**Electricity Project Assignment (200 pts.)**

**Challenges:**

Candidates will work in assigned teams to develop a holiday-themed classroom activity that delivers basic electricity content. The activity should be suitable for 4th grade students and help them develop an understanding that energy can be transferred from place to place by electrical currents. The activity should be focused on the following STEM content standards:

**Science**

4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

**Technology and Engineering**

Standards for Technological and Engineering Literacy

* Standard 3: Integration of Knowledge, Technologies, and Practices
1. Demonstrate how simple technologies are often combined to form more complex systems.
* Standard 7: Design in Technology and Engineering Education
1. Apply tools, techniques, and materials in a safe manner as part of the design process.
* Standard 8: Applying, Maintaining, and Assessing Technological Products and Systems
1. Follow directions to complete a technological task.
2. Use appropriate symbols, numbers, and words to communicate key ideas about technological products and systems.
3. Identify why a product or system is not working properly.

**Mathematics**

Additionally, you will identify and integrate another appropriate Mathematics and/or Social Studies or English Language Arts standard/s.

**Content Information:**

The best teachers are always looking for a way to tie classroom learning to upcoming events/holidays that students are anticipating—i.e., Thanksgiving, Christmas, etc. This provides a natural hook for the students and typically provides the student with something that can be taken home and placed prominently on the refrigerator door or on a shelf! Remember making a Thanksgiving turkey from a trace of your hand during elementary school?

In this case, you are being asked to develop a holiday-themed activity that both represents an upcoming holiday or community event and an introduction to basic electricity. You are welcome to utilize a traditional holiday craft item, but you must also find a way to electrify the activity. As we have learned in this class, it is not enough to simply a purchase a clever craft item at the flea market and then have your students replicate that item in class. ALL ACTIVITIES MUST DELIVER A BIG IDEA and in this case, they must deliver integrated STEM education!

**Electrical Circuits -** Basic Background Information

Electrical current is the flow of charge. When the switch is connected, electrons flow from the anode (positive/top of battery) to the cathode (negative) at the bottom of the battery and return to the positive pole. The battery provides the electromotive force (or e.m.f.) that "pushes" the electrons through the wires of the circuit. Electromotive force is measured in volts. In some ways it is similar to the potential energy stored in an object at the top of a hill. The object might roll down the hill and lose its potential energy and, in an analogous way, the electrons flow down the voltage drop (or potential difference) as they move around the circuit. As the switch is turned on, the light bulb ignites or illuminates (lights up). When the circuit is closed, by throwing the switch, the battery forces those electrons to flow around the wire, thereby creating the current.

**Reading:** Chapter 1: <http://www.allaboutcircuits.com/vol_1/index.html>

Looking for ideas for different types of switches beyond those discussed in class? These are just a few examples:

How to make a toggle switch - <https://www.youtube.com/watch?v=MGXw9bkfM1A>

How to make a slide switch - <https://www.youtube.com/watch?v=qSmYT6hPjUU>

How to make a rotary switch - <https://www.youtube.com/watch?v=I24G3TlSLow>

**Assignment Parameters:**

Working as a team, complete the assignment following the parameters outlined below:

* You will have multiple class meetings to experiment with electricity and complete the craft item and technical/procedural STEM activity, but you will need to develop individual responsibilities so that some of the research and materials development can be completed outside class.
* You will use the Technical/Procedural format (step-by-step instructions) for this lesson, as basic electricity doesn’t lend itself nicely to ill-structured engineering design problem-solving.
	+ Include specific vocabulary in your directions that discusses how the materials that students are using are conductive and how these materials allow for the transfer of energy. You could also specifically talk about the switch, insulators, etc. It is important that students understand the transfer of energy through electrical circuits and the importance of following directions to assemble a product and safely use tools.
* The completed lesson must be submitted electronically and each team member must submit a working sample of the completed project for presentation in class. The completed activity must include high quality photos of you constructing the project (technical-procedure directions or an appropriate-length stop motion video that illustrates the process in detail).
* The completed activity must clearly deliver the basic concepts of electricity and identified STEM content standards.

**Deliverables:**

* Integrated STEM education activity (teacher and student guide) – Submitted as Word/PowerPoint and .pdf
* Completed projects for demonstration in class at least 2-LEDs and functional switch

\*note: your LEDs may not be connected directly to the battery – they must have a circuit pathway using wire, tape, or other conductive materials.

* Technical-procedural directions for completing the project (Part of your student guide) – Submitted as Word/PowerPoint and .pdf

**Evaluation:**

The submissions will be evaluated based on the degree to which they meet the parameters outlined above, are engaging for elementary students, and deliver and address STEM standards*.*

**Format for Writing the Final Design Brief for the Electricity Project**

**Teacher Guide – Written to the teacher**

**Title:** Use a catchy title the will attract the attention of students and provide a hint at the task in front of the students.

**Grade Level:** Use standards and content knowledge to determine the appropriate grade level of the design brief. \*see assignment guidelines

**STEM Content Standards:** \*see identified standards in the assignment.

**Big Ideas**: Identify the major concept that will be delivered through the design brief. It should be central to the STEM disciplines, hold the potential to engage students, include commonly misunderstood materials, and be important enough for the students to remember when they are 30 years old.

**Essential Question:** What question or questions will the student be able to answer after completing the design challenge? Remember use open-ended/open-response types of questions.

**Scenario:** Write an engaging scenario that will capture the attention and possibly intrigue the students. Fictional scenarios are entirely appropriate. A good scenario will place the students into the story or challenge.

**Challenge:** In specific terms, identify exactly what the student teams are required to do to fully answer the challenge in the design brief. Use a statement that says construct, build, make, etc. In this challenge students will be completing a set of technical-procedural directions.

**Tools, Materials, and Resources:** Identify all of the tools, materials, and resources that will be available to the students as they attempt to solve the challenge. Try to keep the list small, students need to know that in the work world, unlimited supplies are rarely available and there are benefits to solving problems as efficiently as possible.

**Content information:** Provide any content information and/or research materials related to the identified STEM content standards that the students will need to adequately solve the design challenge. – Consider the essential vocabulary.

**Results:** Identify what (exactly) the students need to deliver to the teacher upon completion of the design challenge (i.e., what product, notes, journal, etc.). Results are sometimes referred to as deliverables.

**Limitations:** Identify the boundaries for the students (maximum size, materials allowed, how fast/slow, etc.). Think about all of the ways that student creativity might take their solution beyond your boundaries. Limitations are sometimes referred to as parameters or constraints.

**Evaluation:** List and describe, in specific terms, how the students will be evaluated. A rubric is a good choice. Also remember to evaluate the contributions of all team members so that one student isn’t left doing all of the work.

**Student Guide – Written to the student**

**Title:** Use a catchy title the will attract the attention of students and provide a hint at the task in front of the students.

**Big Ideas**: Identify the major concept that will be delivered through the design brief. It should be central to the STEM disciplines, hold the potential to engage students, include commonly misunderstood materials, and be important enough for the students to remember when they are 30 years old.

**Essential Question:** What question or questions will the student be able to answer after completing the design challenge? Remember use open-ended/open-response types of questions.

**Scenario:** Write an engaging scenario that will capture the attention and possibly intrigue the students. Fictional scenarios are entirely appropriate. A good scenario will place the students into the story or challenge.

**Challenge:** In specific terms, identify exactly what the student teams are required to do to fully answer the challenge in the design brief. Use a statement that says construct, build, make, etc. In this challenge students will be completing a set of technical-procedural directions.

**Tools, Materials, and Resources:** Identify all of the tools, materials, and resources that will be available to the students as they attempt to solve the challenge. Try to keep the list small, students need to know that in the work world, unlimited supplies are rarely available and there are benefits to solving problems as efficiently as possible.

**Results:** Identify what (exactly) the students need to deliver to the teacher upon completion of the design challenge (i.e., what product, notes, journal, etc.). Results are sometimes referred to as deliverables.

**Limitations:** Identify the boundaries for the students (maximum size, materials allowed, how fast/slow, etc.). Think about all of the ways that student creativity might take their solution beyond your boundaries. Limitations are sometimes referred to as parameters or constraints.

**Evaluation:** List and describe, in specific terms, how the students will be evaluated. A rubric is a good choice. Also remember to evaluate the contributions of all team members so that one student isn’t left doing all of the work.

**Directions for completing the Project:** Provide the technical procedural directions or a link to a video of the technical procedural directions that you have created.

**STEM 4033 Electricity Project Rubric (200 pts.)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Category** | Up to 6.5 pts. | Up to 12.5 pts. | Up to 18.5 pts. | Up to 25 pts. | Score |
| **Exemplary Teaching Model/Prototype (50pts.)** |
| Aesthetics | The developer/s construction lacked thought and planning. Many details need refinement to create an attractive product. Little to no use of creativity. | The developer/s construction process was successful, but 3-4 details could have been refined for a more attractive product. Minimal use of creativity. | The developer/s demonstrated careful thought and planning in construction process but 1-2 details could have been refined for a more attractive product. Strong use of creativity. | The developer/s demonstrated careful thought and planning in construction process to create a neat and attractive product. Exceptional use of creativity. |  |
|  | Up to 6.5 pts. | Up to 12.5 pts. | Up to 18.5 pts. | Up to 25 pts. |  |
| Functionality | The model or prototype does not function |  |  | The model or prototype functions flawlessly and as intended. |  |
| **Curriculum Development (150pts.)** |
|  | Up to 25 pts. | Up to 50 pts. | Up to 75 pts. | Up to 100 pts. |  |
| **Technical Procedural Organization****(100 pts.)** | Curriculum developer/s were did not present new information; did not follow recommended pattern; potential audience wouldn’t be able to grasp content or complete task due to incomplete information or minimal technical-procedural directions. Low-quality images. | Curriculum developer/s were clearly uncomfortable with curriculum content and technical procedural directions. Project included rudimentary information and/or partially met requirements. Included images, but these could have been taken with greater precision and attention to detail. | Curriculum developer/s were at ease with content, but fails to fully address all requirements of the curriculum assignment and technical procedural directions including high-quality images with consistent background. | Curriculum developer/s demonstrated full knowledge (more than required) and includes rich information that fully addresses the assigned task. Potential audience would learn STEM content and be able to complete the project using the technical-procedural directions. |  |
|  | Up to 5 pts. | Up to 10 pts. | Up to 15 pts. | Up to 20 pts. |  |
| **Curriculum Organization****(30 pts.)** | Potential curriculum audience would not understand because the product is not sequenced or organized adequately. | Potential curriculum audience would have difficulty following and completing the curriculum. | Curriculum is presented in logical sequence utilizing a recognized curriculum format. | Curriculum presents information in logical, interesting sequence using a recognized curriculum model which the potential audience can follow. The teacher’s guide is broken down so that the potential audience can understand the process for completing the activity with students. |  |
|  | Up to 5 pts. | Up to 10 pts. | Up to 15 pts. | Up to 20 pts. |  |
| **STEM Content and Alignment****(20 pts.)** | The curriculum does not thoroughly address standards or meet the intention of the standards. Minimal content information is provided. | The curriculum addresses standards but does not meet the intention of the standards. Some content information is provided. | The curriculum addresses some of the standards and meets the intention of the standards. Some content information is provided. | The curriculum thoroughly addresses the standards and meets the intention of the standards. Thorough content information is provided. |  |
|  | 0 pts. | Up to 2.5 pts. | Up to 5 pts. | Up to 10 pts. |  |
| **Curriculum****Mechanics****(10 pts.)** | Curriculum has four or more spelling errors and/or grammatical errors. Organization was ill-conceived. | Curriculum had three misspellings and/or grammatical errors. Organization was an issue. | Curriculum has few misspellings and/or grammatical errors. Organization was adequate. | Curriculum has no misspellings or grammatical errors, was organized well, and was attractive. |  |
| **Comments: Total Points: /200** |