Coming Attraction

By **Mairlyn Kiser** for BRPTV
Tazewell Middle School, Tazewell, VA

GRADE LEVELS:
4^{th} – 8^{th} grades

TIME ALLOTMENT:
5- 45 minute blocks

SUBJECT MATTER:
Science, Math

OVERVIEW:
This lesson will focus on magnets and magnetism. The students will investigate the different types of magnets. They will build electromagnets and perform different experiments on these electromagnets. They will distinguish between objects that will or will not be attracted to magnets. The students will use web sites to find information on magnets and magnetism and will use this information to create a Power Point presentation, which will be shared with the class.

LEARNING OBJECTIVES:
Students will be able to:

- Describe ways a permanent magnet can be damaged.
- Define the terms "attract", "repel", and "magnetic field" with regard to the way that magnets affect each other.
- Identify the poles of a magnet as the most powerful parts of the magnet.
- Identify the different types of magnets.
- Describe the differences between permanent and temporary magnets (electromagnets).
- Construct a simple electromagnet and investigate the behavior of the magnet.
- Use web sites to collect information and create a PowerPoint presentation, using the collected information.
- Graph data collected and label graph.

STANDARDS

State Standards:
The objectives listed may be used in part to address the Virginia Standards of Learning at http://www.pen.k12.va.us

Science:

4:1 The student will plan and conduct investigations in which
a) distinctions are made among observations, conclusions, inferences, and predictions;
b) hypotheses are formulated based on cause-and-effect relationships;

4:3 The student will investigate and understand the characteristics of electricity. Key concepts include

a) simple electromagnets and magnetism

6.1 The student will plan and conduct investigations in which
a) observations are made involving fine discrimination between similar objects
b) data are collected, recorded, analyzed, and reported using appropriate metric measurements;

LS.1 The student will plan and conduct investigations in which
a) data are organized into tables showing repeated trials and means;
b) variables are defined;
c) an understanding of the nature of science is developed and reinforced.

PS.1 The student will plan and conduct investigations in which
a) data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted;
b) problems and questions;
c) an understanding of the nature of science is developed and reinforced.

PS.11 The student will investigate and understand basic principles of electricity and magnetism. Key concepts include
a) magnetic fields and electromagnets

Math:
4:20 The student will collect, organize, and display data in line and bar graphs with scale increments of one or greater than one and use the display to interpret the results, draw conclusions, and make predictions.

6:18 The student, given a problem situation, will collect, analyze, display, and interpret data in a variety of graphical methods, including
a) line, bar, and circle graphs

7.17 The student, given a problem situation, will collect, analyze, display, and interpret data, using a variety of graphical methods, including
b) line plots;

8:12 The student will make comparisons, predictions, and inferences, using information displayed in line, bar, and picture graphs.

MEDIA COMPONENTS:

United Streaming-*Electricity and Magnetism-The Magic of Magnets*
www.unitedstreaming.com
Computer
LCD
Smart Board (This can be optional. The overhead projector or chalkboard may also be used.)

Web Sites

http://www.kent.k12.wa.us/KSD/EP/newcurriculum_links/ep_science.htm
Canada Science and Technology Museum
At this site there is background information for magnets. You will find commonly asked questions about magnets and magnetism.

http://www.school-for-champions.com/science/magnetism.htm
Magnetism at the School for Champions.
Here the students can find an explanation of magnetism. Students will learn about magnetic field, attraction, repulsion, etc.

http://ippex.pppl.gov/interactive/electricity/
Electricity and Magnetism
This is an interactive site where students will be introduced to many of the basic concepts involved with electricity and magnetism and how magnetism relates to electricity.

http://www.bbc.co.uk/schools/revisewise/science/physical/12_act.shtml
ReviseWise Fact Science
This site is an interactive site that is animated. The activity will show the properties of magnetism. It will have an activity to do, a fact sheet, a test, and a worksheet.

http://www.factmonster.com/ce6/sci/A0831162.html
Fact Monster: Magnetism
Here the students will get an introduction to magnetism. They will find information on magnetic poles, forces, fields, and magnetic materials.

http://kosmoi.com/Science/Physics/Magnetism/
Science-Physics –Magnetism
This site gives much information on magnetism. It tells about the materials that magnets attract and why. It also explains how to magnetize certain metals by stroking the metal a certain way.

http://www.zephyrus.co.uk/magnets.html
Facts About Magnets
At this site students will find many facts about magnets and magnetism. They will find revision questions and printable worksheets.

http://www.technicoil.com/magnetism.html
Magnet Facts
Here the students can find the relationship between the magnets' poles and the earth's magnetic poles. The students will find out about the earth's magnetic field and how it protects us from the rays of the sun.

MATERIALS :

Materials needed for Introductory Activity:

- 1 pair of "singing" magnets (These can be bought on-line at http://www.chinaberry.com/11068.cfm or sometimes these can be found in a toy store or science store.)
- 1 of each: paper clip, nail, screw, piece of screen wire, piece of aluminum foil, piece of copper wire, rubber band, piece of pipe cleaner, golf tee, zinc pellet, metal fastener, twist tie, piece of cassette tape and a piece if aluminum wire

Materials needed for Learning Activity:

- Computer(s)
- LCD
- CD with United Streaming video (if downloaded onto CD)
- Smart Board (Again, this is optional. Use overhead or chalkboard.)
- Materials to fix an electromagnet:

✓ 7 Large nails
✓ 7 Thin nails
✓ 14 pieces of copper wire– 2-45 cm long, 2- 65 cm, 2-85 cm, 2-100 cm, 2-120 cm, 2- 140 cm, and 2-160 cm

Per Group:

✓ 1- 6-volt battery
✓ Set of alligator clips
✓ 10 to 12 paper clips
✓ Pencil

PREPARATION FOR TEACHERS:

✓ Download the United Streaming videos to your desktop or download the United Streaming videos to a CD.
✓ Make sure you go through the instructions from the student materials handouts so that you understand and are familiar with the lesson format and what the students need to do or understand for the lesson.
✓ When using media, always provide the students with a ***Focus for Media Interaction***, which is a specific task to complete during or after viewing video segments, Web sites, or other media material.
✓ If you use a Smart Board, you can have the words **Attract** and **Repel** in the notebook ready to be used.
✓ Prepare the nails ahead of time by wrapping one large nail 10 times with one of the 45-cm long wire. Coil the other 45-cm long wire around one thin nail 10 times. Coil a thin nail and a large nail each with the 65-cm long wires 20 times. Coil a thin nail and a large nail each with the 85-cm long wires 30 times. Coil a thin and large nail each with the 100-cm long wire 40 times. Continue with the next nails being coiled 40 times, 50 times, 60 times, and 70 times. (This saves a lot of time if the coils of wire are already on the nails.) Mark the nails as 20, 30, 40, 50, 60 and 70 and make a set with the large nail and thin nail that has the same number of coils. You will have 7 sets.
✓ Have prepared in baggies a collection of the things that they will test with magnets. Such things are: paper clip, nail, screw, piece of screen wire, piece of aluminum foil, piece of

copper wire, rubber band, piece of pipe cleaner, golf tee, zinc pellet, metal fastener, twist tie, piece of cassette tape, and a piece of aluminum wire.

Introductory Activity:

Tell the students that today they are going to begin learning about attraction. **Ask**: "What is attraction?" (Expect to get different kinds of answers.) **Say**: "We're going to learn about magnets and why they stick to some things and not to others." (Have the "singing" magnets in your hand and play with them as you talk to the students.)
Ask: "How will these magnets behave if I toss them up in the air and catch them?"(Let students try to predict what will happen. The magnets will make a musical noise as the magnets come together in the air. Some of the students will want to toss the magnets in the air.) **Ask**: "Why do magnets stick to some materials and not to others?" (Students are to give some guesses.)

Now, show the students the different materials, such as the paper clip, screw, golf tee, nail, etc. Have the list on the Smart Board. Have the students copy this list on their paper. The students will predict whether each item will be attracted to a magnet or not. Allow a student to work on the Smart Board as a student is asked if that item will be attracted to a magnet. After each item has been identified as *will* or *will not* attract a magnet, have a student use a magnet and see if it can be attracted to a magnet. Check your answers on the Smart Board. (You may use an overhead projector or chalkboard.)

Say," Now we are going to learn more about magnets and where they were first discovered."

LEARNING ACTIVITIES:

*Note to teacher: Have the United Streaming video downloaded to desktop or on CD ready for viewing before class starts.

1. **Focus for Media Interaction**: **Say**, "Today, we are going to watch a video on magnets. I want you to watch and be able to tell me what the natural occurring magnets are called and how they might have been discovered and where were they discovered?" **Start video (00:35)** when you **see** the words "The Magic of Magnets" and **hear** music. **Pause (01:43)** when you **see** a world globe with the word *magnetite* on it and **hear "…**so the Greeks called the rock responsible for this attractive force magnetite." **Ask**: "What are the natural occurring magnets called?" (magnetite) "How might they have been discovered?" (Maybe a farmer had a metal tool or spear head magically stick to a piece of magnetite.) "Where did they discover this unusual effect?" (In a part of Turkey, called Magnesia; so the Greeks called the rock magnetite)

2. **Focus for Media Interaction**: **Say**, "During this next segment I want you give me some examples of how we use permanent magnets. Also, I want you to tell me some of the different kinds of magnets." **Resume** and **Pause (02:07)** when you **see** a hand pushing down on donut-shaped magnets on a pole and **hear** "…some are shaped like horseshoes and some are donut shaped." **Ask**: "What are some examples of how we

use permanent magnets?" (We use magnets in hundreds of ways, from holding up pictures to producing electricity.) "What are some of the different kinds of magnets?" (Some are round and some are bar-shaped. Some are shaped like horseshoes, and some are donut shaped.)

3. **Focus for Media Interaction**: **Say**, "Next, I want you to listen for the name of the two poles that magnets have and how magnetic poles react with each other." **Resume** and **Pause (02:47)** when you **see** 2 bar magnets being pushed around and **hear,** "When opposite sides are near, they are attracted or pulled together." **Ask**: "What are the names of the two poles of a magnet?" (north and south pole) "How do poles that are alike when put together react?" (They push away from or repel each other.) "How do poles that are different react when put together?" (They pull together or attract each other.)

4. **Focus for Media Interaction**: **Ask**, "Do magnets attract all objects?" (No) "I want you to be able to tell me what things are attracted to the magnet and where are magnets the strongest." **Resume** and **Pause (04:27)** when you **see** the bar magnets with two south poles pointing toward each other and iron filings are on them and you **hear** "You can see the lines of force are repelling each other." **Ask**: "What things are the magnet attracted to?" (only some metals, paperclips) "Are all metals attracted to the magnet?" (No) "Which metals did the video say was attracted to the magnet?" (nickel, iron, and cobalt) "Where are the magnets the strongest?" (at the ends)

5. **Focus for Media Interaction**: **Say,** "We're going to watch this next section of the video and I want you to tell me what they called the earth and why. Also, I want you to tell me what scientists think causes this effect." **Resume** and **Pause (05:44)** when you **see** a glove with the word *auroras* on the screen and **hear** "They are referred to as auroras, or the northern and southern lights." **Ask**: "What did they say the earth is?" (a giant magnet) "Why did they say the earth is a giant magnet?" (There is a magnetic north pole and a magnetic south pole.) "What are the two ends of a magnet called?" (north pole and south pole) "What do scientists believe is the cause of the magnetic effect of the earth?" (The very hot liquid metals in the outer core of the earth that creates electric charges that cause the magnetic field.)

6. **Focus for Media Interaction**: **Say**, "In this next section I want you to listen and tell me who were the first to use magnets to sail the seas and how did these sailors make their compasses." **Resume** and **Pause (06:24)** when you **see** a map and a ship sailing across the ocean and **hear** "…comparing this needle with the direction of the boat." **Ask**: "Who were the first to use magnets to sail the seven seas?" (The ancient Chinese) "How did these early sailors make their compasses?" (A needle was stroked across a magnetite. It was, then, placed in a bamboo reed and placed on a piece of cork. After that, it was all placed in a container of water where the needle would turn toward the north.)

7. **Focus for Media Interaction**: **Say**, "Now we're going to find out what causes magnetic effects in materials and what develops. What materials are different and why?" **Resume** and **Pause (07:49)** when you **see** a nail with staples stuck on the end

and **hear, "**When the staples are knocked free, they lose that magnetic effect." **Ask**: "What causes magnetic effects in materials?" (the movement of electrons) "What develops because of the movement of electrons?" (a north and south pole in most materials) "Why do most materials have no magnetism?" (The magnetic field cancels each other out.) "Which materials are different than most?" (iron, cobalt, and nickel) "Why are they different?" (They have domains or groups of atoms that line up together creating a magnetic field.) "What is a temporary magnet?" (an object that is made of iron, nickel or cobalt and is magnetized by stroking the object in the same direction)

8. **Focus for Media Interaction: Say**, "Now, I want you to watch to see how magnets can be damaged and why?" **Resume** and **Pause (08:10)** when you **see** a nail over a flame as the staples fall off the nail and **hear** "…move faster and as a result, move out of alignment." **Ask**: "How are magnets damaged?" (by dropping or heating the magnet) "Why are the magnets damaged by dropping or heating them?" (The domains are out of alignment)

9. **Focus for Media Interaction: Say**, "This time I want you to watch for the name of the scientist who discovered that electricity could cause a magnetic effect. Also be able to tell what this kind of magnet is called and some uses of this magnet." **Resume** and **Stop (09:53)** when you **see** a small motor that is being held and **hear** "…with a drive shaft between them that contains the electromagnets." **Ask**: "Who was the scientist who discovered that electricity could cause a magnetic effect?" (Oersted) "What kind of magnet is it called?" (electromagnet) "What are some uses of the electromagnet?" (door bells, phone receivers, and many motors)

10. **Say**, "Now I am going to pass out different shaped magnets and allow you to see what these magnets will do." The students will begin investigating with these magnets. "Will they stick to the spiral wire of my notebook? Will they stick to my lipstick tube?" The students will try to find metal things that will stick to the magnets. This is a good ending for the 1st day.

2nd Day

Before beginning the second day, refer to what students have learned the previous day. Review:

- What are temporary and permanent magnets?
- What are the two poles of a magnet called?
- How do like and unlike poles behave?
- Where are the magnets the strongest?
- What are the different kinds of magnets?
- What is the magnetic field?
- What is an electromagnet?

1. **Say,** "Today we are going to make an electromagnet. You will use a 6 or 9 volt battery and a set of alligator clips. You will work in groups of two. I will choose who will be in each group. One will be the 'gopher' and the other will be the 'writer'. After I have grouped you, I will ask the 'gopher' to come and pick up the materials you will need."

2. Show the Data Table (attached at end of lesson) and **say**, "I want you to follow directions to fill this out. I will give each group a set of nails to use. (It is easier to give a set of two nails to each group. When they have finished collecting their data, they can pass these to the next group and receive a set from another group.) These nails will already have the wires coiled around them. You will attach one end of the wire to one terminal of the battery. You will attach the other end of the wire to the other terminal of the battery. Using the <u>end</u> of the nail, you will see how many paper clips it will pick up. Do this 2 more times and record the number of paper clips each time in the correct column. When you are finished with the data from that nail, disconnect it and do the same with the other nail that you have. After you are finished collecting data from the set of nails that you have, pass them to the next group and get a set of nails from a group that has finished their data collecting." Make certain students understand the directions.

3. **Say**, "Make sure that you have collected data for each set of nails being passed around."

4. Have the materials for each group and have the "gopher" from each group pick up the materials. Demonstrate for the students how they are to connect to the battery terminals to the wires. Demonstrate how you want the students to pick up the paper clips. (Each group should do the very same thing when they are collecting data.) Pick up the paper clips with the nail and count them. Now have the students do the same.

5. After the students understand what they are to do, they may continue. When they are finished, they are to hold up their hands to let the teacher know they are finished.

6. When the students are finished, they will graph their findings. With the Smart Board, find the grid for graphing in the "gallery" of the Smart Board under math. (If you do not have a Smart Board, you may use the overhead projector.) Construct the graph by supplying the name of the graph and title the x- and y-axis. Using this grid, have one student from one of the groups volunteer to fill in the graph from their data they collected during the investigation. When this student has finished the line graph, ask the other students who had data similar to this student's group. Now, have another student from another group graph the data that was collected by his/her group on the graph on the Smart Board. (Or overhead.) Compare and contrast the data collected by the two groups and discuss the differences.

7. **Ask** students, "What would happen if you coiled the wire more than 70 times on the nail? Is there is a limit to the number of paper clips that can be picked up? Would you be able to pick up more paper clips? How could you find out the answers to these questions? What do you think would happen if you used more than one battery? How would you be able to find the answer to that question? What do you think would happen if you used a large bolt? How might you find out that answer?" (Students are

allowed to predict and problem solve with these questions. There is not necessarily any right answer.)

8. **Say,** "Now we are going to find out more about magnets and magnetism as we do some research in the computer lab. We will be going to the computer lab where I will give you your directions." Take students to computer lab.

Day 3-5

CULMINATING ACTIVITY:

Say," In this activity we will make a PowerPoint presentation after we have done some research. You will go to a web site(s) that has information about magnetism. You are to find the answers to at least 7 of the following questions. I will give you a paper with these questions on it. The paper that I am going to give you will have directions on what to do. You will go into my Portaportal account where the web sites are available. (You will go to portaportal.com where you will sign in as a guest as mskiser. This is a Portaportal account made for my students.) You are to use these web sites under "magnetism" to answer the following question.

- What are magnets and what is magnetism?
- What are temporary magnets and permanent magnets? Give examples
- What are magnetic force fields and where are the magnets the strongest?
- Who discovered magnets?
- Who were the scientists who helped us to understand magnets?
- What is magnetite and where was it first found?
- How does a compass work?
- What are the different kinds of magnets and what are some uses of magnets?

Say, "When you have found these answers, you are to prepare a PowerPoint presentation with these questions and/or answers. You are to have at least 8 slides in the PowerPoint. The first slide is to be the title page and your name(s). You are to have all the written (typed) information on the PowerPoint before you add any transitions, sound, or graphics. After you have finished the written (typed) work, you are to raise your hand and I will review the presentation. If the work you have done meets the criteria, then you may add the transitions, sounds and/or graphics."

1. Have the students go to the computer lab or wherever they can be on a computer. The students will work individually or in groups of two.
2. **Say**, " I want you to log on and go to search. Type in **portaportal.com** and enter. Go to the box where you will sign in as a guest. Sign in as **mskiser**. There you will see the web sites that you will use. All you need to do is click on one of the web sites under **magnetism**. When you get to this web site, you will find information on magnetism. Use this or any of the other web sites to answer at least 7 questions. You may begin now."

3. Give the students time to complete a Power Point presentation. (I would not give them more than 2 or 3 days.)
4. When the students have finished their Power Point presentations, they are to present what they have created to the class. Use a rubric (see end of lesson) to evaluate what the students have prepared.

CROSS-CURRICULAR EXTENSIONS

Science:

1. Students will use what they have learned about magnetism and how it relates to electricity to start their studies about electricity. You can recreate the device that Oersted made to show that a flow of electricity creates a magnetic field.
2. Students can make their own compasses. This is a great time for students to learn how to use a compass. They need to know that the north pole of the magnet will point to the magnetic north pole of the earth, which is not the literal North Pole on the Earth. This would also be good research for Social Studies.

Language Arts :

1. Students can write a tall tale about "Magnet Boy/Girl". They will use their knowledge of how magnets behave to explain how he can get into trouble. But, they can use those same properties to explain how he gets out of trouble.
2. Students can use the same concept of "Magnet Boy/Girl" and create a comic book or a comic strip.
3. Use a graphic organizer to list the important facts about magnets and magnetism and have the students write an essay about magnetism.

Art:

1. Students can draw and color their comic strip of "Magnet Boy/Girl".
2. Draw and diagram the different kinds of magnets and show the magnetic fields of each magnet. They could use each kind of magnet and put a transparent sheet over each. On the transparent sheet of paper, the students can drop iron filings and draw the magnetic field.

Social Studies:

1. Students can research the area in Turkey that first discovered the rock magnetite. The students can investigate to see how the early Greeks and other ancient civilizations used magnetite.
2. The students can research the magnetic north pole in relation to the Earth's true North Pole as they are studying magnetism in science.
3. Students can research how the early explorers used magnets/compasses on their journeys. Example: How did the settlers come to Jamestown, using compasses.

Math:

1. Using statistics, students can graph data on the number of magnetic bracelets sold for health purposes, the number of magnetic insoles sold, etc.

COMMUNITY CONNECTIONS:

1. Invite a dairy farmer to the class and have him bring in the magnets that farmers use to put in the stomach of cows. The dairy farmer can show students the magnets and discuss why and how the magnets are used. Students who do not know this will be amazed. (The magnets are to collect all metal bits that cows pick up as they graze. Magnets collect the metal and holds on to it as the metal and the magnet goes through the cow's digestive system.)
2. Have a medical person who uses MRIs visit the classroom and give a presentation on how an MRI is used. MRIs and other medical "wonders" use magnets. These could be researched before the medical person came to the classroom. The students would get a good understanding of the connection between the real-world and things you learn in school.
3. Take a small trip to the junk yard in your community. Large magnets are used to move large metal objects, such as old cars. The large magnets are on the end of cranes. Students will enjoy seeing the huge amount of magnetism involved in using such a large magnet.

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Making an Electromagnet

Supplies needed for one electromagnet:

1 - 6 volt battery

1 large nail

1 small nail

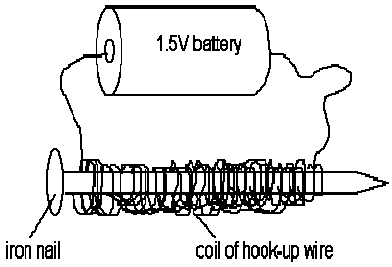
1 copy of Data Table

Wire needed for each nail

(wire sizes in Teacher Preparation)

1 set of alligator clips

12 to 14 paper clips



Directions:

1. (See Teacher Preparation for wire measurements.) Take the wire and coil it around the large nail 10 times. Attach one end of the wire to one battery terminal. Attach the other end of the wire to the other battery terminal.

2. Using the end of the nail, see how many paper clips the nail will pick up. Record this number in the Data Table under the first trial for 10 coils. Do this step 2 more time for trial 2 and trial 3. Record the number of paper clips picked up for each trial.

3. Do step 1 and 2 with the nails that have the 20, 30, 40, 50, 60 and 70 coils, respectively. Do 3 trials for each nail with the different number of coils. Record each time.

4. Do steps 1 through 2 with a slim nail.

Data Table

Large Nail

Number of Paper Clips

Number of Coils	1st Trial	2nd Trial	3rd Trial
10			
20			
30			
40			
50			
60			
70			

Slim Nail

Number of Paper Clips

Number of Coils	1st Trial	2nd Trial	3rd Trial
10			
20			
30			
40			
50			
60			
70			

MAGNETISM AND MAGNETS

Directions: Go to www.portaportal.com and sign in the guest box as mskiser. Here you will find the web sites for magnetism needed to answer the following questions. After these questions have been answered, you may continue to do your Power Point presentation.

- What are magnets and what is magnetism?

- What are temporary magnets and permanent magnets? Give examples

- What are magnetic force fields and where are the magnets the strongest?

- Who discovered magnets?

- Who were the scientists who helped us to understand magnets?

- What is magnetite and where was it first found?

- How does a compass work?

- What are the different kinds of magnets and what are some uses of magnets?

RUBRIC

for

Graphic Organizers

CATEGORY	Exemplary	Proficient	Developing
Arrangement of Concepts	Main concept easily identified; ideas or facts arranged orderly and appropriately	Main concept easily identified; ideas and facts arranged orderly most of the time	Main concept not clearly identified; all facts and ideas not in order or shown
Graphics/Sound	Graphics used appropriately; greatly enhances the main idea; are clear and well situated on the page	Graphics used appropriately most of the time; most graphics are good quality and add to the topic	Graphics are inappropriately used; graphics were poorly chosen and does not enhance the topic
Contents	All information and facts are correct; all facts studied are included; no mis-spelled words or grammatical errors; extra information added	Most of the information and facts are shown; few incorrectly spelled words or grammatical errors;	Contains very little information or facts studied; incorrect information used; numerous spelling and grammatical errors;
Text	Easy to read and of appropriate size; font is used effectively; page not overloaded with text;	Most text is easy to read; most of the pages are not overloaded with text;	Font not easily read; too many different fonts used; most pages overloaded with text
Design	Good visual appeal; good backgrounds; fits page; color used effectively; overall, very pleasing	Design is fairly good; has good visual appeal most of the time; uses color effectively most of the time; background color is good most of the time	Design is cluttered; little visual appeal; color is not used effectively; mostly bad choices of color;
Presentation	If a group, partners work together effectively; presented and not read word for word;	If a group, partners work together most of the time; most of presentation not read word for word	If a group, partners do not work together well; presentation read word for word