

The possibilities for high school science assessment resources completely online that develop higher level thinking skills are limited. My prior experience with webquests was poor. They seemed to require more time than necessary and often strayed from the desired content leading to more time loss and confusion for the students. So, I am working with a site that offers students tools and information in conjunction with offline activities / lectures. Ultimately, students are being required to use their gained knowledge to judge the health of different ecosystems using digital cameras, satellite imagery, computer analysis tools, and laboratory investigations. The study is taking place over several weeks as the students judge the color changes in areas over time.

<http://mvh.sr.unh.edu/index.htm> - Measuring Vegetative Health (MVH) from the University of New Hampshire (UNH) – This website offers interactive tools / simulations for students to understand light and the way scientists use light to measure ecosystem / plant health. There are a series of lessons, activities and free, downloadable programs that can be run offline. The website offers background information on the topic that students can use to familiarize themselves with the material. The material can be applied to any level of learning from grades 5 through 12 depending on the additional instruction.

Learning objectives / outcomes:

Maine Standard D3c – Matter and Energy

- Students will understand the how atoms absorb and emit energy as light.

Maine Standard E2 - Ecosystems

- Students will understand the role of light (energy) in photosynthesis.
- Students will understand the additive properties of light and deductive properties of pigments with respect to color.
- Students will understand the distinction between absorbance and transmittance of light and its role in plant health.
- Students will understand how to collect data and judge the health of an ecosystem using light and technology.

NETS-S-8

- Select and apply technology tools for research, information analysis, problem solving, and decision making in content learning.

Student engagement:

*Cognitive Processes*

Students utilize the online material to develop a foundation of understanding about light and plant health. This sites information and simulations in conjunction with my lessons offers students information in the Comprehension realm where they gain basic terminology and an understanding of how that terminology can be applied to a problem. They then advance this to higher level thinking by judging plant and ecosystem health using the new tools available to them. Students are challenged to define a region to study and devise a way to analyze the health of the region using the new tools. This includes taking photographs using a digital camera, locating satellite images, and taking leaf samples. The students quantify their observations using the spectrophotometer in the lab, the light analysis tools from the website, and Excel as an organizer. The results are then going to be presented in the form of a written lab report later in the term as more data is compiled. The assessment process incorporates student time-on-task, which involves their ability to work effectively with different activities taking place in one classroom. Also, they are being assessed on their ability to find and gather data using technology to analyze a region. Finally, they are being assessed on the ability to develop a conclusion that incorporates empirical evidence. At the end of the lesson, students should have a good understanding of light and photosynthesis, which will be evident in their final products. They will have to explain how light energy is obtained by plants and how that process can be used to predict the overall viability of an ecosystem.

*Social Skills*

Students were required to work in pairs with our 2 students to 1 computer set up in the laboratory. Because of this, they have to take turns and communicate the steps to ensure each person

knows how to complete the tasks. At the conclusion of the course, they will be completing a lab practical that will require them to work with the tools in a new way to solve a problem. The social aspect is not a primary objective of the lessons, but is a consequence of the resources available.

Effectiveness of assessment resource:

This site offers students the ability to interact with the additive property of light to understand how light is transmitted or absorbed to produce the colors we see. Students are able to quantify the different colors into percentages of Red, Blue, and Green using the TriColor simulation. The Mixing Color simulation offers a visualization of the deductive properties of pigment colors and the additive properties of light color. The Vegetation Analysis enables students to compare photographs of plant specimens that they take using a digital camera as well as satellite images that they acquire from the Internet. The tool enables students to quantify the images into percentages of red, green, and blue. They are then able to use a spectrophotometer in the lab to measure the %absorbance and %transmittance of specimens. Some students will be separating the pigments within the different leaves at different times in the season to understand which pigments are active at different wavelengths of light.

In the past, I have done this lesson without the online addition of tools from UNH. I used flashlights, colored pencils, and a spectrophotometer. These items produced interest; however, the MVH digital analysis tools along with the simulations offer students the ability to gain greater understanding of how light behaves. This helped to decrease the time spent trying to explain the difference between pigments and light with respect to color. Also, students were able to interact with more data in a shorter period of time enabling greater reflection on what they were studying. Previously, it would require two groups at a time to work with the spectrophotometer looking at their prepared leaf samples. The other students were engaged in different activities from book work to creation of light combination models primarily as busy work. The online tools allow the students to all be engaged in the different functional processes. While two groups worked with plant pigments in the spectrophotometer, the other groups were engaged in looking at digital images for data. When the entire process is done, the students will compile all of their results into graphs that will show the color shifts through the seasons.

Subsequent lessons will need to have more images from the summer using the picture post for students to analyze. In Maine, there is a relatively short time that vegetation is available for study during the school year. The other change that would benefit the use of this site would be to have students work with non-plant images to start as a group on the SmartBoard. This would let them become familiar with the process of breaking down what they see into RGB. This may shorten the time vs. learning curve.