Energy 101

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2nd and 3rd grade Gifted and Talented Program

Overview/ Background

Unit Duration: 5 weeks (5 in class lessons)

Next year I will be teaching in the Raytown School District in a pull-out gifted and talented program called Challenge. The students are bused to the school which houses Challenge and experience 3 hours of instructional time one day each week. While Challenge teachers teach K-6, two grade levels come together on each particular grade (K-1, 2-3, 4-5). This particular unit is designed for 2nd and 3rd grade students. The Challenge program offers services to students from all ten elementary schools in the district. One grade level is brought on the same day from every school; for example, all 2nd and 3rd graders in the Challenge program are bused on Mondays.

The Raytown School District contains ten elementary schools, three middle schools, and two high schools. The Raytown School district has schools residing in three different cities which all touch borders: Raytown, Kansas City, and Independence. Raytown is a suburb of Kansas City, Missouri. The district as a whole is 36% Caucasian, 50% African American, 10% Hispanic, and 4% other. In the district, 66.9% of students qualify for free or reduced-price lunches. Breakfast has now become free for every student in all of the elementary schools. While the district is accredited, some of the schools in the district qualify as Title 1 schools, including the one in which the Challenge program is housed.

Unit Rational

The modern generation is known as being "plugged in"; very connected to the cell phones, computers, tvs, and other electronic devices. It comes to no surprise that the only type of energy that most students know about is electronic energy. Through this unit, students will be exposed to many different types of energy. They will explore a select few types of energy in detail and will find out how they can make a personal difference in the "energy crisis." Since each student has different previous learning experiences, the unit will be differentiated in content, process, and product. There will also be differentiation for student choice as an engagement tool for students and as a way for students to further investigate their personal interests.

Unit objectives:

- Students will be able to identify several different types of energy, such as potential, kinetic, light, sound, electrical, thermal, and mechanical.
- Students will apply their knowledge of these energy types to real life scenarios, such as the physics in a roller coaster.
- Students will demonstrate the movement of energy.
- Students will synthesize how they can make a difference in the energy crisis.

Involving the Family System

Starting in the 2014-2015 school year, all parents were required to provide an email address in order to register their child in the district. An email is sent to parents after each Challenge lesson; since each grade level is seen once a week, the parents are sent a weekly email. Each email details what lessons were taught and what homework the students have. These emails are also sent to the regular classroom teachers of the Challenge students so that they know what enrichment they are being given.

Students will be given some work time in class for their independent projects. If this time is not sufficient for a student, they will be expected to work on their project at home. Students may also take their projects home to work on them if they desire the extra time. While parents are often helpful in assembly or providing materials, students will be expected to complete the projects on their own. The teacher can aid in providing necessary materials as requested by the student.

Common Core State Standards

When choosing standards, our supervisor has asked us to stick with the older grade level. Since this lesson is for 2nd and 3rd grade, the standards will be aligned to 3rd grade.

CCSS.ELA-LITERACY.RI.3.1
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

CCSS.ELA-LITERACY.RI.3.3
Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

CCSS.ELA-LITERACY.RI.3.5
Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently.

CCSS.ELA-LITERACY.RI.3.6
Distinguish their own point of view from that of the author of a text.

CCSS.ELA-LITERACY.W.3.1
Write opinion pieces on topics or texts, supporting a point of view with reasons.

CCSS.ELA-LITERACY.W.3.2
Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

CCSS.ELA-LITERACY.W.3.3
Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.

CCSS.ELA-LITERACY.W.3.7
Conduct short research projects that build knowledge about a topic.

CCSS.ELA-LITERACY.W.3.8
Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

CCSS.ELA-LITERACY.SL.3.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.

CCSS.ELA-LITERACY.SL.3.4
Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.

CCSS.ELA-LITERACY.SL.3.5
Create engaging audio recordings of stories or poems that demonstrate fluid reading at an understandable pace; add visual displays when appropriate to emphasize or enhance certain facts or details.

Daily Plans

Lesson 1: Introduction to different types of energy

Lesson 2: Potential and kinetic energy and their application to real-life physics

Lesson 3: Sound energy and how it travels.

Lesson 4: Light energy

Lesson 5: Conservation of energy

Sample Lesson Plans

Lesson 1: Introduction to different types of energy

When many students hear the word "energy", the picture that comes to mind is electrical energy coursing through a wire and powering an electronic device. I would like to begin this unit by broadening their use of the word "energy" to include several other types of energy.

When students enter the classroom, they will find several different stations set up around the room. The stations will be labeled with their station number, materials, and instructions on what to do, but will not say what type of energy is being demonstrated.

Station 1: Sound energy- a blown-up balloon

Station 2: Mechanical energy- a Judy clock with visible gears

Station 3: Light energy- an open window with the sun shining through

Station 4: Electrical energy- a small fan which can be easily plugged int an outlet

Station 5: Thermal energy- Hot Hands brand hand warmers

Station 6: Potential and Kinetic Energy- a small basket, a small ball, and a paper towel roll

Students are broken into small mixed-ability groups of 2-4 in order to explore each station. Using the organizer attached, students make educated guesses as to what kind of energy is being demonstrated at each station. Once students have visted and experienced every station, they return to their desks and use their science textbook in order to check their answers.

Students then each choose one of the types of energy to read more about. They may look in the science textbook and do their own research online in order to gain a basic knowledge on their topic. Students will then create a poster, powerpoint, or Prezi with which to teach the rest of the class about their form of energy. At this point in the process, students will have only gathered general information about their source of energy, so this project should not be time consuming. The students will then present their findings to the class.

Differentiated What: Both content and product are differentiated. The content is differentiated by the student's ability to choose one energy type in which to learn more. The product is differentiated through the student's choice to present via a poster, powerpoint, or Prezi.

Differentiated How: Through student choice, different students will be researching basic information on different types of energy and will presenting this information to their peers in various ways. This gives students the opportunity to play to their own strengths or to venture out of their comfort zone.

Differentiated Why: While there are many types of energy, not all of them will be covered in depth in this unit. Students will have the opportunity to peak their interests in a potentially new subject that may not receive considerable direct instruction.

Name_____ # _____ Date _____

Types of Energy

Word Bank

sound energy	electrical energy	thermal energy	potential energy
light energy	mechanical energy	kinetic energy	

Follow the directions on the page. Using the words from the word bank, fill in what kind of energy the experiment or video demonstrates.

1. _____energy_ Take a balloon and hold it against your ear. Have your partner put their mouth against the balloon and speak into the balloon.

2. _____energy_ Look at the back of the Judy clock at the gears. Move the hands of the clock. What kind of energy makes the gears move?

3. _____energy_ Look out the window. What kind of energy is coming in through the window?

4. _____energy_ Plug in the fan. Turn it on. Think about what kind of energy is making the fan move.

5. _____energy_ Feel the small packet. What kind of energy make it feel warm?

6. _____energy_ and _____energy_ Put the ball at the top of the paper towel tube. Let the ball roll through the tube into the basket. What kind of energy makes the ball roll through the tube?

Lesson 2: Potential and kinetic energy and their application to real-life physics

The teacher will begin by inviting any students who presented on potential or kinetic energy on day 1 to summarize their findings to the class once more. As a refresher, the teacher will show the following youtube video. The video explains the definition of kinetic and potential energy and how the two forces are highly utilized at amusement parks.
https://www.youtube.com/watch?v=Ehx1P4adv6I

Students are split into two ability groups based on their comfort with potential and kinetic energy. The teacher can assess this through who did their previous research on these forms of energy and who did not. Or the teacher can have students write what they know about these types of energy and assess answers for accuracy.

Tier 1: Students to whom kinetic and potential energy is still new and foreign will be placed into tier 1. Tier 1 students will be placed into pairs and then will get the opportunity to design their own skate park using the Energy Skate Park: Basics simulator on PhET on an iPad. https://phet.colorado.edu/en/simulation/energy-skate-park-basics PhET is a science resource for teachers and students alike and all simulators and lessons have been peer-reviewed. If you have an app friendly device, you could also use the Experience Physics app to create the physics of a skateboard rider. Pairs of students will work together to design their own skate ramp on the iPad. In this scenario, we will remove external forces such as friction and will be able to issolate the kinetic and potential energy alone. Once students have created a skate ramp that they like, they will create the blueprints for the ramp, including bar graphs of the potential and kinetic energy of each hill and dip.

Tier 2: Students who have more mastery of kinetic and potential energy will placed into tier 2. Tier 2 students will be placed into pairs and will get the opportunity to design their own roller coaster. Ahead of time, the teacher should buy 2" foam pipe insulation and cut each piece in half so that it creates 2 u-shaped ramps. The students will use this tubing as the ramps for their roller coaster. They may use chairs, desks, and tape, if needed in their design, but the roller coaster must work and get a ball from the start safely into the basket at the end. Once students have a roller coaster they like, they will create the blueprints for the ramp, including bar graphs of the potential and kinetic energy of each hill and dip.

Differentiated What: The process is differentiated. Tier 1 is learning through a controlled computer simulation of a skate ramp. Tier 2 is learning through the creation of a roller coaster ramp. They then create the same product based on what they created and observed.

Differentiated How: Although both groups are applying potential and kinetic energy to real-world scenarios, Tier 1 is doing so in a controlled environment which shows them different graphs of the skater while he is moving. Tier 2 still has friction, gravity, and other forces to consider.

Differentiate Why: This portion is differentiated to support students who are still novices in their knowledge of potential and kinetic energy. The two activities mirror each other in many ways, except that one has a controlled environment in which the experiment occurs. With the added support and graphs, Tier 1 students will still be successful and will be able to fill gaps in their knowledge.

Lesson 3: Sound energy and how it travels

The teacher will begin by inviting any students who presented on sound energy on day 1 to summarize their findings to the class once more. The lesson will use Gardner's Entry Points in order to immerse students in sound energy and how it travels. Students may choose which immersion experience in which to partake.

The Foundational Window: Sound energy has a lot of specific vocabulary that accompanies it: hertz, sound waves, crest, troth, midpoint, frequency, and pluck, to name a few. Create a dictionary of sound vocabulary terms that your classmates and you can use as reference.

The Aesthetic Window: Have students view this video of paint on speakers. The sound vibrations make the speaker heads move, causing the paint to bounce into the air. The camera has been placed in slow motion, music has been set as a background, and a conductor is conducting the "orchestra" of "dancing" paint. https://www.youtube.com/watch?v=eBvm4FZF8L4 In this video, sound and visual art have merged and created one experience. The Blue Men Group pour paint onto drum heads and collect the spatter as they hit the drums. https://www.youtube.com/watch?v=LP0eK7Tg1OQ How else can sound be turned into art? Students may design or build a way in which sound waves or vibrartions can also be visual art.

The Narrative Window: Students would watch "The Magic School Bus: In the Haunted House". In this episode, students have created a new musical instument and are on their way to an orchestra competition when the bus breaks down. They wander into a nearby house only to find that it is full of sound waves they can see. Students discover that sound is vibration, fix their new instrument so that it can vibrate, and do well at the orchestra competition. After viewing this episode, students will be encouraged to write a narrative story of their own with child's intereaction with sound and sound waves. Maybe kids find an abandonded ammusement park and can see the sound waves of previous giggles, screams on roller coasters, vendors shouting for hot dogs, footsteps, etc.

The Logical/ Quatitative Window: When a substance is put onto subwoofers and certain frequencies are played, the substance will create different paterns.

https://www.youtube.com/watch?v=wvJAgrUBF4w Based on your observations, find a way to display the data of which frequencies produce which patterns.

The Experiencial Window: Using a slinky, you and your partner can create a representation of a sound wave. Stretch the slinky across the floor, one end in each partner's hand, and have one person move the slinky up and down. See if the frequency changes the number of waves. Try to create the most number of waves and the least number of waves while still maintaining constant movement.

Differentiated What: Each group has a different way to explore sound and the products they produce all vary. Each entry point is accompanied by a product which must be created, and some entry points even have 2 products to choose from.

Differentiate How: Student interest was taken into account. Student learning styles have been taken into account and students may choose their entry point, as per Gardner's advice. The teacher may choose to have the students explore each entry point, as Gardner suggests.

Differentiated Why: Similar to the differentiated how, I differentiated this unit for two reasons: to make it intellectually appropriate for learners of all level and to engage students through choice. I wanted to create a project which would make students of all levels feel successful, whether they read and write at a Kindergarten level, on level, or at a middle school level. Many students in my class become overwhelmed easily by informational text, so having specific questions to answer helped make the task seem less daunting. I also wanted to meet the learning needs of my highest students, who process information more quickly. They had the opportunity to go more deeply into their learning and consider new material. I believe that student choice is a powerful engagement component. When students are learning about topics of their own interest, they are more intrinsically motivated to learn. Through choices covering many subject matters, they can find something of interest to themselves.

Lesson 4: Light energy

Students will choose one of the following light experiments below and complete the procedure with a partner or group. Students will then follow the steps of the scientific method by completing the attached student recording sheet from Bill Nye the Science Guy's educational materials.

Students will then be placed into groups composing of one person from each experiment. The students will explain to the group what their experiment consisted of, what they observed, and what they wrote on their recording sheet. They will also pose wondering and questions to each other and write them on the "wonder wall" if still confused about something at the end of the lesson. The teacher and the students will address the questions on the wondering wall in that or the next class period, or students will be encouraged to look up the answer and then share it with the teacher or the class.

UP PERISCOPE! ***Objective: To demonstrate how reflected light and mirrors can be used for viewing objects not in the direct line of sight.*** • Cut the top off a one-quart milk carton. • Make two slits (one by eight centimeters) two centimeters from the top of one side (along its width), and another slit on the opposite side, two centimeters up from the bottom of the carton. • Place a ten centimeters mirror on the bottom of the milk carton at a slight angle, so it can be viewed through the bottom slit. • Place a ten centimeters mirror on top of the carton, at a slight angle, and tape it to the edge of the carton. Place the mirror so that you can look through the slit and see the bottom mirror. • Look through the bottom mirror to see objects reflected in the top mirror. • Place your periscope over a wall or around corners to let you see objects you wouldn't otherwise be able to see.	**WATER PICTURES** ***Objective: To reveal refracted (bent) light through water.*** • Place a penny in the bottom of a pie tin next to the edge of the tin. • Bend down so that, at your eye level, you can't see the penny. • Pour water in the pie tin, maintaining the same eye level. • Light bends when entering water, so the resulting refraction will make the penny visible.	**BLENDING COLOR WHEEL** ***Objective: To demonstrate how spinning colors can change visually.*** • Using a compass, draw a 15-centimeter diameter circle on stiff cardboard or paper. • Divide the circle into three equal parts around the outside of circle, forming a Y. • Color one section red, one section yellow, and one section blue. Cut out the colored circle from the paper. • Punch two holes 4 millimeters apart in the middle of the circle. • Cut a piece of string 70 centimeters long. Thread one end of string through one hole and back through the other hole. Tie the ends of the string together. • Hold both ends of the string, with the wheel in the middle of the string. • Move your hands with a circular motion, allowing the string to twist. Pull your hands apart, then let them be drawn in towards the wheel repeatedly, causing the wheel to spin. Observe the new colors that are forming.	**MIX YOUR COLORS IN A FLASH** ***Objective: To demonstrate how blending the primary colors of light (red, blue, and green) in various combinations will produce different colors of light.*** • Use three flashlights that give the same amount of light brightness. • Cover each flashlight with one of the following colors of cellophane: red, dark blue, and green (primary colors of light). Use various layers of cellophane so that the colored lights are the same brightness. • Shine the colored light from each flashlight on one spot on a piece of white paper from a distance of 20 to 30 centimeters (or until blended). WHITE light should be produced. • Red and green lights combined will produce yellow, blue and green will produce blue-green, red light and blue light will produce purple light. • Experiment blending different colored lights to see what additional light colors can be produced.

Differentiated What: The content has been differentiated. The process and product are still the same for all students.

Differentiated How: Students have 4 different scientific experiments to choose from. These 4 experiments vary in choice and allow students to pursue their interests. All students still have the same process and product because they still have the same measurable outcomes: to complete the scientific process and record their observations.

Differentiated Why: The choices that the students get to choose from engage them in the lesson. Student engagement is a key motivating factor, one that can make or break a lesson. Giving

students the choice gives them a sense of freedom and leads towards more intrinsically motivated students.

Bill Nye the Science Guy

Student Recording Sheet

Name _____ Date _____

Title of Experiment _____

Question: (What are you testing?) _____

Procedure: (Describe the experiment) _____

Materials: (List what you used) _____

Observations: (Record what happened) _____

Results: (Make your own data table)

Conclusions: (Use your observations and results to describe what you learned)

Lesson 5: Conservation of energy

Students will be given the tic-tac-toe board when they enter. They will choose their 3 projects, have their choices approved by the teacher, and then begin work. This sound take 3 class periods to complete and may require some work time at home as well.

Find the differences between fluorescent, CFL, and LED light bulbs. Decide which lightbulb is best and explain why in an informational essay or presentation.	Only plastic, paper, cardboard, and aluminum can be put in the pick-up recycling bins in KC. Create an infographic telling the public how they can recycle other materials. (ex. glass, clothes, Chistmas lights, etc.)	Trash- free challenge: Try to go an entire week without creating any trash in your lunch. Bring lunch in reusable containers, a cloth napkin, etc. Share your experience with the class.
With the permission of your parents, find the cost of your family's electric, water, and gas bill for the past 3 months. Chart the information on a bar graph. Pledge to make the next month lower by reducing the amount of energy you use.	FREE CHOICE (with teacher approval)	Write a persuasive letter to your parents persuading them to make one change in your lives that could help the environment. (ex. change to CFL bulbs, get a programmable thermostat, start recycling, etc.)
Create a video, powerpoint, or Prezi explain how energy conservation is directly related to the health of animals, people, and the Earth.	Create a list of easy ways for people to reduce the amount of energy they produce. For help, go to http://www.earthday.org/	Research "vampire voltage" and what it means. Be a vampire voltage detective and pledge to unplug any electronic device when it is not in use. Recruit 5 people to make the same pledge.

APP FRIENDLY OPTIONS:

If you have a class iPad or students have an iPad, Smartphone, etc. at home, give them this additional choice board from which to choose conservation projects.

The app, Leafully, helps utility customers visualize their Green Button data, as a variety of units, such as the amount of trees needed to offset an individual's energy usage. Leafully encourages users to set energy savings goals and to share their progress on Facebook. Use this app for 1 week and report on your usage and goals.	Go to the BBC Climate Change game. Here's your chance to see if you can do better in the hot seat. The game tests your decision making skills while holding the top job of President of the European Nations. You must tackle climate change and stay popular enough with the voters to remain in office. Beat the game and write a letter explaining what choices you made.	The wotz app lets users explore and play with Green Button data. Provides several games based on the "shape" of your data, and provides creative comparisons to illustrate your usage, like how many cheeseburgers worth of energy you used last Tuesday from 5-6 pm. Report on how many cheeseburgers of energy you used and make a graphic to display this information.
Using the Energy for iPad app by Kids Discover, learn more about light and heat energy. Share your findings with the class.	FREE CHOICE (with teacher approval)	In the Experience Physics app, explore the energy of a pendulum. Create blueprints of the pendulum you created and then build that pendulum. Explain to the class how when the kinetic and potential energy is the highest/ lowest.
What's Invasive. Created by National Park Service rangers and biologists, this app allows the user to identify and map weeds and pests in their area. Submitted observations allow scientists to locate, study and try to remove the species. - See more at: http://wilderness.org/blog/9-free-nature-and-wildlife-apps-kids#sthash.8NALJo0O.dpuf Use "What's Invasive" to clear the invasive plants out of your backyard or the school courtyard.	Earth Day has passed us by, but the games that were set up to promote it endure on many sites around the web. Kaboose.com has a small collection of simple Flash based environmental games like Clean Up Your World. The games are simple enough to introduce the youngest of the lot to the need for environmental cleanliness.	Project NOAH (Networked Organisms and Habitats). This program is for recording wildlife sightings. Take photos of plants and animals, submit the data for use by researchers and earn cool badges. There is also support for classroom-based work on their website. - See more at: http://wilderness.org/blog/9-free-nature-and-wildlife-apps-kids#sthash.8NALJo0O.dpuf Download Project Noah onto your phone or device. Upload animals and plants you can't identify. Help others identify theirs.

Differentiated What: The product has been differentiated. Since the products are all so different, the content and process are all also differentiated. Since each product contains a different vein of energy conservation, the content varies in its details. The process by which the student finds their information or research is different in each choice as well.

Differentiated How: The tic-tac-toe board allows students to create different products and, through these products, choose different contents and processes. Students who enjoy animals, for example, may choose the content that discusses how energy conservation helps animals. Students who would rather make a concrete change in their lives rather than researching and writing may choose the no-trash challenge or to be a vampire voltage detective.

Differentiated Why: The products allow students the freedom of student choice. They know their own learning styles and can find a project that allows them to learn in a way that suits them best. Student choice is a powerful tool and allows students to tailor learning to their own needs, without necessarily even being cognitive of the change.

Resources

Lesson 1:
Stations worksheet included

Lesson 2:
iPad
https://www.youtube.com/watch?v=Ehx1P4adv6I
https://phet.colorado.edu/en/simulation/energy-skate-park-basics

Lesson 3:
iPad
https://www.youtube.com/watch?v=eBvm4FZF8L4
https://www.youtube.com/watch?v=LP0eK7Tg1OQ
https://www.youtube.com/watch?v=wvJAgrUBF4w

Lesson 4:
Bill Nye the Science Guy educational resources that accompany his videos. “Light Optics” and “Light and Color” were both used. Our district provides them in pdf.

Lesson 5:
iPad
various apps and websites listed on choice board
Tic-tac-toe choice board(s) included