hours  **VII.      Assessment of Non-Cognitive Factors** - Social Skills and or Habits of Mind:   Collaborative Team Work; Attentive Listening; Disagree with Idea Not the Person; Flexibility in   Thinking; Perseverance;  **VIII.    Level of Voice -** Classroom Level 2 – Normal Voice Table Talk  **IX.       NASA (BCES) 5-E Framework:  (Student Behavior)**   **ENGAGE**  ***Los Angeles energy consumption*** must be reduced by \_\_% by \_\_\_\_. This will contribute to the state of California to reduce fossil fuel dependence and make the transition to clean energy sources such as solar power. This will require that all residents in homes and apartments as well as businesses understand the daily ways they can reduce energy consumption. LADWP believes that K-12 students can help lead the way for families and businesses to participate in reduction our carbon footprint and moving California to a “green –energy” state.  In this lesson, we will explore more closely how we use energy in our homes and identify some ideas for conserving energy or using it more efficiently.  sustainability hands.png  **EXPLORE**  sustainability earth.jpg  **Formation of Groups:**  We will use the **Human Graph** to create groups of four. How much do you know about energy  consumption and conservation in your household?   **Role Assignments**  **The Materials Manager/Encourager** is the person who will drive the farthest to return home today who picks up, distributes, manages and returns all materials. The **Encourager** Is responsible for promoting a sense of *can-do-it-ness* within the group as the encourager establishes and maintains a positive team spirit with phrases such as \*great idea," "we work well together,” etc.  **The Checker** is the person to the right of the materials manager/encourager who works with the team to assure smooth accomplishment of the objectives. The Checker makes certain that all tasks are carried out correctly by following the checklist provided in the lesson; and helps to secure answers to team questions on content or procedures. (The Checker may also serve as the **Traveler**)**.**  **The Traveler** is the person to the right of the checker who leaves the group when requested to seek out assistance from other teams. The Traveler is responsible for working with the checker as the group engages in predictions and trials and goes to other groups to gain insight or new ideas for problem solving;  **The Recorder/Reporter** is the person to the right of the Traveler who Is responsible for recording all the predictions and ideas that the group employs in completing the task, and upon completion, organizing how the team will report their solutions and group performance to the whole group.  **The Observer** is the person to the right of the recorder/reporter who is responsible for using the *observation checklist* to record when the social behaviors-- as well as the frequency of intelligent behavior (aka *soft-skills*, *non-cognitive factors, habits of mind*) are noted. [for transfer to the classroom, the observer might also score how many of the NGSS science practices are seen to be engaged in this activity).  **Task**  **sustainability kidshands.png**  Your team has been hired to come up with some good ideas about how your classmates might reduce their energy consumption in their homes. It will be important to LEARN the information they will need to be motivated to accomplish this important *global citizenship* task by helping them to understand the KNOWLEDGE that your team has acquired. Your team will determine what is needed to persuade your peers after you have ***explored more closely*** how you use energy in your home. A variety of materials and procedures will be provided to each team. The teams will use the ***Energy Efficiency Data Sheets*** to test and then record the outcomes of the tests, as well as any variables identified  Your team will be responsible for identifying **three workable ideas** for conserving household energy or using it more efficiently. You will present your ideas as a persuasive presentation to the entire group using visuals and data you have prepared—See Explain-Exend.  **EXPLAIN (EXTEND)** Your team is encouraged to use your individual cooperation, communication, problem solving and creative thinking skills to **identify the three recommendations** for reducing household energy use and to **prepare a motivating and understandable presentation** that will convince classmates that they can use your ideas in their homes. During your planning time, the **Recorder** will work with your team in determining the order of effectiveness of the energy-efficient proposals that you have made.  Next, your team’s Materials Manager will bring you newsprint and markers for the team to create a visual or graphic that shows evidence of significant learning as they created workable ideas for Household Energy Conservation. After team members have discussed the outcomes of the information they received, transferred and applied to their proposed program they complete their Individual Logs.  **EVALUATE:**  Content Formative Assessment  Content Summative Assessment  Formative Assessment of Non-Cognitive Factors  **X. Materials List**  Kill-a-Watt meters  6-8 Household appliances  4-6 Sets of Team Worksheets for introduction, *Engage* and *Explore*  4-6 Sets of Content and Participation Forms for *Evaluate*.  Easel paper and Markers for presenting visual graphic during team argument for solutions  Computers for entering Team Data and visual graphic during team argument for solutions |
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