Alternative Fuels Activity and the Socratic Method

Alexandria Suchy-Mabrouk, Depaoli Middle School
Grade Level – 7th Grade

Objectives

- To show students that all technologies have advantages and disadvantages.
- Have the students discuss those advantages and disadvantages together with respect.
- Initiate a dialog between students based on common scientific research.
- Introduce the topic of Global Climate Change using relevant, recent news.
- To engage students who otherwise would be behavior problems or shut down.
- Get students used to journaling and alternative assessment methods.

Concepts

One concept is how to determine if something is a fact or if it is an opinion. When students read the text for the second time they had to decide which parts were facts and which parts were opinion. Another concept is student communication of their ideas. Students had to discuss if using ethanol was ethical during the Socratic seminar. The last concept is to determine if students could explain the costs and the benefits of technological advances. They are to discuss these advantages and disadvantages during the Socratic seminar and write their responses to their questions in their compositions books.

Nevada Science Standards

There are two science standards explicitly addressed during this lesson. The first is N.8.A.2, which states that students know how to critically evaluate information to distinguish between fact and opinion. The second is N.8.B.1, which states that students understand that consequences of technologies can cause resource depletion and environmental degradation, but technology can also increase resource availability, mitigate environmental degradation, and make new resources economical. The lesson may be adapted to include more specific scientific concepts and ideas.

Basic Procedures

This is a good lesson to teach in the first month of school during what will be the first science class for many seventh grade students. Many of these students will not have a lot science background and few, if any, will be aware of the inquiry process inherent in the methods that this lesson focuses on. It is up to the teacher recreating this lesson to study the Socratic Method, familiarize themselves with it fully and decide exactly to what extent they wish to detail the procedures and lesson concepts with the students. See Appendix for information about Socratic Methods by Heather Coffey.

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The first part of the inquiry process is questioning and theorizing and will be mostly teacher led. Tell the students the question, which in this case is, "Is using corn ethanol wise/ethical?" Students will have no input into the question that was created for this early lesson but future Socratic discussions may be more student-led and designed. After they were told the question, the article is read together as a class. Students pose questions on sticky notes during this time. A common first question written on the sticky notes is "What is ethanol?" Since many students need more background on what ethanol is, this ties in with the idea of inquiry. So show a short movie on where corn ethanol comes from and how it is produced. If time permits allow students a day in the library or computer lab to produce short presentations on ethanol.

Students are to form their own hypotheses and to answer the sticky note question. Have them write their hypotheses down in their notebooks before reading the article for a second time. In order to investigate their hypothesis by reading the same article for a second time, directed the students to underline portions of the text were facts and which portions were opinions using different color pens or highlighters.

Initiate a discussion about which parts they will be using to their support or disprove their hypotheses. As a class have them decide which facts should be used to form their own opinions, not other peoples' opinions. For the analysis of their data (the article text) pose some questions to them: "What are some consequences if we stopped using ethanol?" and/or "What are some consequences if we continue to use ethanol?" These types of questions are designed to help the students analyze their research and organize their thoughts. The students write their own responses in their science journals and reference which lines in the text they used to formulate their answers.

The lesson at this point can take on the character of synthesis-learning. More direct questions can be posed like, "Is it wise to use corn ethanol?" They are to write response(s) in their journals. After finishing writing their response in their journals they are to read their response(s) to their shoulder partner. Initiate another class discussion of the question using a Socratic seminar. During the dialogue, ask only the initial question. If students begin to stray or add too many of their own opinions stop them and ask them to find a portion of the article that supports their position. For the extending theories part, ask students after the Socratic seminar is complete what they would do fix the current crisis that we have with the current laws about ethanol production in the United States. This is asked as a sponge. Students share their responses to the class.

Another learning exercise that can be added is to have students take the list of words that they didn't understand and either guess what the words meant from the reading or look up their meanings. Most likely this second exercise will be done on a second day. They can also keep track of which words were defined using which method and why they decided to use that method.

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Additional questions about ethanol use can be incorporated such as: "What are some consequences if we continue producing ethanol?"; "What are some consequences if we continue to use ethanol?" and/or "Is it wise to use corn ethanol?" As before students are to discuss their answers with their shoulder partner. Students generally begin to understand that issues are not black and white and both sides need to be listened to.

Student Response in Actual Practice

The most overwhelming result of this activity was the way the method of questioning caused student-led, appropriate discussion and that the students really enjoy doing this activity. When told that they had to move the desks back because class was almost over students, even the most unmotivated students, typically ask if they could keep doing the Socratic seminar for just a little longer. The next day students seem interested in when the class can do another activity like this one. An interesting observation is that many of the least motivated students were the ones that were most involved in the discussion or asking other students where the evidence in the text was to support their statements.

Incorporating the Nature of Science Standards

One of the nature of science characteristics is that students know that different people can draw different conclusions from the same evidence. This characteristic was made very clear during the Socratic seminar. Even though all of the students had read the same article they realized that different people had created different conclusions. In the case of this article it seemed mostly based two major points of view. The first is that all humans should have access to cheap food sources and the second that corporations should increase the price of food items. Some students felt that corn shouldn't be used for ethanol because of rising food costs because people would go hungry while others felt that it was good for corporations to make more money because then in return the corporations might make more jobs. Both points of view were represented and all the students respected each other's viewpoints. A second characteristic in the nature of science is being able to distinguish between fact and opinions. Students had to determine which parts of the

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article were facts and which parts were opinions. They had to underline the two categories using different colors.

After they underlined the article independently they compared their results with their shoulder partner's results. Any discrepancy between the two had to be resolved and they had to come to a consensus about which lines represented facts and which represented opinions. Then, as a class discussions regarding which they should be using to create and develop their own opinions: facts or opinions. A third characteristic in the nature of science is risk and benefit. Students realized that using corn ethanol has benefits for our society and but it also has many risks.

During the Socratic seminar and when they wrote in their compositions books they were asked to respond to questions that brought this to light. Students realized, and it is evident in their work, that there were good things about using corn to make ethanol, such as the fact that people are employed by the corn ethanol industry, and also bad things, that food prices were going up. This was also a majority of the conversation that took place during the Socratic seminar. Students respectfully discussed the issues surrounding corn ethanol, which included the ones already stated, clean energy, becoming less dependent on foreign fuel and a worldwide hunger crisis.

A fourth characteristic in the nature of science that this lesson addressed was ethical behavior. At the end of the Socratic Seminar students had to decide if using corn ethanol was ethical or wise. They had to write a short response to that question in their journals that is read later on. Their responses will generally demonstrate that they had a deep understanding of how complex the issue of using corn ethanol is in the United States. Some students even try to come up with solutions to the problem. Many of them will suggest that instead of having a strict law such as the one currently in place about how much of the United States' corn harvest must be converted to ethanol that we should instead have different standards based on how much corn is grown. The larger the amount of corn produced the more ethanol that should be made and if the corn harvest is small, like this year, then the amount of corn used to make ethanol should decrease. These are only a few of the results teachers can expect when using this method

Differentiated Instruction

Differentiated instruction addresses both how students receive the information in this lesson and how they are able demonstrate comprehension of the topic. Students received the information using many different techniques. Two of them specifically are of value for this lesson outline. The first is using a method called close reading. During this students first read the article out loud together. They know the question that they will be answering in the end (for this activity: "Is using corn ethanol ethical or wise?"). During the reading they can write down any questions they have or vocabulary words that are unclear to them. These are collected on sticky notes on the board and looked over. The instructor can decide where to go next based on the feedback. The

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next time they read the article they do it silently and they are asked to underline anything that was a fact with one color and any opinions with another. The second way for them to gain knowledge about the topic was a short video about how corn ethanol is made, what it is and some of its uses. The feedback obtained from the students helps the instructor to formulate the questions used to help prepare them for the Socratic dialogue. Students were given two different ways to process the information. The first was independently. Students were asked to answer three questions alone. After they had about twenty minutes to answer the questions alone they read their responses to their neighbors for help clarifying their point of view. Instructors are to make sure that they are trying to convince their shoulder partner that their view is correct. They were only supposed to use to the time to clarify their responses to the questions. There were two products that students had to produce. The first was being part of the Socratic Seminar and the second is their written response. Between the two all learners are able to develop a very strong understanding of what were the main issues facing corn ethanol use in the United States and that between one of those two method students had an opportunity to demonstrate whether or not they had a clear understanding of the issues.

Assessment Strategies

There were many different ways they were assessed during this lesson beginning with very informal to more directed assessment to a writing essay exam. After reading the article for the first time students got to write questions that they had or vocabulary that was on clear on sticky notes. These sticky notes were anonymous so students could ask anything they liked. The second way to assess their learning was by looking at the underlined articles. They had to underline which parts of the article were facts and which were opinions. These can be quickly scanned for accuracy and completeness with appropriate grade assigned. A third way to assess them would be to grade their responses to the questions in their journals. Reading through their journals and to see what they were able to comprehend from the article is most likely the best way to ascertain learning. Using the Socratic seminar itself as a basis for grading is authentic and effective. Students were part of a student led discussion, where the purpose was to decide if using corn ethanol was ethical or wise. Setting up appropriate and fair rubrics will allow the instructor to make quick and accurate assessment. The final assessment was on their test where they were supposed to describe one benefit and one risk associated with corn ethanol. This wide range of assessment is both varied and in-depth. Conclusions about their understanding of the topic are assured by using two or all of the suggested methods.

Additional Information for Instructors

Journal entries made by students are the 21st century version of portfolio assessment. Specifically, start them on journaling the first day of class. Set up guidelines appropriate to grade level and subject matter.

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A second important aspect of this activity is the shoulder partner's evaluation during the Socratic seminar. They are labeled as student #1, student #2 and student #3. For a real life example, student number #1 makes the point in their answer that the United Nations is predicting a food crisis and thus we could have more corn to eat if we stop making ethanol all together. They tried to make a connection to this fact and the actual price of corn, which is not a clearly formed thought. Their evaluation for the Socratic seminar is favorable and they were very involved and clearly participated in the dialogue. Student #2 has stated some consequences of what will happen if we stop using corn and referenced which lines in the article support their stances. The writing however is choppy and not clearly formed ideas. They appear to not have participated during the dialogue at all other than listening to others speak. Student #3 has one idea stated but hasn't backed up their opinion with any facts from the text. They were active participants during the Socratic seminar and were able to communicate their point of view and use the text to support their ideas during the dialogue. Working together like this with this type of partnership increases the level of communication and participation. Most instructors will be very impressed with the level of thought and consideration that students put into the Socratic seminar.

Some students will not perform as well during the journal assignment but many of those same students will able to talk about their answers on the test in a fully formed and well-articulated manner. Allowing the many avenues for expression and self-assessment will give students the freedom to take risks and share ideas more genuinely than if more traditional approaches by way of teacher-directed, guided learning methods are employed.

Using the assessments, particularly the first one with the sticky notes, to really guide how the lesson was taught was an effective way to not only begin, but to get students used to the idea that they were being assessed but keeping the focus on production of ideas and expression. Instructors who put in the time and work within the basic construct of this method will be pleased and enlightened. Students love the Socratic seminar and really blossom when given the opportunity to study and learn in this fashion. In many classes observed it was noted that the students didn't want to stop and behavior problematic students were well engaged. Most students ask when they can do the next Socratic seminar. Try to include one Socratic seminar per quarter during a standard school year and please let share your results

Please share your comments about successes with this method with Alexandria Suchy-Mabrouk, c/o Depoali Middle School, 9300 Wilbur May Parkway, Reno, Nevada 89521, 775-852-6700 or by e-mail: Alexandria Suchy-Mabrouk <asuchymabrouk@washoeschools.net>

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