2009 AAAS/Subaru Essay Writing Competition for K-12 Educators
Finalist Essay

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Grades 10–12

Amazing School, Amazing Students

It's amazing. My school, I mean. You see, A. Linwood Holton Governor's School (ALHGS) is Virginia's first virtual school, perhaps the first one in the country. All of my students log into my classes via the Internet from their home high schools or in some cases from home.

I was asked in 1998 to leave my position as assistant professor at East Tennessee State University to join the staff at the Governor's School. I had just gained tenure, too. It was a tough decision, but I am glad that I decided to go with ALHGS. When I discovered that I would provide a challenging curriculum to students in many geographically isolated areas of southwest Virginia, I knew it was the thing to do. I realized I was treading on new ground; this was a first in education. I am able to provide classes in engineering, robotics, astronomy, and physics to these students.

Let me try to explain how this works. Most of us are familiar with synchronous learning where a learner and instructor are in the same place at the same time. Synchronous Web-based learning uses the World Wide Web. That is what I do. In this way, I can reach students in small rural schools that don't offer physics or astronomy. We experience classroom interaction in a virtual environment. Instruction via PowerPoint slides is distributed to many locations but occurs through real-time (simultaneous) interaction between students and me. Synchronous learning systems are used to deliver this type of learning. These software tools have a number of common characteristics and features: browser-based, two-way audio, collaborative application viewing and sharing, whiteboard, synchronized Web browsers, and online testing. Students also receive CDs of the PowerPoint slides, all assignments, and materials at the beginning of school orientation. Each of my classes is archived every day so that if a student misses school, he/she can always go to our website and download the lesson that was missed. By the way, you ought to visit the A. Linwood Holton Governor's School site to see our course offerings. I also have a supplemental website.

We have about 350 students enrolled this year and serve 42 high schools in 14 school systems. Many of the rural schools in our region are very small, some with populations of 200 students. This limits the course offerings. So, I feel really good about being able to provide opportunities for these gifted and talented students. However, there's more to my classes than virtual experiences.

I like to get my students involved in classroom activities that are relevant, fun, and exciting; something different that they haven't done before. There are many, but I can talk about only a few here. Since our school is very close to Bristol Motor Speedway, I thought it would be interesting to have our own race, the Mousetrap 400, somewhat analogous to the Sharpie 500 race at Bristol. The

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students could use only the materials that I had given them during orientation: four wheels, one small piece of balsa wood, a mousetrap, glue, and a string. The goal was to be creative in building the car. Two students even developed a four-wheel drive car. Prizes were given to students whose cars finished the 400 cm race in the fastest times. Students determined the average speed and acceleration of the cars. See the photos on: Dr. Rapp's World of Physics and Astronomy. One student saw the relevancy: "This was the most fun I ever had doing a lab. What a cool way to learn about speed and acceleration! Race day was really exciting. I see the physics in this lab."

We have a small airport in our community, so I thought an aeronautics lab would be relevant. I learned that I had one student that was taking flying lessons! My physics students had to construct a model airplane from a kit and then learn how to make the airplane fly in a circle. They had to find the time and distance for one revolution and then calculate the speed and kinetic energy of their plane. All students were successful and thrilled about seeing their plane sail off into the wild blue yonder. Student's learned a lot: "This was a pretty fun lab, despite all the measurement and calculation. It was a good application of conversion and of various formulas. Even though I thought the glue would never dry and that I'd break every stick before completing my plane, the little thing pulled through and flew pretty well. It was a good lab for the end of the year, since it was more fun than actual work. It was a relaxing way to end the course." "I learned many things in this lab. First of all, I learned how to build an airplane with simple materials. I learned how an airplane flies, how to calculate kinetic energy, and how to find the average speed. I also learned the physics involved in flying airplanes. This lab was very interesting and fun. I enjoyed doing it."

During the last three years, I have helped two teams of students submit research proposals to use the world's largest solar telescope at the Kitt Peak National Observatory (KPNO) in Arizona. Both teams were successful in their submissions and received an all-expense paid trip to the KPNO. They were able to work with two astronomers in completing their research. The last group of students was interested in calculating the sun's rotation rate at different latitudes as well as studying the relationship between sunspot size and the strength of the magnetic field. The students were learning about science just like a scientist does. They had questions and used scientific inquiry to find the answers in a very authentic learning environment. Both teams were successful in completing their research, including publication of their work. Here are comments from the students (excerpted from their paper, The Effect of Sunspot Size and Latitude on Magnetic Field Strength in Sunspots): "We were 1,941 miles from home and 6,875 feet above sea level before we realized it was not just a dream. After researching for hours, writing a proposal, and conducting a few teleconferences, we were really at the Kitt Peak National Observatory. We were two students standing on a mountain made for research. A once-in-a-lifetime opportunity stood before us, and we took full advantage of it. Our purpose was to research sunspots on the world's largest solar telescope in hopes of learning more about the world of science."

Another project began because students had questions about the Milky Way galaxy. They wanted to know if the Earth was located in one of

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the spiral arms of the galaxy and if the galaxy was rotating. I suggested that we find the answers when we travel to the National Radio Astronomy Observatory on our annual field trip. Students gathered over 50 sets of data concerning the motion of hydrogen in the galaxy using a radio telescope. By pointing the telescope at different galactic longitudes and gathering data about the frequency shifts of the hydrogen, students discerned that the Milky Way is indeed rotating. If they detected a blue shift (when the frequency of the detected hydrogen was above 1420.41 MHz), this meant that the hydrogen gas was moving toward Earth. If a red shift was detected, this meant that the frequency of hydrogen was less than 1420.41 MHz, and the gas was moving away from Earth. Students also detected clumps of hydrogen atoms in the Milky Way at periodic intervals. This allowed them to deduce that the Milky Way galaxy is indeed a spiral galaxy and that the Earth is located in one of the spiral arms. The students were scientists for the weekend, collecting and analyzing data, and finding evidence to answer their questions about the universe! This is hands-on, minds-on learning! I believe this is the most efficient and memorable way for students to learn.

This type of learning is also found in my engineering class. I challenged my engineering students to build geodesic domes out of rolled newspapers and masking tape. They were somewhat uncertain if they could accomplish the task but thought it would be an exciting endeavor and a unique learning opportunity. Students had to figure out a way to test the structural integrity of the dome, too. Most of them used weights, some used bricks, and some students had other creative ways to achieve the task. They could definitely see the relevancy of this project since they planned on majoring in engineering of some kind in college. This was also a good example of scientific inquiry; students had to think outside the box, like an engineer. One of my students made this comment: "This was definitely a challenging project. I was surprised to see how much weight the dome would support."

Learning has taken on a new twist at our amazing school. Why don't you give us a virtual visit and see a revolution in education? Amazing students are making learning their own.