Magnetism Lesson

Michigan State University
TE 861B-730 Inquiry, Nature of Science
Fall 2013
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Performance expectations:

- 3-PS2-1 Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
- 3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence so that a pattern can be used to predict future motion.
- 3- PS2-3 Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

In November, I will be teaching a unit on magnets. In order to see where my students are in their understanding of magnets, I will ask a portion of my students a series of questions to help shape my upcoming lessons. During the unit, the students will participate in and carry out all of the science and engineering practices the *Framework* suggests. The main practices the students will use are asking questions and defining problems, planning and carrying out investigations, analyzing data, constructing explanations, and communicating the information they have found with their peers (practices 1,3,4,6,8). I hope to incorporate all of these practices in the lessons if I have time.

The Disciplinary Core Idea I am connecting my lessons to is PS2.A: Forces and Motion. The *Framework* says, "By the end of grade 2 [students should be able to] objects pull or push each other when they collide or are connected. Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. An object sliding on a surface or sitting on a slope experiences a pull due to friction on the object due to the surface that opposes the object's motion." (pg. 115)

I will also be incorporating some crosscutting concepts, listed below, that will be used after the interview questions. The three main concepts the students will be engaging with are patterns, cause and effect, and structure and function. The class will look for patterns in their discoveries with magnets. They will experiment with, "If I put a magnet close to this. What will happen?" The students will also explore what a magnet is made out of and why it works the way it does.

Kid Friendly Goals:

- Explore how magnets work by conducting multiple investigations to discover what is attracted to magnets.
- After the investigation, students will be able to list and explain what materials are attracted to magnets and what materials are not.

- Students will be able to discuss the different types of experiments and which ones were helpful in determining what materials are attracted to magnets.

Initial Plan

Phase 1: Engaging with a Problem/Questions

For the first lesson, I will open with asking the students what they know about magnetism and magnetic objects. I will also ask them what magnets can attract or what items are attracted to magnets. By asking them these questions, I am using a type of formative assessment that will help me find out where they are in their thinking on the topic of magnets.

To spark their interest, I will place one magnet on their desk. This way they can manipulate it in their hands and perhaps try to stick it to their desk of chair.

Big Idea Questions

1) What do scientists do?
2) What makes science different than other subjects we study in school?
3) How does a magnet work?
4) Can magnets be used for anything other than sticking papers to your refrigerator?
5) What types of objects to magnets attract?

I will make mental notes about what they say so I can go back to clear up any misconceptions later in our discussion. At this point, I will know the thoughts of some of the students because of the interview questions I have asked. Ultimately, I want them to be able to defend how they know what they know about magnets.

Phase 2: Data or Observations/Evidence.

To start expanding their knowledge and exposure to magnets, I will divide the students up into groups to explore nine different investigation stations. At these stations, the student will simply write down their observations on a piece of worksheet I have provided. They will be free to create their own ways to test the magnets at each station.

1) Swinging Pendulum - The pendulum looks a little crazy as it's attracted or repelled to the carious magnets the students place - there is a magnet in

the tip of the pendulum so it's the interaction of the two that causes the pendulum to swing.

2) Architect - The students can build structures with the balls and sticks - there are magnets in the tips of the sticks, but the balls are simply metal so they'll always be attracted to the sticks regardless of polarity.
3) Toy - The students should be able to make the toy spin using the repelling feature of magnets.
4) Magnetic or No? - The students should easily be able to group the objects into magnetic and none magnetic groups.
5) Patterns - The boxes are filled of iron fillings.
6) Explore - This station just allows the students to explore magnets and the effect they have on certain objects.
7) North and South - This station focuses on the repelling and attracting forces.
8) Figure Out the Poles - More experiments with the north and south poles.
9) Levitate - At this station, the students need to keep a very light piece of metal infused paper in the air as long as they can.

As the students move from station to station, they will be answering questions, examples provide below, which are specific to each station. Below is an example of the formative assessment for station one.

P.O.E

Predict:

1) What do you think will happen if you put a magnet near the pendulum?
2) What do you think will happen to the movement of the pendulum when you place two magnets near it?

Observe:

1) The students will take 10 minutes to observe experiment and make notes of the differences in movement.

Explain: (I will ask the students about their results.)

1) What is the rhythm of a pendulum?
2) What happened to the pendulum when you placed one magnet near it?
3) What happened to the pendulum when you placed two magnets near it?
4) Why do you think you got the results that you did?

By exploring and discovering at these stations, the students will be able to gather evidence and background knowledge about magnets.

On the table provided below the students can write down their observations about magnets and what items are attracted to magnets and which ones are not.

1) Swinging Pendulum Place one magnet on top and hang the stick from underneath. Place a couple of magnets in the tray below. Give the pendulum a nudge and watch what happens. Now try to rearrange the magnets (you may want to turn some over) and see how things change.	2) Architect Play with these pieces and build some structures. Can you use what you're learning in your class regarding structures? What works and what doesn't?
3) Toy Play with this toy, Make sure you use both parts. Can you make it dance? Spin? Wobble? What do you think is going on?	4) Magnetic or no? Test the items on the tray. Divide into two piles, magnetic and non magnetic.

5** Patterns Can you make some patterns using the magnets and the powder in the box? What do you think the powder is made of? How many different patterns can you make?	6** Explore Walk around the room and find things that are magnetic and things that are not magnetic. Write down at least 4 items. Did anything surprise you?
7** S and N What do you notice about the S and the N ends? Which ones repel? Which ones attract?	8** Figure out the poles? Two magnets are labeled (S and N) and two are simply colored. Can you determine which color is S and which color could be labeled as N?
9** Levitate Stack these magnets onto a pencil. Can you make them hover in midair?	Other Thoughts or observations-

Phase 3: Finding and explaining patterns / Explanation.

After the students have explored different types of magnets and participated in the activities above, the teacher will facilitate putting their observations into a chart. To start this phase of the investigation, the students will be in groups and will create a chart summarizing their observations. It may look like the one below.

Substances Attracted to Magnets	Substances Not Attracted to Magnets
Metals	Not Metal
Nail Paperclip Pins Many Parts of a Car Canadian Nickel	Aluminum Foil Paper Stainless knives Popsicle Stick Pennies Nickels Quarters Chrome Plastic

The students will then divide up into groups and discuss what patterns they see in their results. If they need to visit a station again to support their thoughts, they will be more than welcome to do that. The students should come to the conclusion that metallic substances are attracted to magnets, but not all metals are magnetic, mostly iron (nickel and cobalt, but these are rare in everyday life). They should also conclude, based on the stations,that like poles repel; opposite poles attract. We will also be talking more in depth about this in the next lesson.

Phase 4: Alternate Explanations.

If the students still have any misconceptions about what items magnets can attract, they will be given the time to go back to the stations and experiment further. They will also be able to do this if they disagree. After this lesson, we will be reading *What Makes a Magnet?* by: Franklyn M. Branley, to help the auditory learners understand how magnets work.

Phase 5: Communicate and Justify:

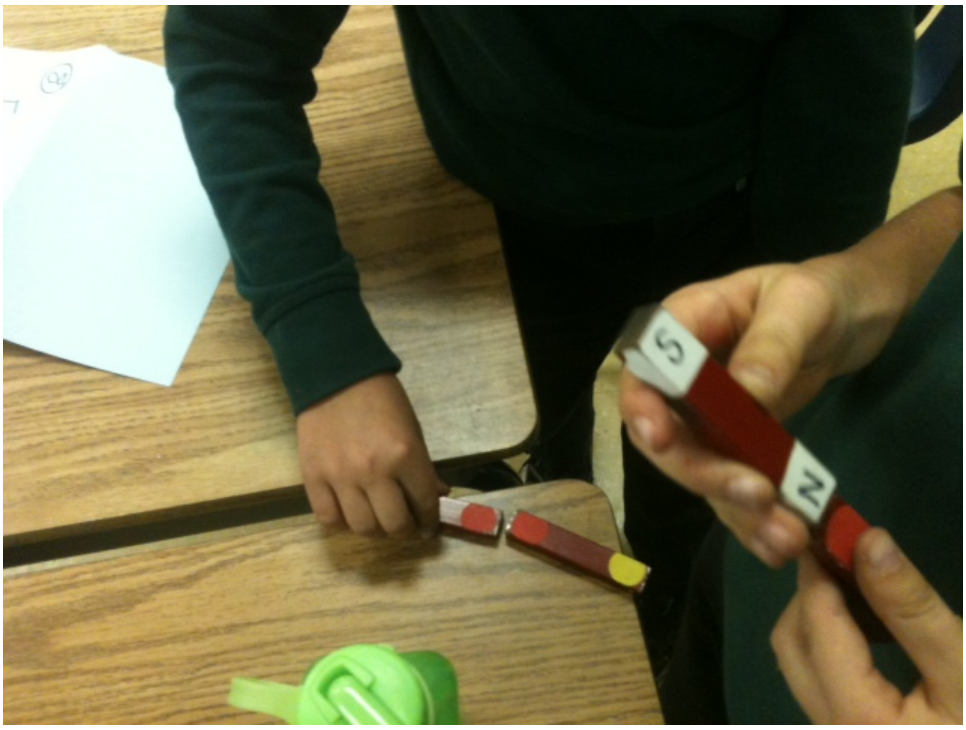
After the groups have come to an agreement about what types of materials are attracted to magnets, they will write their results in their journals. The students will answer the question, “What materials are attached to magnets?” The students will write in complete sentences and include any of the observations they think are important. This is the summative assessment I will use to assess the students on what they learned from the experiments. Based on this assessment, and my observations of participation throughout, the unit will help me conclude the students grade for this series of lessons.

Reflections

The magnetic lesson I taught started with nine stations that allowed my students to explore and discover magnets and create thoughts and conclusions about what magnets attract. I instructed the students to write down any observations they observed at each of the stations they visited.

I did not give specific instructions to the students on how they should plan and conduct their own experiments; I simply let them explore. They were also not given instructions to look for cause and effect relationships. I did not give these specific instructions because I did not want to overwhelm anyone. Second and third grade students work best when they are given one instruction at a time. However, when the students were observing and discovering magnets at the stations, they started constructing experiments that showed the cause and effect nature magnets have when something is attracted or repelled. By the end of the station time, the students where asking questions of their own and trying to discover the answers. The students were able to discover some properties of north and south poles of magnets. They discovered that two poles of the same magnitude do not attract each other, but in fact repel each other. The students also were able to conclude what objects were attracted to magnets and what objects magnets have no effect on. Overall, I believe my students did a great job carrying out the performance expectations I hoped they would.

A specific example of the students carrying out the performance tasks was how all of the students were able to complete all of the station rotations exploring the different properties of magnets. The students used their critical thinking skills to try to predict what would happen when using magnets. One student said, “Mrs. Hoogsrta! Look what happens when I put this magnet close to the screw.” His eyes were glued to the screw as it was pulled to the magnet. “Mrs. Hoogstra, what do you think will happen when I put the magnets close to the paper clip?” I responded by asking this student what he though would happen. “I think that it will fly across the top of the table to the magnet!” After a few more excited connections he was able to come to some conclusions about magnets.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N

Names Henry Ryan William B

You can also play Nands 1) Swinging Pendulum Place one magnet on top and hang the stick from underneath. Place a couple of magnets in the tray below. Give the pendulum a nudge and watch what happens. Now try to rearrange the magnets (you may want to turn some over) and see how things change. magnets go through flesh.	It does Nands. It stands up. 2) Architect Play with these pieces and build some structures. Can you use what you're learning in your class regarding structures? What works and what doesn't?
The magnets look like hare. if you play with the green and red man it picks upall of it. 3) Toy Play with this toy, Make sure you use both parts. Can you make it dance? Spin? Wobble? What do you think is going on?	You can make huge magnet lines. 4) Magnetic or no? Test the items on the tray. Divide into two piles, magnetic and non magnetic.

Name: Liz Willa Addie Leah

pendulum swings to where strongest magnet on the bottom is. 1) Swinging Pendulum Place one magnet on top and hang the stick from underneath. Place a couple of magnets in the tray below. Give the pendulum a nudge and watch what happens. Now try to rearrange the magnets (you may want to turn some over) and see how things change.	They fall down on the side they were propped up on the top. 2) Architect Play with these pieces and build some structures. Can you use what you're learning in your class regarding structures? What works and what doesn't? They sticks can attach to each other.
The big magnents more since they have a stronger force. 3) Toy Play with this toy, Make sure you use both parts. Can you make it dance? Spin? Wobble? What do you think is going on?	When magnets are slipped over other magnetic things they stick. 4) Magnetic or no? Test the items on the tray. Divide into two piles, magnetic and non magnetic.

Names Sarah Claire Martha

1) Swinging Pendulum Place one magnet on top and hang the stick from underneath. Place a couple of magnets in the tray below. Give the pendulum a nudge and watch what happens. Now try to rearrange the magnets (you may want to turn some over) and see how things change. that way it works through paper	2) Architect Play with these pieces and build some structures. Can you use what you're learning in your class regarding structures? What works and what doesn't?
The toy magnet are stronger than the magnet it comes with. 3) Toy Play with this toy, Make sure you use both parts. Can you make it dance? Spin? Wobble? What do you think is going on? With the toy magents you do not have to pres it to the plastick	the staples are magnetic the magnet will not stick to the thumb tack 4) Magnetic or no? Test the items on the tray. Divide into two piles, magnetic and non magnetic. the black will not stick

You cam make a long patterns, 5** Patterns Can you make some patterns using the magnets and the powder in the box? What do you think the powder is made of? How many different patterns can you make?	N and S both stick to the edge of the wall. 6** Explore Walk around the room and find things that are magnetic and things that are not magnetic. Write down at least 4 items. Did anything surprise you? it sticks to the magnets at #2.
7** S and N What do you notice about the S and the N ends? Which ones repel? Which ones attract? north and north repel.	 if you push it forces the S to go to the N. 8** Figure out the poles? Two magnets are labeled (S and N) and two are simply colored. Can you determine which color is S and which color could be labeled as N?
9** Levitate Stack these magnets onto a pencil. Can you make them hover in midair?	Other Thoughts or observations-

Martha

5** Patterns Can you make some patterns using the magnets and the powder in the box? What do you think the powder is made of? How many different patterns can you make?	6** Explore Walk around the room and find things that are magnetic and things that are not magnetic. Write down at least 4 items. Did anything surprise you? it sticks to the airvent
7** S and N What do you notice about the S and the N ends? Which ones repel? Which ones attract? North and North will chase eachother	8** Figure out the poles? Two magnets are labeled (S and N) and two are simply colored. Can you determine which color is S and which color could be labeled as N? Yellow is S Red is N
9** Levitate Stack these magnets onto a pencil. Can you make them hover in midair?	Other Thoughts or observations-

If you put the magnets right under but not quite touching they look like spikes. 5** Patterns Can you make some patterns using the magnets and the powder in the box? What do you think the powder is made of? How many different patterns can you make? You can feel them working through your fingers when you put them on either side of your hands.	You find a lot of things that are not magnetic. 6** Explore Walk around the room and find things that are magnetic and things that are not magnetic. Write down at least 4 items. Did anything surprise you?
the circle magnets can stick on either side 7** S and N What do you notice about the S and the N ends? Which ones repel? Which ones attract?	when both of the same kind one turns around 8** Figure out the poles? Two magnets are labeled (S and N) and two are simply colored. Can you determine which color is S and which color could be labeled as N? red - north yello - south
9** Levitate Stack these magnets onto a pencil. Can you make them hover in midair?	Other Thoughts or observations-

One way in which I think the students did not carry out some the performance tasks that were taught to them was the lack of thoroughness when

taking notes. Even though I told them they needed to take detailed notes about their observations, most groups did not take good notes.

Final Revisions and Reflections

I think that next time I teach this lesson, I may want to have smaller groups. During this lesson, there were four or five students at each station. This worked well enough, but I think each student would have the more time interacting with the magnets at each station. I also would like to add a station or two that involves reading a book about magnets to help them build background knowledge about magnets and incorporate more English Language Arts standards (ELA) to the science lesson. A final stage of the lesson I would add would be a short tutorial on how to take detailed notes. I would teach the students what is important to write down in order to help them remember what they observed for a future class.

Continuing to Work with Students

To ensure that my students will continue to interact with magnets, I will have them explore magnetic fields and create their own magnets. We will also be interacting with more literature that discusses magnets, so we can review what we have learned from this lesson. When we are finished with our magnet unit, the students will still be practicing the performance tasks they learned and performed during this unit. We will be practicing observing, exploring, discovering, and asking questions across the curriculum. When we do this, I will be sure to help the students make connections between what they are doing and science. They will then come to the conclusion that thinking with a scientific mind can help them solve problems in all subjects.

Turning in and Sharing the Assignment

You should BOTH turn in your plan to the dropbox AND share it with other members of your team. When you turn in the plan to the dropbox, add your last name to the beginning of the file name. So an assignment that I turned in would be named GotwalsLessonSequence.doc, for example.

Scoring Rubric: Total points = /200

Note that grades will be based on *how good this lesson sequence would be the next time you teach it.* Some things don't work when you're trying something new. That's OK, as long as you can explain how you have learned from the experience and how you will make changes for next time.

Component	*Points*	*Comments*
Performance Expectations/Objectives (10 points)		
Plans and teaching Phase 1: Establishing problem (20 points)		
Plans and teaching Phase 2: Observation and data collection (20		

points)		
Plans and teaching Phase 3: Finding and explaining patterns in data (20 points)		
Plans and teaching Phase 4: Alternate explanations (20)		
Plans and teaching Phase 5: communication and justification (20)		
Final report: Students' learning (35 points)		
Final report: Revisions and reflection (35 points)		
Final report: Phases 4 and 5 (20 points)		