



Attracting Students to STEM Careers

by Judith Pauley, CEO, Process Communications Inc.

Science and technology are increasingly important in our daily lives, in the economic survival of our country and in maintaining our standard of living. Many leaders are concerned about ways to attract more students—especially female students—to pursue careers in science, technology, engineering and math (STEM) fields.

The recently released 2009 National Assessment of Educational Progress (NAEP) report—which covers grades 4, 8 and 12—stated that fewer than a third of students have a solid grasp of science and fewer than 3% scored in the advanced level.¹ A few weeks earlier, international science test results showed that U.S. students trailed their counterparts in many European and Asian countries. This must change if the United States is to be competitive in science and technology.²

Teachers and education groups have given many reasons for the lack of understanding of science—for example, a shortage of qualified science teachers, a shortage of advanced science classes in low-income and rural schools and the ideas to test only math and reading skills, not science skills, under the mandates of No Child Left Behind. Indeed, educators have stopped teaching science in some elementary schools.³

There may be a correlation between the reasons students do not want to pursue STEM careers and the reasons students give for dropping out of school. The National Dropout Prevention Center⁴ at Clemson University in Clemson, SC, says students give the following reasons for dropping out of school:

1. No one cared.
2. I didn't feel I belonged.
3. Classes were boring.
4. What we were learning had no relevance to my life.
5. They didn't teach the way I learn.

These answers offer insights about why some students are reluctant to study math and science. Further, they provide clues to things educators can do to attract students to STEM careers. Some examples:

- Make classes exciting and fun.
- Demonstrate to students how the subject matter affects their lives.

- Show them the types of exciting careers available in STEM fields.
- Illustrate to them that the teacher is interested in them and in their progress.
- Help them get their motivational needs met in class.

Individualize instruction so the material is presented the way each student learns.⁵

All of these reasons are related to the motivational needs of individuals. In his research, Taibi Kahler, a clinical psychologist from Purdue University, has identified six different personality types.⁶ Each of the six types learns, communicates and becomes motivated differently. One type needs to know people like them and care about them as people. Another type needs to hear they have done good work. A third type needs to know their teachers respect them for their values, ideas or opinions. A fourth type needs to have fun. A fifth type needs excitement and to stand and move around. The sixth type needs to have some quiet alone time periodically throughout the day.⁷

When people do not get their needs met they go into distress. Each type does different predictable things when in distress. Research shows that when teachers include something in every class to help each of their students get their motivational needs met, students are more motivated to learn, discipline problems are greatly reduced and student academic achievement soars.⁸ Engaging individual students is one way to interest students in the various STEM subjects and encourage them to pursue STEM careers.

What can be done?

Make classes fun and exciting. Do experiments and other hands-on projects. Make sure all students know the teacher cares about them as individuals. Compliment students on their work. Respect their opinions and dedication. Provide reflection time in every class period. Show students how science relates to their lives. Have experts in various STEM fields explain careers that are open to the students, including the amount of money they can earn.⁹

A physiology teacher in a high school in the Watts District of Los Angeles was discouraged because her students were not interested in the subject matter and were not doing any work. In researching for her master's thesis at the University of California-

Los Angeles, she used the students in her most challenging class as the experimental group and used the students in her other physiology class as the control group. For her research with the students, she used a university textbook, gave both groups pre and post tests of motivation, compared discipline problems before and after, and compared grades before and after.

She taught the control group the way she always taught. In the experimental group, she included something in every class to help students get their motivational needs met positively and brought in experts to explain career possibilities. In the control group, student motivation or grades did not improve, and there were many discipline problems. They thought the text was difficult. In the experimental group, however, every student's motivation and grade improved. They were excited about physiology, and there were no discipline problems. They thought the text was easy.^{10, 11}

In education today, the three R's refer to rigor, relevance and relationships. They have the order wrong. As evidenced in the earlier example, if educators establish relationships with every student, show them the relevance of the material to their current and future lives and individualize the way they present the information by including something in every class to help each student get their motivational needs met, they can make the material as rigorous as they want, and the students will be motivated to learn it.¹²

Some examples

In an elementary school in Maryland, a teacher had her class, which was studying the Amazon, build a rain forest with trees, plants, birds, other wildlife and a wooden bridge over a stream. The students loved to guide visitors through the forest and explain the ecology to them.¹³ A middle school science teacher in Alaska filled his classroom with stimulating items, including strings of multicolored lights hanging all around the room, a stuffed bear head and a stuffed bald eagle on the wall and mobiles hanging from the ceiling. His students loved to come to the room, and they hated to leave at the end of the class because the atmosphere was so stimulating and his classes so exciting.¹⁴



When I taught, I included hands-on experiments and fun demonstrations in nearly every class. For example, when I taught about sound, I brought in pieces of PVC pipe, had the students cut the pipe to various frequencies and parade through the hall playing tunes. At Halloween, I had them dress up as their favorite element or physicist and give a 15-second talk about their element or person. As a group project in one of my physics classes, students made a self-propelled hovercraft. One student pedaled it and had to carry five other students around a slalom course. They took first place in a state competition. The next day, they demonstrated the hovercraft in the gym for the entire student body.

If students are to be encouraged to pursue careers in science, teachers have to make science an integral part of the school day starting from the first day children enter pre-school and have it continue throughout high school and college. This means that all teachers have to have some science training and be excited to teach it. If they are not, their students will pick up subconscious signals from the teacher that will influence their attitudes about science.

Excited teachers

For that to happen, exciting science courses must be included in the teacher preparation curriculum at every university. Also, university professors must be committed to helping their students succeed. I've asked graduate teachers if they feel they have failed whenever they expel a student from class or when a student who has done the work fails a class. Universities should expect no less from their professors.

Unfortunately, some university professors have the attitude that they present the material and it is up to the student to learn it. This attitude must change. The three R's and individualized instruction are just as important in universities as they are in K-12 education. University professors must make their science classes exciting and stimulate student enthusiasm so that when they become teachers, they will have a positive attitude toward science and math, and they will, in turn, want to make their science and math classes stimulating for their students. This may require a culture shift in some universities.

Teachers at all levels and professors in universities must take responsibility for the success of all their students, individualize the way they teach, establish positive relationships with every student and include something in every class to help each student get their motivational needs met positively. In short, they must inspire their students to want to pursue these careers. Educators should also enlist parents in encouraging their children to explore their environment and having them to get excited when their children bring things home or tell them about things they are doing in their science and math classes. Finally, educators must find ways to make math relevant and fun.^{15, 16} This is the key. Make science and math fun, make it real and make it interesting.

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Judith Ann Pauley is the CEO of Process Communications Inc. in Potomac, MD. She is also an adjunct professor in the education departments of seven universities, including

ASQ Higher Education Brief February 2011 (Vol. 4, No. 1)

the Education Leadership Department at George Mason University in Virginia and the Education Department at California State University-San Marcos. Pauley holds a doctorate in physical chemistry from the Catholic University of America in Washington, D.C., and has taught chemistry and physics for more than 42 years in universities and high schools in the United States and Asia.

Kris Mercer's Floyd Dryden Middle School science classroom, Juneau, AK, contains stimulating items, including strings of multicolored lights hanging all around the room, a stuffed bear head and a stuffed bald eagle on the wall and mobiles hanging from the ceiling.



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