SMED 4353: Science Lesson Plan

Teacher: Cortney Hand

Lesson Title: Energy Transfers Through Moving Objects

Grade Level: 4th

Lesson Description: In this lesson, students will demonstrate how energy can be transferred from one object to another through moving pennies.

Learning Central Focus

OAS-S Standard (number and title): 4-PS3-2 Energy

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Performance Expectations:**
Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K– 2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.	**Definitions of Energy:** • Energy can be moved from place to place by moving objects or through sound, light, or electric currents. **Conservation of Energy and Energy Transfer:** • Energy is present whenever there are moving objects, sound, light, or heat. • When objects collide, energy can be transferred from one object to another, thereby changing their motion. • In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. • Light also transfers energy from place to place. • Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. • The currents may have been produced to begin with by transforming the energy of motion into electrical energy.	• Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

Essential Questions:
How do you see energy being transferred every day?
When is energy present in your daily life?
How does speed effect how energy is transferred in situations like car wrecks, playing baseball, etc.?

Students will know…	***Students will understand…***	***Students will be able to…***
• What energy is • What a prediction is • What energy can transfer through • Vocabulary related to the lesson	• Energy can transfer through moving objects • The faster an object moves, the more energy it has • Energy transfer can cause a change of motion	• Develop questions about objects that collide • Make predictions based on observations • Draw conclusions based on observations • Communicate results through presentation

Academic Language:
Energy- the ability to do work

Conservation of energy- energy cannot be created or destroyed, it is transferred from one form to another
Potential energy- stored energy waiting to be used
Kinetic energy- energy in motion or being used
Motion- change in position of an object with time

(KY Schools, n.d.)

Background and Misconceptions

Content Background: Energy can be transferred from one object to another through moving objects, like pennies. Before the penny is moved, it has energy that is potential. When the penny is being moved from one place to another, the penny's energy is kinetic. When a penny is moving faster, it will possess more energy (KY Schools, n.d.). Energy can be transferred through the moving pennies when the two, or more, pennies collide together. The collision of the pennies causes a change of motion.

Common Preconceptions and Misconceptions:	**How will you address these with students?**
1. Energy isn't transferred from object to object unless the objects are in contact directly. 2. An object contains energy within that is used when the object moves. 3. A heavier object has less motion energy than a lighter object because heavier objects move slower than lighter objects. 4. The amount of motion energy depends on the size of an object. 5. The speed of an object is not affected by the motion energy of that object. (Oklahoma Science Teachers, 2015)	I will address these misconceptions by explaining to students how energy can be transferred from object to object many ways and also demonstrate that for students. I will explain to students how an object gains energy, how size effects objects energy, and how speed affects objects motion energy. I will explain this to students while also supporting explanations with demonstrations throughout the lesson.

Preparation to Teach

Time Needed: 60 minutes

Materials & Equipment:	**Featured Picture Book(s) (if applicable):**
- 110 pennies - Paper plates - 1 Desk for each group - Student science notebooks - Bill Nye the Science Guy video- https://www.youtube.com/watch?v=haJWh9Pa-io	Not Applicable

Student Pages Needed for Lesson:
-Appendix A- "I used to think…but now I know" FACT (Keeley, 2008)

Safety Considerations: Students should be cautious when pushing the pennies together. Many students will want to push the pennies together as fast as they can. Monitor students as they do so. Students also might have the urge to throw pennies, but procedures must be put in place at the beginning of the lesson that state that throwing the objects is not appropriate for this experiment.

Set-up Before Lesson:

- Create a Smart Notebook slide that contains an example of the "I used to think… but now I know" FACT (Keeley, 2008), along with slides that contain Bill Nye the Science Guy video, vocabulary from the lesson, informal assessment questions that the teacher will ask throughout the lesson, and example of

how to write experiments within students science notebook.

- Set up 10 lab stations so each pair of students can have their own station. Each lab station should have at least 1 desk.
- Put 10 pennies on 10 plates and set one at each of the stations.
- Prepare a plate of 10 pennies for you to use during demonstrations, as the students will have questions throughout the lesson, especially during the "Elaborate" and "Evaluate" stages.

Instructional Strategies and Learning Tasks (*Description of what the teacher will be doing and what the students will be doing. Make sure to illustrate how you will model academic language and how the students will use academic language)*	
Learning Activity	**Formative Assessment (Formal & Informal)**
Engage: Begin by discussing the concept of energy with students. Ask students what they know about energy. Ask students if they can think of any ways energy could be transferred between objects? Students will write down what they know about energy in their science notebook. Teacher will ask students to turn and talk to a neighbor about what they wrote down and how energy is and a variety of ways students think energy can be transferred between moving objects, among other ways. Explain to students that today we will be using everyday objects to demonstrate energy and motion.	Formal: Students share what they think energy is and what prior knowledge they have about energy. Student's responses to what they know about energy in their science notebook will inform the teacher of the prior knowledge students have.
Explore: Put students in groups of two. Give each group a plate with 8 pennies on it. Ask students to experiment how they can use energy to create motion with only two pennies. I expect to see students pushing one penny into another penny. Students then must record one discovery in their science notebook. The groups must also record at least two "I wonder" questions they want to investigate as they continue experimenting later in class. Give the students about 10 minutes to explore using pennies to transfer energy and create motion. *Teacher will be walking around the room listening to student's discussions and wonderings about energy.	Informal: Students discussions will allow the teacher to evaluate the student's ability to generate questions. The discussions heard, the "I wonder" questions, and one recorded discovery will show the teacher if the students are demonstrating new knowledge about energy.
Explain: Teacher will lead a discussion about what the concept of energy is (energy- the ability to do work). Then will discuss with students the two types of energy, potential and kinetic. (potential energy- stored energy waiting to be used; kinetic energy- energy in motion or being used). Teacher will show penny lying on table and describe it having potential energy, then the teacher will push the penny and describe it having kinetic energy. Also discuss conservation of energy with students (conservation of energy- energy cannot be created or destroyed, it is transferred from one form to another). Teacher will show Bill Nye the Science Guy video over Energy to class (TBA ISD, n.d.). (https://www.youtube.com/watch?v=haJWh9Pa-io) After teacher and students discuss the vocabulary terms and watch the Bill Nye the Science Guy video on Energy, students will fill out the FACT (explained in assessment section to the right). After they complete the FACT in their science journal, students will predict what they think would happen if the number of pennies used or speed at which they pushed the penny would change the outcome of their experiment.	Formal: Students will complete an "I used to think… but now I know" FACT (Keeley, 2008). Once students record what they used to think about energy and know what they know, they will discuss with gather with another student from the class and discuss how their ideas about energy has changed. If students have trouble remembering what their initial thoughts about energy were, they can refer to their journal entry made at the beginning of class.

Students will then be able to experiment with their pennies again in their groups of two. *The teacher will explain to students they can use as many of the pennies they were given at once to transfer energy and cause motion. The teacher will mention that they should think about the speed at which they push their pennies. Teacher will explain to students they must have 4 documented experiments that are all different. (Different meaning they must not have the same number of pennies involved and also same speed used more than once). Students will document the number of pennies, if they pushed the penny slow, medium, or fast, and then record the change of motion that was caused in their science journal.	
Elaborate: Students will look over their first experiment they recorded with the pennies. They will look over their first experiment to see what they can change about their experiment to incorporate what they just learned about energy before continuing to experiment with the pennies for their other three documented experiments. The teacher will pose a challenge that at least one of the group's demonstrations must be a collision. (If the teacher notices none of the students have experimented a collision while he/she is walking around, the teacher will demonstrate to the students how when you spread the pennies out on the floor or a desk, you can flick one penny into another. The movement of the penny that was flicked will cause the other pennies to move.) As students are experimenting with different numbers of pennies and the speed at which they move the penny, the teacher will be walking around the room listening to the student's conversations. The teacher will be asking probing questions such as: "What causes the pennies motion to be slower or faster?" "What happens when the pennies collide with each other?" "What differences did you notice when there were more or less pennies used in the experiment?" etc. As students record at least 4 of their experiments, they will write down any discoveries they found about energy, energy conservation, and how energy can change motion. Once students write down their experiments and discoveries, they will see if they answered their two "I wonder" questions they wrote down during their first experiment. If they did not answer their questions, they will then discuss with their group partner and answer their two "I wonder questions."	Informal: Students are required to maintain documentation of their experiments with moving pennies in their science journal. I expect to see students draw how they made energy move between objects. For example, pushing one penny into another penny, which caused the second penny move. Students should also be explaining their drawing. This will allow the teacher to check for students understanding and application of predictions, variables, and ideas to change their science experiments. Students may be given an outline of variables that can be changed, such as number of pennies, speed, surface pennies are on, and also if it is a collision. This will give them a reference on how they can alter their experiments to learn new information about energy, energy conservation, and how energy can cause a change in motion.
Evaluate: Each pair of students that were grouped together will orally present their experiments/discoveries to the class (TBA ISD, n.d.). In their presentation to the class, each student must discuss what they have learned about energy and how energy is transferred between moving objects. Students have the choice to use their science journal or not to support what they orally present to the class. Students will also turn in their science journal they documented their experiments with moving pennies in. Teacher may create and provide a rubric for evaluating the group's	Formal: Students presentation will show the teacher what information students have learned about energy being transferred between moving objects and how it can cause a change in motion. Students' science journal will also show their thought process and responses to any wonderings, questions, or predictions; they had while

presentation based on the standards she wanted her students to achieve.	experimenting with their pennies.

Differentiation strategies to meet diverse learner needs:*)*

This lesson has visual and tactile elements throughout that allows for visual and kinesthetic learning. Students are paired with a partner, which allows support for students who are at different ability levels since I will be pairing the students up. Lower students may need assistance coming up with experiments that have a collision involved- the teacher will show an example of a collision with pennies to those students as situations arise. Advanced students may finish documenting their experiments early, if so they will be provided with a more advanced experimentation with moving pennies, which will allow them to measure distance and speed of pennies when energy is transferred. ELL students may need assistance recording experiments in their science journal.

References:

Oklahoma Science Teachers. (2015). Oklahoma academic standards-science overview: 4th Grade Overview: Motion. Retrieved from: https://drive.google.com/folderview?id=0B_pBNbQVSt6ffndMaXlEc2ZhTHVwc0tBVnBuQ3R1YXdkR21PWnRjVER5WkhDUlgweXJpdGc&usp=sharing&tid=0B_pBNbQVSt6fflMwajJqNGpTR1RMZ2MyT0pOdXJuSTIzTF9GbUpQa2h5b2ZqUm9pTXNvSkU .

Keeley, P. (2008). *Science formative assessment: 75 practical strategies for linking assessment, instruction, and learning*. Thousand Oaks, CA: Corwin Press & NSTA Press.

KY Schools. (n.d.). *Moving Pennies*. Retrieved from: http://www.mccracken.kyschools.us/Downloads/4%20NGSS%20UNIT%20Energy%20Waves.pdf.

TBA ISD. (n.d.) *Fourth Grade-Moving Pennies*. Retrieved from: http://moodle.tbaisd.org/pluginfile.php/127446/mod_resource/content/1/TG%20Lesson%201%20Moving%20Pennies.pdf

Appendices:

Appendix A- “I used to think.. but now I know” FACT