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| **Title** | Lesson 3: Investigating Electric Vehicles (EV’s) |
| **Introduction** | This lesson anchors a webquest investigation of electric vehicles and their impact on our society. Students will use EV websites to gain information on the ways EV’s are alike and different from gas-powered vehicles. Students will also categorize some of the major differences they discover. With teacher direction, students will begin to focus on the battery as a significant feature of EV’s. |
| **Curriculum Alignment** | North Carolina Essential Standards 8.P.2.1 Explain the environmental consequences of the various methods of obtaining, transforming and distributing energy.  North Carolina Essential Standard 8.P.2.2 Explain the implications of the depletion of renewable and nonrenewable energy resources and the importance of conservation. |
| **Learning Outcomes** | Students will explore electric vehicle websites (Nissan Leaf and Tesla) to gather information on the similarities and differences between electric and gas-powered vehicles. Differences will be categorized, noting that the battery is a significant difference. Students will generate a class list of ways that powering a vehicle with a battery is different from powering a vehicle with gasoline. Finally, students will synthesize their understanding into a written paragraph explaining the main differences between regular and electric vehicles. |
| **Time Required and Location** | Block schedule (60-90 minute classes) 2-3 consecutive days needed.  Traditional schedule (45-60 minute classes) 3-4 consecutive days needed. |
| **Materials Needed** | 1. I notice/I wonder chart sample (1 per student)  2. Graphic organizer (T-chart, Venn diagram, Double bubble, or other suitable for comparing and contrasting (1 per student). See supplemental resources section for link to a graphic organizer site.  3. Computer and internet access  4. Class EV differences chart  **Technology resources**  1. Computer and internet access for pairs or groups of four students.  2. Access to these websites.  <http://www.nissanusa.com/leaf-electric-car/index?dcp=ppn.epid!.&dcc=ecid!.eaid!#/leaf-electric-car/>  <http://www.teslamotors.com/> |
| **Participant Prior Knowledge** | To assess prior knowledge, brainstorm with students about hybrid or electric vehicles. This can be done orally by asking the question, “What do you know about hybrid or all electric vehicles?” and discussing responses. Another option is to pose the question in writing and have students write for 1 -2 minutes before sharing responses. The goal is to simply get students thinking and talking about hybrid and electric vehicles. The discussions can serve as a segue way into the exploration. |
| **Facilitator Preparations** | 1. Make sure that you have access to computers with internet access for student use. (Ideally pairs of students have a computer, but one computer to groups of 4 will work.)  2. Make sure that your school’s internet filter will allow access to websites used in the lesson.  3. Create a sample “I notice/I wonder” chart as a model for students. You may want to include several example entries as models for students. See attached “I notice/I wonder” chart for reference.  4. Select and prepare a graphic organizer that supports comparing/contrasting. (Good choices are T-charts, Venn Diagrams, or Double-Bubble charts.) Each student will need one. Copy for students or prepare a digital copy for student reference. See supplemental resources section for a link that can provide samples.  5. Access and become familiar with the websites students will be using.  <http://www.nissanusa.com/leaf-electric-car/index?dcp=ppn.epid!.&dcc=ecid!.eaid!#/leaf-electric-car/>  <http://www.teslamotors.com/>  6. Assign pairs of groups to a website to explore. (About half the groups should explore the Nissan site and the other half should explore the Tesla site.)  7. Prepare a chart called EV differences chart. Use this to collect students’ answers in the Content Wrap Up section. See attached sample. This can be on chart paper, copied for students, or prepared electronically. |
| **Activities** | To assess prior knowledge, brainstorm with students about hybrid or electric vehicles. This can be done orally by asking the question, “What do you know about hybrid or all electric vehicles?” and discussing responses. Another option is to pose the question in writing and have students write for 1 -2 minutes before sharing responses. The goal is to simply get students thinking and talking about hybrid and electric vehicles. The discussions can serve as a segue way into the exploration. |
| **Assessment** | Ask students to answer the following question in writing. What is the biggest difference between EV’s and gas powered vehicles? Be sure to support your answer with at least 2 reasons that you explain. Use complete sentences.Rubric for grading.  |  |  |  | | --- | --- | --- | | Above Expectations | Meets Expectations | Below Expectations | | Identifies battery as significant difference and gives reasons. Supporting details reference website or class discussions and make connections to real world. | Identifies battery as significant difference and gives reasons. Supporting details reference website or class discussions. | Does not identify battery as significant difference or cannot give reasons to support ideas. Shows misunderstandings such as looks of car as being most important. | |
| **Critical Vocabulary** | Electric vehicle—vehicle that is powered by battery and not gasoline  Emissions—gases released from burning fuels.  Charge—amount of energy found in a battery  Charging station—device for recharging battery with electricity  Battery—two or more connected cells that produce electric energy. |
| **Modifications** | Use cooperative grouping to support ELL or learning disabled students in reading of the text found on the websites. You can also provide a printed copy of the class’s EV Battery Differences chart to students with note taking limitations if necessary. For more gifted students, extend the activity by asking them to research hybrid vehicles and compare their differences to EV’s. Gifted students can also research other EV websites to gain more information to share with the class. |
| **Alternative Assessments** | Rather than writing a response to the assessment, students can orally give you their answers or can draw a picture to support their answers. Another option is to provide a CLOZE paragraph frame to support thinking.  Example of CLOZE frame: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the biggest difference between electric vehicles and gas vehicles. This is because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Another reason for the difference is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| **References** | The Nissan Leaf websiteis very is very detailed. Take the time to go through it in depth. The FAQ’s deal with many questions that consumers have about the implementation of electric vehicles. You can also download the brochure to have printed materials for students.  <http://www.nissanusa.com/leaf-electric-car/index?dcp=ppn.epid!.&dcc=ecid!.eaid!#/leaf-electric-car/> |
| **Supplemental Information** | Ideas for graphic organizers (comparison/contrast and others)  <http://my.hrw.com/nsmedia/intgos/html/igo.htm> |
| **Comments** | This lesson serves as an introduction to a webquest unit that will explore the implications of electric vehicles. By the end of the unit, students will understand battery basics and explore lithium ion technology, plan daily and vacation trips in EV’s while accounting for charging needs, calculate electricity needs and costs, map charging station needs, and make a personal evaluation about electric vehicles. Students will also be challenged to utilize engineering principles by incorporating an alternative energy based improvement to electric vehicles. |
| **Author Info** | Melaine Rickard  Turrentine Middle School, Alamance Burlington School System, Burlington, NC 27215  Grade 8 ELA and Science  19 years experience  NBCT in Science, AIG certified  This lesson was developed as a result of an externship experience with Dr. Lisa Grable, Precollege Education Deputy Director of the Science House. Dr. Grable directs the Young Scholars and Research Experience for Teachers program at the FREEDM center at NCSU. This program is sponsored by the NSF and gives students and teachers the opportunity to learn about renewable energy. My experiences included hands on activities at the Science House and FREEDM center, job shadowing of scientists and engineers, field trips to laboratories on NC State’s campus, and visits to industry sites such as Shearon Harris Nuclear Plant, UNC Cogen plant, and Progress Energy.  This lesson represents the fundamental understandings necessary to begin to think critically about energy choices and meet the demands of energy needs in the future.  For more information about the Science House of the FREEDM Center, go to <http://www.science-house.org/index.php/outreach-projects/freedm-outreach> |