Rainbows and Solar Energy

by Melanie Ann Kirschner, 2014 CTI Fellow
Albemarle Road Elementary

This curriculum unit is recommended for:
Kindergarten Science

Keywords: Energy, Solar Energy, Rainbows, Sun, Renewable Resources, Photovoltaic Cells, Electromagnetic Spectrum

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis:

Kindergarten students love looking at rainbows, but they do not know just how important rainbows can be. This curriculum unit explores the electromagnetic spectrum in terms of something that is familiar to the students; rainbows. Students will study the order of the colors of the rainbow and be able to discuss why they are in the order they are in. Students will be completing labs, and they are allowed to work through their labs in a trial and error way, allowing them to guide their own learning. They will then connect their knowledge of rainbows and the electromagnetic spectrum to solar energy. They will complete a lab with Photovoltaic cells and experiment with different angles of light and how much electricity it produces by how fast a windmill moves when connected to the cell. Throughout the unit, the students will be recording all their thoughts and findings in a science journal.

I plan to teach this unit during the coming year in to 22 students in Kindergarten Science.

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Melanie Ann Kirschner

Introduction

I teach Kindergarten at Albemarle Road Elementary School in the Charlotte-Mecklenburg School system (CMS). CMS is one of the largest school districts in the country and has received recognition as being one of America's best. [1] We are a Title-1, Pre-K through 5th grade school with approximately 1500 students. Of those 1500 students, 96% qualify for free and reduced meals. Our population is very diverse, with approximately 44% Hispanic, 42% African American, 5% White and 8% Asian. Also, approximately half of the 1500 students are limited English proficient, which means that they speak another language in the home. Spanish is the language that is predominately spoken, but there are many other languages that can be found in my school. We also have a growing refugee population where we have been getting students from strife-affected areas such as the Sudan, Congo, Liberia, Somalia, Eritrea, Ethiopia, Nepal, Bhutan, Burma and El Salvador.

My classroom consists of 22 students currently (we have a highly mobile population with families moving in out of our area apartment complexes and my classroom numbers can fluctuate). Fourteen of my 22 students are ESL, English as a Second Language. The majority of those students come from families that speak Spanish, but two of those students do not. Two of my students are Burmese, which makes it hard to communicate with their parents. Since my school has many staff members on hand that speak Spanish, it makes it easier to communicate with those families since we send home translated handouts and notices every time we send something home and make phone calls as necessary. This year, we have some access to a translator line that can help us contact parents who speak languages other than Spanish. We are able to call a number and contact a translator who then calls the parent to have a conference call. This way, I am able to inform parents, in their own language, of their student's progress or of any concerns I may have.

Rationale

I want to give my Kindergarten students an introduction to a topic that will be discussed many more times throughout their school careers. Energy is central to our existence and our way of life[2]. There is nothing that we do in our everyday lives that does not need energy. From our electronics to our cars to our food, energy is needed to make all of these things happen. Unfortunately for us, many of the resources that we use are finite

resources, such as oil, and we depend it for so much. We need to find an energy source that is renewable, so that we are not so dependent on a source that can be used up completely.

Solar energy is a renewable source of energy. It is becoming more common as societies look for alternatives to fossil fuels. While solar energy is not reliable, it can be collected and used without releasing any greenhouse gases that could harm us in the long run. We see ways of collecting solar energy nearly every day, in things such as calculators or toys that move when in sunlight when they have a small photovoltaic cell inside. With a solar calculator, you can cover up the photovoltaic cell and your calculator will not work. My kindergarten students may have seen something like this, but are not aware of how it actually works.

To a kindergarten student, the Sun is something that is in the sky. They know when they see the Sun it is day and when they don't, it is night. They also know that when the Sun is out, it makes things warm and that you can get sunburns. They don't realize that the Sun is doing so much more for us than just making us warm. I want my students to be able to understand that the Sun is very important to us and how we can use the Sun in our everyday lives.

Objectives/Standards

The goal I have for this unit is to have my students understand what the Sun does for us. I want them to know that the Sun gives plants energy to grow and in turn, it gives us (and animals) energy when we eat it. I also want them to understand that we can use the energy we get from the Sun in other ways, such as to power our homes and devices. I want my students to understand that the choices they make, such as leaving lights on, can affect how we use things.

In order to teach solar energy, we will be reading some books on rainbows, the Sun and solar energy as well as have many others available to my students so that they may reference them on their own. These types of books are Informational Texts which my students may not be as familiar with. It gives them a chance to interact with books that are telling them new information, not just entertaining them with a story. Not only can we read in books, there is a very informative website called Energy Kids that I can guide my students through. There is a lot of information and illustrations that are on their level as well as games and riddles that can be used for fun.

We will also be conducting some experiments throughout this unit. In the course of completing the labs, there will be a lot of discussion and talking with partners for my students. Speaking and listening is a very big part of the Common Core and it is necessary to be able to speak in complete sentences as well as be able to hold a conversation with another person. By letting my students, for the most part, take the lead

in their learning; they will be able to practice talking to their peers. Since this is a science unit, they will also be using scientific vocabulary in their conversations.

My students will also be covering writing Common Core standards by writing in their science journals. They will be practicing sounding out words and writing in complete sentences by this time. Since they are reading informative texts, they will be able to write their own informative texts. They will be able to tell their writing audience what they did during the experiment and the results of that experiment.

Scientific Content: Overview for Teachers

The definition of energy is the ability to do work and it comes in many different forms.[3] There are two types of energy, stored energy and kinetic energy. Stored energy is just like it sounds, energy that is stored. Energy can be stored in plants, wood, and in you. When you eat food, you are storing the energy that you get from food in your body until you need it to walk, kick, run, climb, etc. When you burn wood, you are releasing the energy that has been stored in the wood. Kinetic energy is energy that is being used. When you kick a ball, you are using kinetic energy.

Energy resources also come in different forms. There are inherited resources and there are renewable resources. The inherited resources are those that we call fossil fuels. Fossil fuels are defined as oil, coal, natural gas. These resources are a finite resource that we cannot replenish. Once we use all of it, there is no more. Unfortunately, these are the resources that we use the most. We need the oil for our cars, the natural gas to heat our homes, and coal to help generate electricity. This is why we need to talk about renewable resources in order to stretch out how long our inherited resources last us.

Renewable resources are just what they sound like. They are resources that we can use over and over. They include solar, wind, geothermal, biomass, and hydropower. These resources are very good for our environment as they do not let off any harmful greenhouse gases, but they are not reliable. There will be cloudy days which prevents the sunlight from getting to the solar panels as well as calm days which prevent wind turbines from moving. Since it is not reliable, we cannot fully rely on renewable resources to power our everyday lives. According to the Energy Kids website, in 2013, only 10% of our total energy consumption was made up of renewable resources and out of that 10%, only 3% comes from solar energy.[4]

Solar energy is the energy we get from the Sun. There are two ways in which we can use that energy. We can use the Sun to heat water, heat air, use it as a solar cooker, and use photovoltaic cells to convert sunlight into electricity to power our homes. You can also use the sunlight to heat a liquid to produce steam, which turns a turbine to generate electricity that can be used in homes. Photovoltaic cells "change sunlight directly into electricity."[5] You see photovoltaic cells everywhere, in calculators, watches, flashlights,

and even on some houses. The bigger the cell, the more electricity can be created from the Sun.

Photovoltaic devices or solar cells change sunlight directly into electricity.[6] Photovoltaic devices are made of silicon which absorb the photons from sunlight. When enough sunlight is absorbed by the silicon, the electrons in the silicon are dislodged and they travel towards the front surface of the cell. The electrons all have a negative charge and the imbalance that is created from having a lot of negative electrons on one side creates a voltage potential like a battery with positive and negative terminals.[7] When the two sides are connected, a current flow happens and is able to power a device as small as a watch or as big as your house.

The energy that we get from the Sun travels to the Earth through light waves.[8] Some of the waves can be seen (visible light), but most of the waves cannot be seen. These waves are all found on the electromagnetic spectrum. The electromagnetic spectrum begins with long wavelengths of light but contain low energy, such as radio waves, and goes to the shortest wavelengths with the most energy in gamma rays. The visible light, the rainbow colors, occurs midway along the spectrum.

Teaching Strategies

Socratic Seminar

Socratic Seminar, as defined, is "a collaborative, intellectual dialogue facilitated with open-ended questions about a text".[9] The teacher, since they are in Kindergarten, will act as a facilitator to their discussion, guiding their learning by asking open-ended questions. If the students ask you a question, answer them back by asking a question of your own. Have a list of open-ended questions prepared ahead of time based on solar energy and the Sun so that you can help your students start their conversation (with Kindergarteners, this is very important as sometimes they do not know how to begin a conversation connected to a topic) (see appendix for examples).

In order to have these deep conversations, it is necessary to have some procedures in place so that everyone gets a chance to share their information. The first procedure I have is to have all my students come to the carpet and sit in our 'sharing circle'. The sharing circle is when they come to the carpet and sit on a letter (the letters run around the outside edge of the carpet) where they are facing the middle. There are three sides that the students are allowed to sit on because the last side is where I sit so that I can guide the conversation.

Conversation is the most important part of the Socratic Seminar, so there must be steps put into place to ensure that there is a conversation, not just people shouting out. In my class we will utilize the 'Share Bear'. When a student has the 'Share Bear', they are

the only one who may share their thoughts, feelings, ideas. In order to get a turn with 'Share Bear', the students must listen to each other and raise their hand only when the first child has finished speaking. That child will then pass the 'Share Bear' on to the next student. Once the students get the hang of waiting for their turn to talk, the 'Share Bear' can be either kept or phased out. Also remind your students to respect each other; there are no bad ideas or thoughts.

Science Journals

Journals give students a chance to process their thoughts about what they have read or what they have discussed. After a Socratic Seminar where a lot of material is covered, it gives the student a chance to process that information and pick the piece that sticks out to them and that they may want to focus on or remember. "Through writing – and drawing as well – students can express and expand their thinking and improve their ability to reflect".[10] The teacher then can assess how well the student understood the topic and guide their lesson for the following day to help them understand the topic.

The students will write down their hypotheses every day in their journal based on questions that I pose to them at the beginning of each lesson. As kindergarten students, I want them to begin predicting what they are going to do in Science, not just when they are reading. After they record their hypothesis, they will conduct the experiment and record the results on the next page in their journal. My students will then be able to see if their hypothesis was correct. On a third page, they will record something that they learned or found interesting during the course of the experiment (or discussion if applicable).

Technology

Technology abounds in nearly every aspect of life nowadays from personal computers, cell phones to iPads or other tablets. With all of this technology around, it is necessary to incorporate it into the classroom to help students learn. I have a Smartboard in my classroom that I will utilize to help my students gain a better understanding of solar energy. I will create Smart Notebook lessons that give the students a chance to come up to the board and interact by moving objects into categories or as a fill in the blank that the students can check to see if they are right by themselves.

I will be able to utilize my school's subscription to Discovery Education which allows me to search for videos that help explain solar energy. Energy is a hard topic to explain to Kindergarten students since they cannot see it, but having a video to illustrate it with simple language allows my students to see how energy works. Discovery Education also has interactive labs that the students can interact with. One lab that I found has students try different combinations of batteries with engines to see which combination allows the little car to travel the most laps. Students have a choice between three different sized

batteries and three different types of motors. They then can mix and match to see which combination is the best.

Science Labs

By having my Kindergarten students complete labs, it makes the content more concrete for them. There is a quote by Benjamin Franklin that says, "Tell me and I forget, teach me and I may remember, involve me and I learn."[11] Students need a chance to manipulate concepts themselves in order to get full understanding of what is being asked of them.

We will be utilizing some simple labs that will help my students gain an understanding of solar energy. Along with our discussion about thermal energy, my students will complete labs that include measuring water temperature in the shade and direct sunlight and cooking with sunlight. When we talk about electricity, I will have my students interact with photovoltaic cells in flashlights and calculators to determine which kind of light best charges those devices and then use the cells to create a car and see how far that it travels.

Classroom Activities

These lessons are designed to give Kindergarten students hands-on experiences with colors, the electromagnetic spectrum and energy. Since they are hands-on activities/labs, there are a lot of materials that will be needed in order to implement the lessons as described. A complete list of materials and when to use them is included in the Resource section. My unit consists of five lessons/labs that run for 45 minutes apiece.

Lesson 1 – Rainbows

We will begin our lesson by coming to the carpet for a brief introduction. My students will walk to the carpet from their seats and sit in their designated space on the carpet. I will hold up a paper plate with three blobs of paint on it (red, yellow, and blue). I will ask my students to name the colors that they see and to make predictions of what will happen when I start to mix colors together (red and yellow, red, and blue, yellow and blue). After we are finished mixing colors, I will ask my students where they see all those colors together. My students should make the connection between the colors and rainbows.

After discussing the colors, we will then start talking about rainbows. I will ask them some questions about rainbows. 'Who has seen a rainbow? What did it look like? When did you see it?' are some examples of what I will ask my students. I will then record their answers on a KWL chart so that we can refer back to it later in the unit. After completing the KWL chart, I will read the story, "A Rainbow of My Own" by Don Freeman. While reading the story, I want my students to pay attention to the colors in the story and to

think of things that they know of those colors (ie: red – strawberries, orange – pumpkins, etc…).

After reading the story, I will pull up my Smartfile for the SmartBoard on the colors of the rainbow. Each slide will have a color of the rainbow and a couple of examples of objects that are that color. While looking at the slides, I will have my students come up with more objects that can be added to the slide. After we have completed the Smartfile, I will have my students create a rainbow book of their own. Each page will have a color listed with a sentence stem. The student can use the Smartfile to add their favorite object into their story (ie: A _____ is red. A strawberry is red). After they figure out what word they are going to use, they can illustrate their page. They will complete a page for each color and the last page will be the rainbow they create using all the colors.

When their book is complete, I will have them return to the carpet. I want to give my students a chance to revisit the KWL chart that we have created. I will give them a chance to add any more questions they may have about rainbows or add any information they may have learned. After they have finished adding to the chart, I will have my students get out their science journals and head back to their seats. I want them to add a page about rainbows in their journal

Lesson 2 – Rainbows Continued

On our second day of rainbow lessons, we will begin by reviewing what we did in our previous lesson. I want them to review the color wheel and what colors make what and I want them to review what they learned from the story we read. I am also going to read another rainbow book entitled, "All the Colors of the Rainbow" by Allan Fowler. While discussing the story, we will go over how rainbows are formed. In our lab today, the students will be given a chance to create their own rainbows.

I will introduce the lab by setting out all our materials that will be used. I will show my students that there are many ways in which we can create a rainbow. There will be 4 stations in which they will explore the materials to see if they can create their own. I will also give them guiding questions that I want them to answer while they are working such as, 'What did you use to create the rainbow?' 'How did it work?' 'Did you have to adjust what you were doing or did it happen right away?' The first station will include a see through cup of water, a ruler, and a flashlight. The next station will be experimenting with CD's and flashlights. The third station is using kaleidoscopes with light. The last station will be creating an oil slick with vegetable oil. I want my students to experiment at every station with how to create rainbows and what they needed to do in order to make one. They will record everything they do at each station in their science journals.

After all my students have had a chance to record their findings, I will bring them all back to the carpet with their journals. I will open a blank Smart Notebook page where I

will record my students' findings. While recording our findings, I will facilitate a discussion of what they saw and why they think it worked like that. I also want them to discuss which way made the best rainbow. In the end, I want my students knowledgeable about how we can form rainbows and what is needed in order for that to happen.

Lesson 3 – Why Do We See These Colors?

I will begin today's lesson by reviewing the Smart Notebook slides that we created from our experiment the day before. We will review how we made rainbows and which way worked the best. I will then introduce today's lesson by telling my students that we will talk about why we see those colors in the rainbow and introduce them to the electromagnetic spectrum. I will then show my students a short clip on Discovery Education entitled, "Waves from the Sun". In this video clip, it discusses that energy from the sun is transported to Earth through light waves.[12]

After viewing the video, we will discuss the visible light that we see on the spectrum. I will divide up my class into 7 groups from shortest to tallest and give them each a color of the rainbow.[13] The three tallest students would get a piece of red construction paper and the next set of three tallest would get orange all the way down until the shortest students get violet. This activity is a good way in which to visually show the students about wavelengths. This way, they will also get an understanding as to why the colors are in that particular order and why it doesn't change. While they are lined up, I will ask my students some follow up questions to check their understanding such as, 'What color has the longest/shortest wavelength of light?', 'Which student(s) represent the longest/shortest wavelength of light?', and 'Does your favorite color have a longer or shorter wavelength of light?'.[14]

As a wrap up to the lesson, I will have my students record in their science journals what they discovered about the colors of the rainbow.

Lesson 4 – Energy and the Sun

We will begin today's lesson by coming to the carpet and reviewing what we have done in previous lessons. Then I will introduce today's topic of energy and the Sun by discussing what energy is and what needs energy. I will show my students another video from Discovery Education called, "The Language of Science: Force and Motion". This video discusses that people need energy in order to move and grow. After watching the video, I will have my students discuss if there is anything else that may need or use energy. I want them to start thinking about plants as well as the electronic devices that they use and enjoy.

I will then take my students outside and have them gather some items, such as leaves, twigs, rocks, etc…. After my students have found the items they like, I will hand out a

piece of Nature Print paper.[15] They will then arrange their items on their paper and make sure that it is placed in direct sunlight. We will leave the paper alone for two to three minutes and wait for it to change color. We will then bring them inside and soak it in water for one minute. After the soak, we will lay it out flat to dry. While it is drying, I will have my students make some observations about what they have seen.

I will facilitate a discussion about what they have seen on their paper as well as what they had seen the Sun do. I want my students to make the connection that the Sun's energy made the paper change. I also want my students to understand that they can feel the Sun's energy when they spend a lot of time out in the Sun and their skin starts to burn. It is burning because the Sun's energy is changing your skin. After our discussion, I will have my students record their findings in their science journals and when their Nature Print is dry, they will paste that in their journal as well.

Lesson 5 – Using the Energy from the Sun

As we have with the other lessons, we will begin by gathering on the carpet with our science journals in hand. We will review what we have learned from the previous days and we will add our new knowledge to our KWL chart. We will also add any questions that my students have come up with during the course of our experiments. After completing our chart, I will have my students watch a Discovery Education clip called, "Sun Racer: A Look at Solar Power" before working on our experiment as it is a good introduction to solar panels.

Our experiment today will include having my students work with small solar panels and experiment with how much sunlight is needed in order for the panels to work properly. My students will spend some time outside manipulating the solar panels and the angles in which they are catching sunlight. They will not be able to record actual angles, but they can see what would happen if the panel was left in direct sunlight or indirect sunlight. They will test it out by creating a circuit with either a small light bulb or moving a small windmill. The students will be able to see how much energy is created with either direct or indirect sunlight by whether or not how strong the bulb glows or how fast the windmill spins.

After the students have experimented with their solar panels, I will bring them all back inside to discuss their findings. While they are discussing, I will be adding more items to their KWL chart about what they had learned by using their solar panels. I will guide their discussion into what happens with the energy if we are not using it. I want my students to understand that we need to conserve our energy if we do not need it at that moment, like turning off lights if we are not in the room, or turning off the television if no one is watching. My students will then go off to record what they found interesting during the experiment as well as something new that they had learned from this unit.

Appendix 1: Implementing Common Core Standards:

These are the standards that my unit will address and will be met in multiple ways. The science standard will be met throughout the unit as the students complete their labs. The reading standards will be met through reading science books about the sun and solar energy. The writing standards will be met through their work in their science journals. The rest of the standards are speaking and listening standards. These standards will be addressed throughout the unit as the majority of our time will be spent on discussing our labs and findings.

KE.1.1: Infer that change is something that happens to many things in the environment based on observations made using one or more of their senses.

RI.K.1: With prompting and support, ask and answer questions about key details in a text.

RI.K.2: With prompting and support, identify the main topic and retell key details in a text.

RI.K.3: With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.

RI.K.4: With prompting and support, ask and answer questions about unknown words in a text.

RI.K.5: Identify the front cover, back cover, and title page of a book.

RI.K.6: Name the author and illustrator of a text and define the role of each in presenting the main ideas or information in a text.

RI.K.7: With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).

RI.K.8: With prompting and support, identify the reasons an author gives to support points in a text.

RI.K.9: With prompting and support, identify basic similarities in and differences between two texts on the same topic (e.g., in illustrations, descriptions, or procedures).

RI.K.10: Actively engage in group reading activities with purpose and understanding.

SL.K.1: Participate in collaborative conversations with diverse partners about Kindergarten topics and texts with peers and adults in small and larger groups.

A: Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion.

B: Continue a conversation through multiple exchanges.

SL.K.2: Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.

SL.K.3: Ask and answer questions in order to seek help, get information, or clarify something that is not understood.

SL.K.4: Describe familiar people, places, things, and events and, with prompting and support, provide additional detail.

SL.K.5: Add drawings or other visual displays to descriptions as desired to provide additional detail.

SL.K.6: Speak audibly and express thoughts, feelings, and ideas clearly.

L.K.6: Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

W.K.2: Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.

Resources

Examples of Open Ended Questions that can be used:

What would happen if_____?
Why did the author write that?
What could we do differently?
What was your favorite experiment? Why?
If you could change one thing in your experiment, what would you change?
Can you tell me what happened?
Do you have any other ideas?
What did you see?
What did you notice?
What did you learn?
How could we do it differently?

Materials For Classroom Use

1. Science Journals
2. Smart Notebook Lessons
3. Discovery Education videos: Discovery Education: Waves From the Sun and The Language of Science: Physical Science K-2: Force and Motion
4. Solar Cells
5. Wires for Circuits
6. Chart Paper for the KWL chart
7. Markers
8. Paint – yellow, red, and blue
9. Paper plate
10. Paintbrush
11. 5 Plastic see-through cups
12. 12 Flashlights
13. 5 Rulers
14. Construction paper – Four each of the colors of the rainbow (4 red, 4 orange, 4 yellow etc…)
15. 5 Kaleidoscopes
16. Computer with a projector
17. Leaves, twigs, rocks
18. Nature Print Paper
19. 5 Small light bulbs
20. Small windmill

Bibliography for Teachers

"Media Room."*Charlotte Mecklenburg Schools*.N.p.,n.d. Web. 1 Nov. 2013. <http://www.cms.k12.nc.us/mediaroom/aboutus/Pages/Didyouknow.aspxyword... >.

This is the website for Charlotte Mecklenburg Schools. It gives great information about our district and the schools that are located within.

Crane, Hewitt D., and Edwin Max Kinderman. *A Cubic Mile of Oil Realities and Options for Averting the Looming Global Energy Crisis*. Oxford: Oxford University Press, 2010.

This is an excellent book that discusses our current energy levels and what we will need in the future. It also discusses all the different types of energy, inherited or income (renewable), with pros and cons of each source.

"Energy Kids: Energy Information Administration." *EIA Energy Kids* -.N.p., n.d. Web.

15 Nov. 2013. <http://www.eia.gov/kids/energy.cfm?page=solar_home-basicsword...>.

This is an excellent website that even adults can use. It gives lots of information about energy, how to use and save energy, and energy history. There is even a section for teachers to use and find activities pertaining to energy to teach to their students.

Breiner, Jonathan M., Shelly SheatsHarkness, Carla C. Johnson, and Catherine M.Koehler. "What is STEM? A Discussion About Conceptions of STEM in Education and Partnerships." *School Science and Mathematics* 112 (2012): 3-11. Print.

This was a great article to read about how STEM is viewed in education since people all have different definitions of what it is. The article also gave an insight into how other teachers/professors view STEM.

Park S.R., Pandey A.K., Tyagi S.K., and Tyagi V.V. 2014. "Energy and exergy analysis of typical renewable energy systems".*Renewable and Sustainable Energy Reviews.*30: 105-123.

This is a good article about renewable energy and its uses do to growing concern of global warming and pollution. In this article, they talk about many different ways to use solar energy as well as biomass cookstoves and how efficient they are.

Pinnell, Gay Su, and Irene C.Fountas."Writing about Reading." In *The Continuum of Literacy Learning Grades PreK - 8*. 2008. Reprint, Portsmouth: Heinemann, 2011. 74.

This book gives a lot of information about literacy instruction and strategies to use with students to help with reading.

"Welcome to Discovery Education | Digital Textbooks and Standards-aligned Educational Resources." Welcome to Discovery Education | Digital Textbooks and Standards-aligned Educational Resources. Accessed November 21, 2014. http://www.discoveryeducation.com/.

Krupa, K. (2010, April 15). Rainbows. Retrieved November 21, 2014, from http://www.educationalsynthesis.org/science/Rainbow.html

This is an excellent site where I was able to get some ideas about how to teach the electromagnetic spectrum to my students.

Reading List for Students

Freeman, Don. *A Rainbow of My Own*. Ancramdale, N.Y.: Live Oak Media, 1982. Print.

This is a wonderful book that is from the perspective of a little boy who wants a rainbow of his own.

Fowler, Allan. *All the Colors of the Rainbow*. New York: Children's, 1998. Print.

This is a good book that contains a lot of information about rainbows like the order of the colors and what makes a rainbow.

Landau, Elaine. *The sun*. New York: Children's Press, 2008. Print.

This book is an excellent book for students to read to gain information about the sun.

Butler, Christine. *Super cool science experiments*. Ann Arbor, Mich.: Cherry Lake Pub., 2010. Print.

This book has solar experiments that students can complete.

Oxlade, Chris. *Solar energy*. Chicago, Ill.: Heinemann Library, 2008. Print.

This book is written from the perspective of the students asking questions. Each chapter is set up as an answer to a question so that it guides students learning about solar energy.

Butler, Christine. *Junior scientists*. Ann Arbor, Mich.: Cherry Lake Pub., 2010. Print.

This book has some interesting solar experiments that students can complete.

Spetgang, Tilly, and Malcolm Wells.*The kids' solar energy book even grown-ups can understand*. Morganville, NJ: Imagine Pub., 2009. Print.

This book is wonderfully illustrated that helps students understand how solar power works.