Bulbous Connectorum

Backward Design Unit Number Two

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Stage One – Enduring Understandings

I've decided to use the same format for my second unit plan. The preceding pieces are so important to my science teaching that they should be stated again. This insures that a reader who may not see the first one can see how my overall pedagogy is constructed.

The term *Enduring Understandings* indicates the knowledge that the teacher would like the student to take with them for the rest of the life. It can also be seen as purpose or underlying meaning – "real reason" students are taking your class.

Every teacher should have their enduring understandings spelled out for their students to see. The students should be able to take any activity done in class and somehow fit them into the matrix these understandings formulate. If this is impossible for either the student or the teacher then the activity should not be done in that class.

With that being said, I must say that I have thought long and hard about what I want my students to really learn from me. Basically, this process has been affirming for my teaching because it has filled my classroom with purposeful activities. So, without further ado, here are the pillars that hold up the temple of science education for me.

1. All students must learn how to examine data and critically think using the scientific method.
2. All students must learn enough science to protect themselves and participate in a democratic society.
3. All students must learn an appreciation for the complexity of nature.

Stage Two - Assessment

Throughout this process, one question has plagued me above all others. How does one assess a student's progress regarding enduring understandings? Assessment of something so broad, yet something so important is a difficult task indeed. The factor that makes this so difficult is the subjective nature of an enduring understanding. Every student could possibly meet the above statements in different, very personal ways.

Therefore, teaching to enduring understandings is assessed most naturally by portfolio assessment. With portfolio assessment a method is created that allows all students to show how they have met the enduring understandings of your class. It allows the students to think beyond rote memorization of details and formulas and forces them to apply the knowledge you have offered to their lives.

The following assessment plan is my prototype for assessment next year. It consists of the following steps…

1. Introduce the concepts of enduring understandings.
2. Show students how portfolio assessment works.
    -Hand out three ring binders
    -Discuss the *Wearing Knowledge* worksheets
    -Discuss the importance of evidence and how it ties into the above worksheet
    -Give students the *Wearing Knowledge* worksheet after every activity.
    -Check portfolios on biweekly basis.
    -Assign grade based on the amount of evidence a student has compiled to show growth.
3. Begin teaching – taking time at the end of each day to discuss the fit of the material to the enduring understandings.

Stage Three – Instruction

This backwards designed unit is designed to teach the concepts of Ohm's Law as well as series and parallel circuits. It is specifically designed for alternative students, giving them hands on experience with the real life principals behind the law as well as its mathematical nature. This unit plan specifically uses the theories of constructivism in its design. Teachers who wish to implement this plan, should study the theory before attempting to do so. The following is a brief description of each lesson as well as their connection to the enduring understandings stated above.

Lesson One – What a Hoser

The teacher begins this lesson by splitting the class into groups and handing out tubes and marbles. Then the teacher instructs the students to stuff the tube full of marbles until the entire tube is filled. Then the teacher instructs the students to put one more marble into the tube and describe exactly what happens. The next step of this lesson requires the teacher to connect what happened during the demonstration to electricity moving through a wire. The teacher may need to review atomic structure with students as well as charges. The concepts of electrical current can be covered easily with the demonstration. If a smaller tube is used, the concept of resistance can also be covered because it will require more force to get the marbles through. The concept of voltage should be linked to the force required to move the electrons in the first place.

This lesson fits the enduring understandings by showing how something as important as electricity is easily broken into understandable pieces.

Lesson Two – V=IR

The teacher begins the lesson by asked the students to create a diagram of the demonstration on the board. Then the teacher makes a diagram of electricity flowing in a wire and asked the students to make a list of similarities and differences. Then the

teacher assigns numeric values to each of the components deriving the V = IR equation. Finally, the teacher hands out a list of problems that students are required to work out in order to practice the math skills involved.

This lesson fits the enduring understandings above by showing students how nature beautifully obeys laws in an elegant fashion. It also shows students how to fit their observations to theory.

Lesson Three – Connect the bulbs

The teacher begins the lesson by breaking the students into groups and handing out the following equipment. One flat wooden board, ten push pins, ten end stripped wires, one nine volt battery, and three light bulbs. Then the teacher shows the students how to light a light bulb by connecting a circuit. Then the teacher asks the class to come up with five different ways to light the bulbs using one or more of the bulbs. The students must note the structure of their circuit and its effect on the light bulbs. The teacher must make an effort to direct students into constructing a parallel and series circuit without directly telling the students that is what they are doing. The teacher must make a big deal about the effect a series and parallel circuit has on light bulbs. This lesson may take several days.

This lesson fits the enduring understandings by giving students direct experience with hooking up electrical circuits. This lesson also gives students direct practice with observation and questioning – both important parts of the scientific method.

Lesson Four – What the Heck! Intellectual Disconnect.

For this lesson, the teacher asks the student groups to create the circuits that created the intellectual disconnect from the day before. They should construct a parallel and series circuit with the light bulbs. Next the teacher should ask the student groups to come up with an explanation for the phenomenon they are witnessing that uses voltage, resistance and current. The teacher needs to be prepared to explain how a light bulb works – showing how it compares to a resistor. Each group must present their results to the class.

This lesson forces the students to apply the theory to their observations testing their understanding of concepts presented in order to alter their state of disequilibrium. It fits the enduring understandings by teacher critical thinking skills and basic science understanding.

Lesson Five – Series and Parallel

The teacher begins this lesson by handing out the materials listed above. Then the teacher instructs the students to create the circuits outlined on the board. When all of the bulbs are lit, the teacher must fill in any gaps in understanding from the day before. If the connection between light bulbs and resistors hasn't been made yet, then it needs to be. Next, the teacher needs to show the mathematical relationship between the resistors in the

circuits, giving the students a worksheet to practice the equations with problems. The teacher then hands out a *Wearing Knowledge* worksheet prompting students to make the connections to the enduring understandings on their own.

This lesson fits the enduring understandings by showing students that the phenomenon they witness is predictable using mathematical means. It gives students an opportunity to practice the math involved and it gives the students the opportunity to fill in any gaps in their knowledge regarding Ohms Law. This lesson is also an assessment of the students understanding of Ohm's Law as well as their growth in regards to the enduring understandings.