Energized!

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This curriculum unit is recommended for:
Fourth and Fifth Grades

Keywords: energy, equity, sources, responsibility

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

Synopsis: Every person uses some form of energy whether it is natural or processed to produce electricity. The purpose of this unit is to bring an awareness of how energy is produced. This unit is geared to allow students to become aware that they have an impact in the earth. Through exploring how energy is produced and by gaining an understanding of their daily energy usage students can see why there is a global energy challenge. Students will learn the pros and cons of various energy sources and will learn solutions that can address our global energy challenge.

I plan to teach this unit during the coming year in to 40
students in Fourth and Fifth grade.

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Rationale

Energy is a resource all individuals should be able to benefit from. How energy is produced makes the difference between how accessible it is for all citizens. Many of us take energy for granted. We flip on the light switch and expect our lights or television to turn on. When we need to charge our phones we expect energy to be readily available for us to use. We often do not consider how much is needed to fuel our everyday lives or to provide us with entertainment such as movies, plays and productions to name a few.

Over the course of time the consumption of energy has grown. As our lives become more technologically advanced our reliance upon energy grows. As we prepare our students to be 21st century citizens, we must also prepare them to provide solutions for future problems. This includes ensuring there will be enough energy in the future to accommodate our lives.

The Global Energy Challenge is just that a global challenge. Citizens from all over the world are challenged with how much energy they use, how they obtain their energy and the cost and efficiency of the energy they use. Many are only concerned with how much money can be made with the provision of energy resources with no concern to the average citizen.

This crisis affects every country, every citizen every part of our world. I feel that students should be aware at a young age of their own personal energy usage. We currently live in a world where technology is on the forefront and devices control our everyday lives. As our world progresses into encompassing more technology in an effort to make our lives easier, the demand for more energy to fuel our technology will also rise.

Although strides have been and are being made to make our world more 'green' it is not enough. Students should be aware of how their everyday actions can help or hurt our world. By immersing students into the current global energy challenge, their awareness will rise. They will become aware of how they contribute to the problem as well as how they can help solve it. Students also need to be aware that the problem cannot be solved overnight but the solution(s) are progressive. The goal is for students to become aware of and understand the responsibility they have as young citizens in our world to help solve our global energy epidemic. Immersing students into understanding our global problem will allow them to identify and respond to larger issues at hand.

Within this unit I would like students to research the cost of energy, the efforts being made to supply affordable energy in an ethical way and the effects of supplying energy to all citizens upon our world. Students will become aware of their contribution to the global energy challenge and possible solutions they can employ even as young citizens. Students are faced with the challenge of understanding energy sources and monitoring their energy use. The main goal of this curriculum unit is to help them with this challenge.

Students in the fourth grade in North Carolina have the opportunity to participate in a program offered through junior achievement called JA Biz Town (site). The purpose of the program is to allow students to gain an awareness of what it takes to successfully run a town and how important each citizen's role is to the success of the town. I plan to build upon these same principles and also align this unit with the fourth grade essential standards for science.

In this program students learn about the roles of citizens and serve in key roles such as grocer, mayor and banker within a community. This program allows students to understand that all roles are important to the success of a community. Students also have the opportunity to learn from one another and cooperate as a community. At the culmination of the program students have the opportunity to run the town. Their dedication to the role they play and their ability to cooperate with one another will determine the success of their town.

In addition, I serve as the energy coordinator for my school. My responsibilities include ensuring that we are being energy efficient as a school and not wasting energy by leaving lights on in an area not in use, leaving smart boards and projectors on, etc. Each month we are given a report of our monthly energy usage. We compare each month against the last to see if we have improved our energy usage as a school. I would like to challenge the students to take a more active role in challenging our staff and their fellow students to be more energy aware.

Introduction

Barringer Academic Center is a National Magnet School of Excellence located on the west side of Charlotte, North Carolina. BAC, as it is affectionately called, is an elementary school in the Charlotte Mecklenburg School District and serves students in grades K-5. Currently BAC has 630+ students enrolled. Though most of the students are African American, BAC does have a diverse population which includes Caucasian, Indian, Hispanic, Asian and Multi-race students.

A variety of clubs are offered throughout the school for all grade levels to enhance students' learning experiences beyond the classroom. Clubs meet during

designated times before and after school during the week. Some clubs such as Science Olympiad, Chess, Cyber Kids, Chorus and Odyssey of the Mind offer students the opportunity to compete with their peers regionally and statewide. Our students have also competed in the Fire and Safety Bowl in previous years.

Students in the third through fifth grades have the opportunity to serve on our school student council. Students in grades four and five who have outstanding academic records are invited to be inducted into the honor society.

Barringer is a unique school. Though it is a magnet school, not all of the students are a part of the magnet program. Barringer is one school comprised of three different programs. Our Horizons program is a program created by The Charlotte Mecklenburg School District to enhance the learning of students working two or more grade levels above their own. Currently this program serves approximately 35 students. Individuals who desire to be a part of the Horizon's program must fill out an application, engage in a series of tests and complete an interview. They are then invited into the program if they qualify.

BAC's gifted program serves students in grades K-5 who are working above their current grade level. Students who are a part of the Horizon's or gifted program generally come from areas that are out of our school's zone. BAC also serves approximately 400 students that live in the neighborhood surrounding the school. The majority are students who are working at or below grade level which do not qualify them to participate in the Horizon's or gifted programs. Many of these students are also economically challenged.

Though Barringer has multiple programs, every student comes to the science lab once a week for 45-60 minutes with their class. The Science lab is offered as a special area class. Students engage in center learning. Each week, students choose a center to work in. Students are not permitted to choose the same center week after week. This ensures that they are experiencing a variety of learning. Each center is aligned to the common core/essential standards for grades K-5. At times students also participate in a class experiment. This is usually when the experiment need more teacher direction.

All students are also required to participate in a school-wide Science Fair held the second week of January each school year. Students work individually, in pairs, as a group or as a class to complete a project. The students follow the scientific method in the development of their projects. Judges, not affiliated with our school, are invited in to interview the students and judge the projects using a rubric for the students, grades 3-5, who have completed an individual, partner (pairs) or group (3 people) project. The top 12 projects are sent to the regional Science Fair held at the University of Charlotte each February.

As the Science Facilitator, I serve every student at BAC. I have been challenged to build a comprehensive science department that builds confidence in students who previously did not have much exposure to science and to challenge students who come with a vast background of science knowledge. My challenges also extend to breaking down a mindset that only *some* students are able to engage in science experiments. Breaking this mindset has not been easy. I have taught my students that everyone is able to engage in science experiments and inquiry, not just some students. When I first arrived, many of my students were shocked that they would have the opportunity to engage in scientific experiments. Students who were previously disinterested in science have now become fascinated with it.

Our school was also chosen to participate in the Engineering for the Efficacy of Elementary Education (E4) pilot program. Students in grade four have immersed themselves in learning about Civil and Electrical engineering. We are currently in year two of this pilot program. BAC is also participating in coding. This is a school-wide effort. Adding these content areas to our school program has driven our science program into an S.T.E.M. (science, engineering, technology and math) program.

Objectives

The purpose of this unit is to bring an awareness of energy usage, the challenges of providing affordable energy to a society and the importance of equity as it relates to energy. In the fourth grade North Carolina Essential Standards requires students to gain an understanding of energy forms specifically, light, sound, heat, and magnetic and how energy is produced. Students will research the various forms of energy through experiments and exploration. This unit will provide students with a hands-on approach to recognizing the pros and cons of each energy source. Students will come to understand how some energy may be more appropriate than others depending on the situation. Students will use this knowledge to respond to scenarios. Students will use what they have learned to ensure that they are ethical in how they respond to the scenarios. They must ensure that all citizens have access to energy. It must be seen as a right for all.

The North Carolina Essential social studies standards for fifth grade require students to analyze life in a democratic republic through the rights and responsibilities of others (5.C and G.2). Students will gain an understanding of what it means to be ethical. Within this unit students will respond to scenarios and be challenged to provide energy for a small community making sure all citizens have equal access to it.

Questions for students to consider:

How is energy produced?

Students will research various forms of energy to gain an understanding of how it is produced. The students will learn locations on the earth and where these energy sources can be found.

What energy sources produce the least amount of waste?

During this unit students will compare the pros and cons of various energy sources. Students will gain an understanding of which sources produce the least amount of waste and which energy sources produce the greatest amount.

What energy sources are the most cost effective?

This unit is designed for students to gain a general knowledge of the cost of energy production. Students will apply what they have learned to determine which energy sources are most cost effective.

How can energy usage be made available for all citizens?

Providing energy for all citizens can seem like an easy task. As students research energy sources and production cost of manufacturing energy, they will become aware that providing energy for all citizens is not as easy as it may seem.

What are some challenges to providing energy for all citizens within a given community?

Providing energy for all citizens at a fair cost is not an easy task. Students will gain an understanding of the challenges that present themselves with providing energy for a community. Location and available resources will be two factors for them to consider.

Strategies

As a kickoff to this unit the director of energy in Charlotte- Mecklenburg Schools will be invited to speak to the students about energy consumption and management in our school district. I believe this will give our students a better understanding of how important energy is and also how important conservation of energy is.

Students will be assigned randomly to groups (possibly not so randomly. I want to take into account students who work well with each other). Students will work in groups to research information about energy. Students will be given scenarios where they will be challenged to apply the information they have gained. Students will be graded using a rubric (see Appendix 1V).

Students will record their information throughout this project in their science journals (one specifically for this project) so they can see their own growth. This journal

will be used as a resource of communication between me and the students. I will use them to check student progress, make comments and provide direction as needed.

Students will determine their carbon footprint by calculating their daily activities. The students will choose the activities they engage in daily such as using a cell phone, taking a shower, taking a bath, eating a meal with meat, eating a vegetarian meal, riding in a car to school, taking the bus to school. Each activity will be given a point value. Each task will be given a point value and students will calculate their points to determine a rough estimate of their carbon footprint.

In their groups, students will research energy sources in the computer lab and determine the pros and cons of each energy source. This information will be used in their final presentation.

Students will complete the activity determine your carbon footprint on Discovery Education (1). This activity challenges students to find a way to provide energy for their business while keeping their cost low and producing a low carbon footprint.

Students will create a final presentation of their project to present to the class. Their presentation can be delivered electronically, three-dimensional (diorama, tri-fold board, clay models, or through another creative way. This is where the rubric will be utilized to determine how effective students were in completing their project (see Appendix 2).

Activities

Activity One

Students will first watch a short video on Brain Pop Jr. (2). Students will respond to scenarios and determine the responsibility of students in each scenario when given specific rights. Scenarios include but are not limited to: The right for students to learn, the right for all students to be safe, the right for all students to have access to needed school supplies, and the right for students to learn in a clean environment. This activity will help them understand that with every right there is a responsibility.

Activity Two

Students will begin by first determining their carbon footprint. A carbon footprint is a way to determine how much pollution you are putting into the atmosphere based on your energy usage (3). Students will be provided with a poster board. The poster board will contain activities that are common to today's lifestyle. Examples include using a cell phone, taking a shower, taking a bath, eating a meal with meat, eating a vegetarian meal, riding in a car to school, taking the bus to school. Each activity will be given a point

value. The activities that require more energy will have higher point values. Students will choose the activities they engage in on a daily basis and add up their points. Students with a lower point value will be considered more energy efficient than students with a higher point value.

Activity Three

Students will be given an energy report from our school. They will learn how to read it and brainstorm ways to decrease our energy usage as a school. Students will then create awareness posters to post around the school at a later date. The purpose of these posters will be to challenge students and staff to decrease energy usage.

Activity Four

Students will be taken to the computer lab to complete an activity on Discovery Education (4). In level one of "How Big is Your Footprint" students are challenged to find a way to power a business while keeping their carbon footprint and energy usage cost down. As students choose one or more energy sources, their data is calculated and they are then provided with a carbon footprint and operating cost. This data can be compared with their classmates to determine the best combination of energy sources. The purpose of this activity is to make students aware that there are pros and cons to every energy source and that no energy source is perfect. Students will also learn that there are energy sources that may be more appropriate given the situation or availability.

Activity Five

After determining their carbon footprint groups will be given an energy source to research (natural gas, oil, nuclear, coal). They will need to determine the pros and cons of their energy source. The group will need to determine where their energy is found (what part of the world), whether or not it is expensive to produce, the risks and the availability. Students will determine the long term effects of their energy source and also the long term benefits. Students will present to the rest of the class the results of their research using a method of their choice (examples are given above).

Activity Six

In the final activity, students will be challenged with making their town (given in the scenario) more energy efficient. They will be challenged to do so by not creating a large carbon footprint and by keeping the cost as low as possible.

Example

Your country has 20 families. It is rich in oil but there is not a lot of land space for windmills and no large bodies of water. Your goal is to produce enough energy for citizens to comfortably live (the level of comfort is determined by each group). You are challenged with producing the smallest carbon footprint and providing energy at the lowest/reasonable cost.

Example

You live in a small country on the coast of an ocean. Your country gets plenty of wind. The citizens of your country would like to invest in wind energy as they feel it would be the most cost efficient for them. Unfortunately they do not have enough space to build enough windmills to effectively power the whole country. They are currently looking into investing in additional energy sources. The citizens do not feel fracking (5) is a good idea as the ground is softer where they live and disturbing the ground underneath might cause a ripple effect of problems. Though they receive plenty of sun, solar energy is very costly and not something they feel they can afford upfront. They have considered trading resources with another country to help them solve their problem. What do you recommend the citizens do first?

The students will have the same number of citizens in their country. The students will be challenged to build an energy efficient community where energy is available to all citizens. The energy must be efficient but also affordable. The students will be able to use the following types of energy sources: natural gas, coal, wind, nuclear and solar energy or a combination of them. The students will be given a budget that they can spend. They may not go over their budget, but they may use less than the allotted amount. Each country must have rules for energy usage and a plan to enforce their rules. Students will research how The United States and other countries set standards for energy companies. The goal is for students to gain a solid understanding of how energy is produced, the effects (both positive and negative) of usable energy sources, and the cost of energy production.

Additional Activity

As an extension to this unit, I will collaborate with the student council at our school (3^{rd}-5^{th} grade students). Their goal is to determine our energy usage as a school, identify ways we are wasting energy, and how we can become more energy efficient. They will raise awareness and challenge the staff to become more energy efficient and to also set a goal for energy usage each month. They will report their findings to me. This will be a service learning project and a green building challenge. Students will have access to the data collected each month by the district (amount of energy). The student council will use the posters previously created by the students.

The student council will conduct surprise checks on each hallway bi-weekly to check for any energy misuse. The hallway with the best rating each week will be determined the energy superstars. Factors that the students will consider: Are smart boards on that are not in use? Have lights been turned off when a space is not being used? Are back doors closed? Is natural sunlight being used in place of artificial light? A point will be awarded for any misuse of energy and a point will be deducted for steps that are taken to reduce energy usage. The hallway with the lowest number of points is the winner.

Summary

This unit has been designed to bring students to awareness beyond themselves as it relates to energy. It is designed to immerse the students into a global issue and to encourage them to find appropriate ways to respond to those issues now. At the culmination of this unit, students should see themselves as positive contributors to their local community and the world at large. Students will have the opportunity to become responsible citizens at a young age rather than wait until they are adults.

Appendix 1: Implementing District Standards

This unit will link to 4th and 5th grade Social studies and 4th grade science standards listed below:

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

Students will understand that energy comes in many forms and can change when interacting with other matter.

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

Students will understand the basic forms of energy and how they respond to motion or change.

Fifth Grade Social Studies standards expect students to be able to:

5. C and G.2 Analyze life in a democratic republic through the rights and responsibilities of citizens.

Students will understand that every citizen has rights and that with every right is a responsibility. Students will understand their responsibility as citizens of this world.

Appendix 11: Additional Resources for teachers and students

Reading List for Students

Atwater, Mary and Prentice Baptiste, Lucy Daniel, Jay Hackett, Richard Moyer, Carol Takemoto, and Nancy Wilson "Forms and Uses of Energy," (Macmillian/Mc-Graw-Hill).

This resource provides students with information about energy. It is idea for students because it was written on an elementary reading level.

Goldemberg, Jose "Energy: What Everyone Needs to Know," (Oxford University Press).

This is a good resource for helping students understand energy. Teachers may choose to provide students with excerpts as the entire book is a little lengthy.

Reilly, Kathleen, M. Energy Investigate: Why We Need Power and How We Get It," (Nomad Press).

This resources guides students into understanding energy by engaging them in hands on investigations.

Websites for students:
http://www.brainpopjr.com
http://www.discoveryeducation.com

Appendix 111: Classrooms Materials List

Available technology or access to a computer lab
Availability to student reading list
School Energy report
Student Science Journals
Tri-fold board

Appendix 1V: Sample Rubric

Category	**4**	**3**	**2**	**1**
Creativity	The students presented the information in a way that took creativity and innovation	The students presented their information will some creativity and innovation	The students presented their information with minimal creativity and innovation	The students did not use any creativity
Information	The students knew their information well and were able to confidently answer questions about their presentation	The students were confident and were able to answer most questions about their presentation	The students knew some of their information and had difficulty answering questions about their presentation	The students did not know most of their information and were not able to answer questions about their presentation
Presentation	The presentation flowed smoothly. All group members participated in the presentation and had equal parts.	The presentation flowed smoothly. All group members participated. Some group members had more parts than others.	The presentation was choppy. Not all group members participated in the presentation.	The presentation was choppy. Not all group members participated. One or two people presented for the entire group.

Notes

1 Discovery Education, November 2014, www.discovereducation.com
2 "Rights and Responsibilities, "BrainPOPJr., www.brainpopjr.com
3 Carbon Footprint: the amount of greenhouse gases used to fuel human activity
4 Discovery Education, November 2014, www.discoveryeducation.com
5 Fracking: when natural gas is extracted from within the earth

Bibliography for Teachers

Crane, Hewitt D., Edwin M. Kinderman, and Ripudaman Malhotra, "A Cubic Mile of Oil: Realities and Options for Adverting the Looming Global Energy Crisis," (Oxford University Press)

This text served as the main text of our seminar. This text is easy to read for the average person. It gives history of energy usage in the world and also gives readers an understanding of how energy is calculated.

Cunningham, Ari "Double Down on Renewable Energy: Why Renewable Energy Investments Are a Smart Move (Amazon).

This book provides information about renewable energy. It also shares information about where these renewable energy resources can be found.

Gray, Terry, M. and Anthony Rappe' "Energy: What the World Needs Now," (Creative Commons Licensing).

This resource provides an in depth look into what energy is through definition and examples.

Hibbard, Devin, Gilda Wheeler and Wendy Church, "Global Issues and Sustainable Solutions: Population, Poverty, Consumption, Conflict and the Environment," (Facing the Future).

This book is a wonderful resource for teachers. It provides activities that can be implemented in the classroom. It is a great way to introduce students to the global energy challenge and help them find solutions to them.

Hinrichs, Roger A. and Merlin Kleinbach, "Energy: Its Use and the Environment," (Brooks/Cole Centage Learning).

This resource provides teachers with a definition of energy, energy usage patterns, resources and exponential growth. It also shares information about the impact energy has on the economy and environment.

Maracelli, Kellie "Teaching Science With Interactive Notebooks," (Thousand Oaks, California).

This is a great guide for teachers. It provides examples and pictures to help teachers implement interactive notebooks within their science instruction.

Stone, Norman J. Renewable Energy Guide Book: Introduction to Popular Alternative Energy Options for a More Sustainable 'Green' Lifestyle,: (Renergy Max).

This resource provides valuable information about carbon footprints and renewable energy sources.

Websites for teachers and students

http://brainpopjr.com
http://www.discovereducation.com
http://www.dukeenergy.com
http://www.eia.gov/kids/
http://www1.eere.energy.gov/education/lessonplans
http://energychallenge.duke-energy.com/
www.facingthefuture.org
http://www.learningaboutenergy.com/
http://www.nsta.org
http://www.neok12.com/Energy-Sources.htm
http://www.nrel.gov/learning/
http://www.ucsusa.org/assets/documents/clean_energy/renewablesready_fullreport.pdf