Assessing Nuclear Energy Assignment

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Grade: Chemistry (10/11)

Standards:

NGSS:

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

NGSS Crosscutting Concepts:

Energy & matter: Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

Stability & change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

NGSS Science & Engineering Practices:

Asking questions (for science) and defining problems (for engineering)

Analyzing and interpreting data

Constructing explanations (for science) and designing solutions (for engineering)

Engaging in argument from evidence

Obtaining, evaluating, and communicating information

ISTE Standards:

3d. Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

6a. Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.

6c. Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

Before Lesson:

Students will receive an article on nuclear energy listing several of the pros and cons. They will be told to read and annotate the article for the following day. (http://www.conserve-energy-future.com/pros-and-cons-of-nuclear-energy.php)

During Lesson:

1. Students return to class and the reading is discussed.
2. Students pick sides, either pro or anti – nuclear energy based on the reading provided and prior knowledge and personal opinion.
3. Students are grouped into trios (give or take based on the amount of students on each side) and are asked to create artifacts that defend their choices. They will need access to laptops, tablets, or any type of computing devices with the internet and time (1-2 days perhaps). Students will be provided a clear rubric (document attached). Some artifacts are listed below.
    - Online blog post
    - Video on vimeo
    - Podcast
    - Article or brochure
    - Presentation (PPT, google slides, Prezi, etc.)
4. After given enough time and guidance, students will be asked to present their artifacts for or against nuclear energy to the class. Emphasis will be placed on good presentation skills. Other groups/students evaluate and draw conclusions from the presentations.

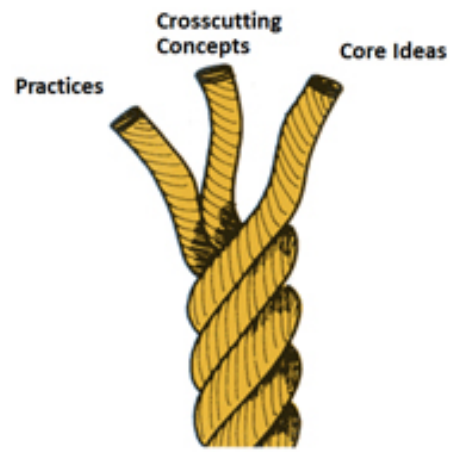
Assessment:

1. Students artifacts and presentations will be scored on the 18-point rubric.
2. Reflective questions will be placed on the assessment for the unit to look for retention and depth of thought.

Lesson Reflection

Background/Rationale:

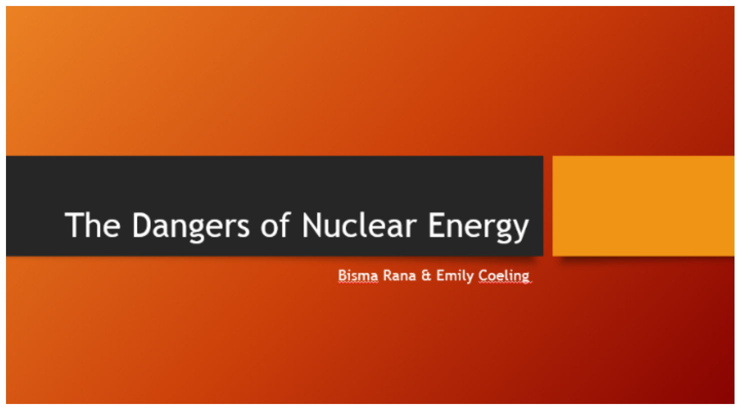
The Next Generation Science Standards (abbreviated NGSS) have been widely accepted as the new way of educating students in science. While these standards are incredibly rich and complex, they also pose a variety of challenges for science educators. Some of these issues include a changed focus away from physical sciences and towards Earth and space sciences, and an increased focus on technology. These core ideas (content specific information) have been enriched with the inclusion of scientific and engineering practices and cross-cutting concepts which aim to tie the various topics in science together, and provide students with authentic learning experiences. When used together, NGSS describes these three components as 3-dimensional learning. Learning that is consciously developed to be coherent and tell a story. Learning that gives students the opportunities to explore like real chemists, build like real engineers, and discover truths about the world like real physicists. This 3D way of educating students is shown at right conveyed by the image of a rope. All of the 3 facets of a student's science education are woven together into one coherent and strong experience. This new way of thinking is difficult for many educators to accept. Many teachers are not prepared to "give up the reigns" and allow students to truly explore. To make things more difficult, Michigan has adopted Michigan Science Standards (MSS) which essentially take the content standards and leave it up to individual districts and educators to include the cross-cutting concepts and the scientific and engineering practices to their own levels of depth. What this does is replace a list of standards, most of which agreed were too long and ineffective, with a short list of standards that are generally vague without any type of support or depth. It reduces the rope pictured above to a single strand of twine; not strong enough to support much weight. It is our job as science educators to use NGSS and MSS, as well as a variety of other sources and educational ideas to create lessons that are meaningful for our students and embrace what it means to embrace the nature of science.



So it is from this point that I set out on my journey to make sense of the "mess" previously described. As someone who teaches primarily chemistry, and with a chemistry major, I really wanted to look at standards in this subject to create something interesting. In chemistry though, we face a lack of standards. As one of my coworkers recently said, we could easily make a two-year class out of biology and teach chemistry in about a month with what we have been given. In my district (Troy Schools) we are using AP standards that the AP curriculum says a chemistry student should know prior to entering the course in order to "flush out" a yearlong course. Added difficulty comes from not only the lack of standards, but the peculiar nature of the standards that we do have, including many on material properties and nuclear chemistry. We as a department are not incredibly well versed in these topics, and many of them have not been taught before in our classes. These topics also are difficult to teach in a lab setting as students don't readily have access to nuclear reactors or high powered microscopes. In addition to these standards, we are also hoping to implement as many of the engineering standards into chemistry as well which has shown to be difficult to do. Thus, the result was this project which aimed to both create a lesson in a difficult to deal with area of the MSS standards (nuclear chemistry) in conjunction with engineering standards and technology standards (from outside NGSS/MSS). I also wanted to include technology into this project in order to get more use out of the various courses I have taken in the path to my master's degree.

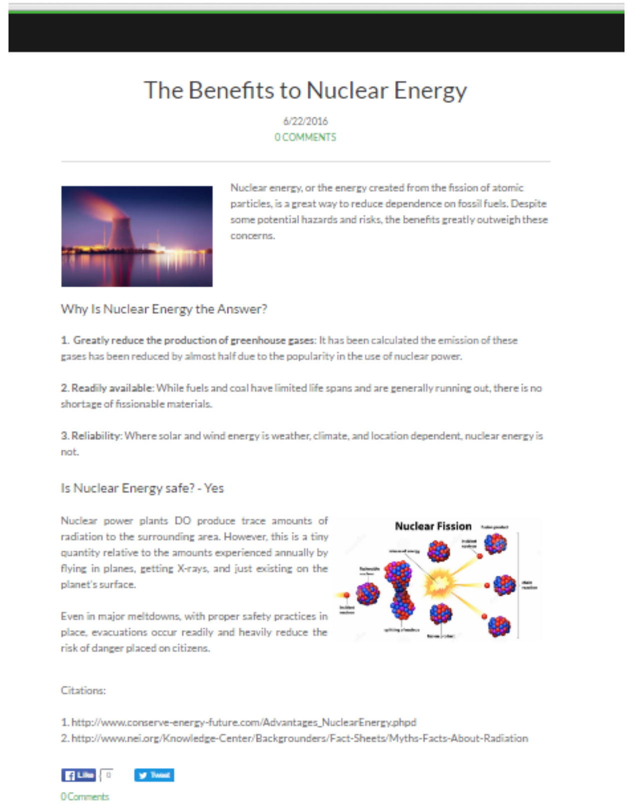
In this activity students are first asked to examine some pros and cons to nuclear energy. It would be my intention to do the heavy lifting of the unit (nuclear reactions and other topics) first and save this for the end. The students would be asked to do this examination by reading and annotating a provided article. A continued hope for our students is that they gain the ability to read and understand scientific literature and draw conclusions from the reading. While seemingly simple, this part of the lesson is vital to developing scientific literacy and helps foster skills needed to be successful on standardized testing, including the SAT. From this reading an in-class discussion would take place. The students would then be sorted into small groups (2-3 students) based on their assessment of the article. The hope would be that they will naturally be divided on whether or not nuclear energy is "good" or "bad". If this is not the case, they will be put into groups in order to have a decent blend of ideas. These groups will be asked to produce artifacts which exemplify their beliefs and aim to convince others to join their side. The artifacts could range from simple presentations to more complex blog posts or videos. While more "classic" projects such as newspaper articles, or trifold brochures would also allow for the information to get across, it seems far more logical to embrace new forms of technology and have the students use those instead. After providing ample time to construct the artifacts, students will give short presentations on what they have created.

Student Trial Reflection:



Due to the timing of this project (at the end of the school year) I was only able to get four students to help me test this out. To be truthful I felt somewhat guilty taking up their time before finals to begin with. Bisma Rana and Emily Coeling were two of my top students this year. Both students were above grade level in terms of the quality of their work and their scores at the end of the year. The work that they did on this was definitely something I was hoping my students would create. Their position was to defend the dangers of using nuclear energy. The artifact that they chose to make was a PowerPoint. They took some serious time to discuss a few different situations where nuclear energy became a problem, and did some analysis comparing the cost of operation to other forms of energy. I felt that it was this analysis that best hit the mark in regards to looking at solutions to a real world problem (as the standard spells out). Their materials were thorough and insightful, and their presentation added quite a bit even though they did read from their slides more than I would have liked. I also thought that it was the easy way out of creating an artifact using a medium they were more comfortable with. If they were to ask for any particular feedback it would be that they could have gone outside the box in regards to how it was created.

Jomar Noceda and Bellamy (Isabella) Seraphinoff, two of my other chemistry students took the opposite viewpoint. Both of these students were also at a higher level than most of my regular chemistry students, although both struggled with various topics during the year. Jomar, although a very successful chemistry student never quite enjoyed the content despite incredible success. Bellamy on the other hand enjoyed the class more, but struggled with some of the topics and her various health concerns. This group chose to go in a different direction and received more mixed results overall. The first major difference between their work and the work the other group did is that they chose to display their work on Jomar's school portfolio. The official method of display was in the form of a blog post. I really enjoyed this because it was a more creative spin than just a typical presentation. It also felt like there would be more creative options if expanded upon, and it was more useful for sharing because it was easily accessible by the rest of the class. When asked about their choice, they did admit that it would not have happened if he hadn't had the portfolio previously – not all students make them, so this is an obvious challenge that would need to be overcome. Another issue that this group faced was that they were missing a level of depth to the project. This was caused (according to the students) due to being short on time. This did lead to a lower overall score when it came to grading them with the provided rubric. I should note that although completed grading sheets are attached, I only offered these four students a small quantity of extra credit for participating – I did not actually provide them these numerical grades.



The Benefits to Nuclear Energy

6/22/2016

0 COMMENTS

Nuclear energy, or the energy created from the fission of atomic particles, is a great way to reduce dependence on fossil fuels. Despite some potential hazards and risks, the benefits greatly outweigh these concerns.

Why Is Nuclear Energy the Answer?

1. **Greatly reduce the production of greenhouse gases**: It has been calculated the emission of these gases has been reduced by almost half due to the popularity in the use of nuclear power.

2. **Readily available**: While fuels and coal have limited life spans and are generally running out, there is no shortage of fissionable materials.

3. **Reliability**: Where solar and wind energy is weather, climate, and location dependent, nuclear energy is not.

Is Nuclear Energy safe? - Yes

Nuclear power plants DO produce trace amounts of radiation to the surrounding area. However, this is a tiny quantity relative to the amounts experienced annually by flying in planes, getting X-rays, and just existing on the planet's surface.

Even in major meltdowns, with proper safety practices in place, evacuations occur readily and heavily reduce the risk of danger placed on citizens.

Nuclear Fission

Citations:

1. http://www.conserve-energy-future.com/Advantages_NuclearEnergy.phpd
2. http://www.nei.org/Knowledge-Center/Backgrounders/Fact-Sheets/Myths-Facts-About-Radiation

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Overall I was pleased by the work and creativity my students put into this project given limited time and resources. Most of the bumps or lack of detail came primarily from the inability to actually do the project as intended during the school day with my guidance. There are several things however that I am still musing about before doing this with a large group in the fall. First, I quickly realized that if I want students to use technology to make these artifacts (more so than a simple slideshow) I will need to motivate them to do so and provide them ample support. I feel that in many cases, students do not know what types of tools are out there, and truthfully, my knowledge is also quite limited. In regards to using Weebly to create a webpage or blogpost, just like what Jomar and Bellamy used, I know a decent amount, but not enough to truly help students create quality products. In order facilitate my students' learning on this front I plan on meeting with our media center specialist in order to discuss and plan things out a little more thuroughly. Just after we completed this project test-drive, she showed me an online research database the school has access to that has a specialized place of just resources on nuclear energy which I had no idea existed. If I cannot be trained adequately on all of the technological aspects available, this work will be done in the computer lab with her presence. With an increased focus on the variety of artifact creating tools, and better support I feel that my students should be able to better take advantage of more courageous methods of sharing their ideas.

Second, although I feel my rubric is detailed, it would benefit from more active discussions with the students before the project. For example, when looking at the artifacts it became clear that they were weak at deciphering what qualitative and quantitative data really meant, and how to use it to support their arguments. They felt that it was easy to find a lot of good information,but they were not sure which pieces they should use and why. When giving out this project I will give a more detailed overview of the rubric and provide better support in the creation of their arguments. In order to do this successfully I may also take some time to wander across the hall and into the English department. When it comes to writing, making arguments, and performing online research it seems like collaboration with more experienced individuals would make a substanical impact on my work with my students. Another idea could be to create a sample on a different topic to model the technology and the quality of work. Finally, assuming that this type of work could be done again in the future, I would add a component to the end where the studnets examine and grade several of the artifacts themselves in order to find comonalities and see how they could improve their work for the next time.

After running through the lesson I asked my students for feedback on the project. I did this in a very nonscientific way, by just meeting with them briefly after they presented their artifacts to disucss their feelings and thoughts. In general they liked the freedom that this project allowed for. While the group that did the online blog post admitted that it would have been easier, and therefor better, to just make a presentation, it was still a more interesting approach than just writing an essay or paper. The students were mixed on the relevance of the work. While they noted that it was more applicable to everyday life and their lives, it was not incredibly dynamic to just research and present what was already done online. The overall opinion was that the project was better than notes or packets of work, but not nearly as enjoyable or interesting as being in the lab. This is a problem that I see with the new standards – they don't all mesh well with work done in the lab. They also felt that it was "easy" and ultimately thought that it was more of an English-type research project than anything else. I am still conflicted about this, as the goal of the project was to look at a larger idea in science. However, at the same time, students are not able to do any actual design or building with this, so we are stuck with surface level analysis and argumentation. The project does in fact get to the heart of several of the standards presented though, so ultimately it is one that should be considered for use.

If there is anything I have learned through this process it is the importance of good curriculum. Using NGSS as the jumping point definitely will be vital in creation of new curriculum, but what truly makes them interesting and more effective are the cross-cutting concepts as well as the science and engineering practices that the Michigan Science Standards have left out. As chemistry teachers in particular, we will need to find a careful balance between the standards layed out by NGSS and the inclusion of our own to supplement and guide our students. For example, in order to reach the goal of understanding Le Chatlier's principle we will need to still teach reactions, and in order to teach reactions we will need to teach chemical formulas. Chemistry is not totally going to vanish overnight. Modeling, visible thinking, project based learning, and a variety of other tools will allow us to achieve these goals in a way that is dynamic and exciting. Do I think that a research-type project is the way to teach everything in chemistry? No. However, through projects like this, teachers can access real-life ideas, show students differeing viewpoints, different types of teachnology, and expose them to the importance of gathering and relaying scientific information. These skills are incredibly vital for students to have when defending their own work in the lab, and this activity is a great training excersize for when more intense laboratory experimentation comes later in the year. While we still have a long way to go, I consider this lesson another important step towards a total embrace of these new standards and this amazing way of teaching our studetns science.

Citations:

Three Dimensional Learning. (n.d.). Retrieved June 22, 2016, from http://www.nextgenscience.org/three-dimensions

Standards by DCI. (n.d.). Retrieved June 27, 2016, from http://www.nextgenscience.org/overview-dci