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LIS 654

Dr. Akers

Makerspace Collaborative Lesson Plan

4th Grade Energy Lesson

Each of us will plan one lesson for a Forms of Energy Unit. Bernhard: electricity, Burke: sound, Cornell: heat, Gonsalves: magnetics

Collaboration Continuum: Moderate collaboration with classroom teacher. Teacher will activate prior knowledge and establish foundational knowledge of magnetics. Librarian will expand upon foundational knowledge through inquiry activity.

Estimated Lesson Time: 40 minutes in the media center

STANDARDS FOR THE 21st-CENTURY LEARNER

AASL Standard:

1. Inquire, think critically, and gain knowledge.

2. Draw conclusions, make informed decisions, apply knowledge to new situations, and create new knowledge.

Skills Indicators:

1.1.1 Follow an inquiry-based process in seeking knowledge in curricular subjects, and make the real-world connections for using this process in own life.

1.1.2 Use prior and background knowledge as context for new learning.

Dispositions:

1.2.1 display initiative and engagement by posing questions and investigating the answers beyond the collection of superficial facts.

1.2.5 Demonstrate adaptability by changing the inquiry focus, questions, resources or strategies when necessary to achieve success.

Responsibilities:

1.3.4 Contribute to the exchange of ideas within the learning community.

Self-Assessment Strategies Indicator:

1.4.2 Use interaction with and feedback from teachers and peers to guide own inquiry process.
1.4.4 Seek appropriate help when it is needed.

Scenario: Working together with the classroom teacher we will introduce and review the topic of magnetic energy. The lesson will begin in the classroom with the teacher reviewing students' prior knowledge about magnetic energy by having students create a KWHL (What do I Know, What do I Wonder, How Will I Find Out, What I have Learned) chart (an example has been included at the bottom of the lesson) to evaluate students' understanding of magnetics. The classroom teacher will continue the discussion by viewing, with the students as a class together, the BrainPOP movies Magnetism and Electromagnets. The teacher will pause, reflect, and discuss while the movies are being viewed to ascertain the understanding of the students. After viewing as a class, students will be given the opportunity to take the quizzes following the movies to reflect on what they have learned and to show the students' understanding level to the teacher. Students will then be paired by the teacher to allow for self-pacing, different learning abilities, and peer teaching and interaction for the hands-on activities. With these smaller groups the students will develop collaboration skills before the lesson. After the library lesson, exit tickets will be handed out and then collected by the teacher to allow for students to reflect on their collaboration and how well they grasped an understanding of the concepts taught.

Essential questions: What is a magnetic field? What is the interaction between like and unlike magnetic poles? What are the combined fields created when like and unlike magnetic poles interact? What is a homopolar motor?

Enduring Understandings: Knowledge and demonstration of how a magnet works and how their poles affect their magnetism.

Student Analysis: This lesson will be taught in conjunction with the classroom teacher who has 28 English speaking students, 12 girls, 16 boys. Students' learning abilities range from

independent to needing teacher guidance. There are 3 students with IEP's which require visual cues during assignments. To ensure these students understand what is expected, I will review all directions as a class and in addition, directions will be on handouts, and displayed on the Smartboard. At various times throughout the activities I will ask these students to restate the directions in their own words, which will reinforce understanding and allow me the opportunity to know if they are following along with the lesson. The reading comprehension for the class ranges from low to average, but they enjoy science topics. However, the students have a difficult time working together. So for this reason and to address the range of learners, students will be assigned partners as previously mentioned.

NC Essential Standards:

4.P.3 Recognize that energy takes on various forms that may be grouped based on their interaction with matter.

4.P.3.1 Recognize the basic forms of energy (light, sound, heat, electrical, and magnetic) as the ability to cause motion or create change.

Overview: In the library, students will add to their knowledge of magnets to define, describe, and draw magnetic field lines around a single magnet. Students will also describe the interaction between like and unlike magnetic poles with the use of bar magnets and iron shavings, and they will draw the combined fields created when like and unlike magnetic poles interact, all the while developing stronger collaboration skills by working in pairs. They will demonstrate their full knowledge of magnets by creating a homopolar motor. In the library, students will be put into teacher-assigned pairs to work through two activities where they will be given the opportunity to demonstrate their understanding of magnetic energy. Using their prior knowledge and knowledge gained through the previously mentioned BrainPOP movies, the students will define, describe, and draw magnetic field lines around a single magnet. Students will also be able to view and describe the interaction between like and unlike magnetic poles, as well as draw the combined fields that are created when both like and unlike magnetic poles interact. They will then take this knowledge and apply it to the task of creating a homopolar motor. Students will come to the library with any written materials from the classroom (i.e. notes taken during BrainPOP movies or teacher lectures), notebooks, pencils, KWHL charts, and know the groups they are assigned to. Using their KWHL charts, students will self-monitor, demonstrate, and broaden learning from the hands-on activities.

Products/Performances/Learning Tasks and Process: Each pair of students will investigate the attraction and polarity of magnets through the use of bar magnets and iron fillings. Students will use new vocabulary (magnetism, magnetic field, magnetic moles, homopolar motor) as they collaborate and problem solve to investigate and determine how magnets work. Students will also demonstrate their total knowledge of magnets through the task of building a homopolar motor. Pairing students should strengthen collaboration skills. Students will refer to their KWHL chart and notebook as they investigate, illustrate, and build their results. Students

will complete an exit ticket at the end of the activity to reflect on learning and identify any questions (see at bottom of lesson).

Library Lesson: I will explain to students they will work collaboratively with their partner and using their knowledge of magnetism explore how a magnet works and then create a homopolar motor that uses a battery and magnets to produce a motion. I will review what each material for the lesson is and how they are to be used. Directions will be at each students' table as well as projected onto the Smartboard. For the students with IEP's, along with peer pairing for more productive collaboration, there will be illustrated directions at their tables. Discussion questions are included throughout the outline of the lesson. The following structure of the lesson will ensue. Each pair of students will have a manila file folder on their desk or table. On top of it they are to place one bar magnet in the center of the file folder. Place a piece of wax paper on top of the magnet. Students next sprinkle iron filings all around the bar magnet (they may need to gently tap the wax paper with their finger to get the best view of the magnetic field lines). Have students draw what they see in their notebooks.

Possible questions to pose to students while walking the room might be: Are your lines of force greater at the ends or in the middle of the bar magnet? (Answer: at the ends) Understanding of this will be evident in students' drawings. Another possible question to pose to students for assessment during the activity might be: What does your drawing help you assume you can make about the strength of the magnetic field at that location? (Answer: The magnetic field is strongest at the ends/poles because this is where the lines are more concentrated and closer together.) The students can now place the used iron filings back in the saltshaker. Allowing students to pace themselves, they can follow posted directions. Next in the lesson, students now place two bar magnets onto the manila file folder so that North poles are facing each other and are about an inch apart. Place the wax paper on top of the magnets. Have students sprinkle iron filings around the north poles of the magnets (again, they may need to gently tap the wax paper with their finger to get the best view of the magnetic field lines). Students then draw what they see in their notebooks. Possible questions for assessing while roaming: Are the magnets are attracting or repelling and how do you know? (Answer: Repelling because the magnetic field lines are bending away from each other.) Again, their drawings should show this. Students then place the used iron filings back in the saltshaker. Allow students to repeat these steps but with a north pole of one magnet facing the south pole of a second magnet. While students are performing this task, the following question can be asked to ascertain students' understanding of concept: Are the magnets attracting or repelling, and how do you know? (Answer: attracting because the magnetic field lines are connecting the two poles together.) Evidence of this can also be seen in student drawings. Have the students clean up their materials. This first part of the lesson is projected to take about 25 minutes.

Now students will be given the opportunity to show what they have just learned about magnets in their creation of a homopolar motor. The successful operation of the motor or the student's ability to solve the problem of a non-operational motor will be used in conjunction with other materials as a tool for assessment. Directions will be as previously stated in the earlier part of the lesson.

Students will be given 3 neodymium disc magnets, 10" copper wire, 1 AA battery. Using these materials, their prior knowledge, and knowledge they gained from the classroom BrainPOP lesson on electromagnets, they are to create an operational homopolar motor. After explaining what each material is, I will demonstrate one possible way to build the motor. Take about ⅓ of the copper wire and bend it into a symmetrical shape leaving the leftover wire in a straight line. Bend this part of the wire around the battery to create the base that wraps around the magnets. Remove the battery and gently widen the circular wire form with your fingers. Place three neodymium magnets on the negative side of your battery. Place the shape on top of the battery so that it touches the positive pole. The round section at the bottom of the motor must be low enough to encircle the magnets! Now let it go. If properly constructed it should start to spin. If not, problem solving skills should be seen with students trying different ways to make the shape spin. Possible solutions might be: flipping magnets around, making sure the copper wire touches the battery at the top and wraps around the magnets at the bottom, the battery is placed directly on top of the 3 magnets, replacing a battery (sometimes they burn out quickly).

Together the teacher and I will roam the room viewing collaboration within the groups as well as asking possible questions to gain insight of the students' understanding of the concept. Some possible questions might be: What might happen if another type of wire like aluminum were used instead of copper? (It probably won't work because the copper wire is a great conductor of electricity where aluminum is not). Why do we have to have the copper wire touching both the magnets and the battery? (Again, this has to do with conduction of electricity).

Assessment Products: KWHL chart, notebook illustrations, exit ticket, BrainPOP quiz, homopolar motor

Assessment Process: At the beginning of the lesson I will briefly review and assess student understanding of magnetism by asking the following questions: How does a magnet work? What are magnetic poles? Can you show me how they work with the bar magnets? What kinds of things are attracted to magnets? At this point I could have some metal and some non-metal items to be used in the process of determining what is attracted to magnets. These questions will let me assess the student understanding of basic magnets and show me which students may need additional help during the lesson. Throughout the lesson the librarian will formatively assess students as I monitor and question the student groups to provide individualized support as needed. The classroom teacher will also be formatively assessing the students when they create their KWHL charts and complete the BrainPOP quiz. The KWHL charts will guide students to self monitor themselves as they refer to their written questions or add new ones and extend their learning as they move through the activities and record their illustrations in their notebooks. The exit ticket responses will further play a role in assessment both for the teacher and librarian and for the students themselves too. The exit ticket will provide student reflection and measurement of essential questions, collaboration, and identify gaps in learning.

Student Self-Questioning: Students will monitor their learning through the use of the KWHL chart as well as the illustrations they create while viewing the results of their activities. This will help to aide in student reflection of their learning and activities.

Instructional Plan

Resources each pair of students will use:

KWHL chart, 2 bar magnets, salt shaker of iron filings, wax paper, notebooks (to record results), pencils, manila file folder, 10' copper wire, 1 AA battery, 3 neodymium magnet discs, exit ticket

Resources instructors will use:

KWHL chart, Discovery Science Techbook teacher resources, 2 bar magnets, salt shaker of iron filings, wax paper, manila file folder, 10' copper wire, 1 AA battery, 3 neodymium magnet discs

Instruction/Activities

Connect/Activate Prior Knowledge/Wonder: In the classroom, students will generate a KWHL chart about magnetics. They will view BrainPOP movies on magnetism and electromagnets.

Direction Instruction:

Modeling and Guided Practice: Librarian will model how to use bar magnets and iron fillings, point out poles of magnets, and construct a homopolar motor while posing appropriate discussion and questioning between partners with the aide of a student volunteer.

Independent Practice (Investigate and Construct): Student pairs will demonstrate understanding of magnetism and magnetic poles and then construct a homopolar motor. They will try to come up with solutions to problems that may arise (i.e. homopolar motor doesn't work).

Sharing and Reflecting (Express and Reflect): During the activities through the use of their KWHL charts and illustrations created in their notebooks, and then at the end of the lesson using an exit ticket.

Instructional Strategies for Differentiation: Pairs will determine what poles are where on the magnets and how these poles attract; they will apply this knowledge in their construction of a homopolar motor.

Instructional Strategies for Reading Comprehension: All directions and materials will be verbally explained, displayed on the Smartboard and at each table, and illustrated directions given to those students with IEP's.

Instructional Strategies for Multiple Literacies: All directions and materials will be verbally explained, displayed on the Smartboard and at each table, and illustrated directions given to those students with IEP's. Activities are hands on learning and students will be preassigned with learners that will best suit their learning needs so as to take full advantage of peer learning. Teacher and I will constantly be available through roaming the room.

KWHL Chart Example (click on words to go to link)

Exit Ticket Example:

Name_____

Subject_____

Today I learned_____

_____

_____

_____

I may need more practice with _____

_____

_____

_____

I have a question about _____

_____

_____

_____