Science Class—No More Yucks!

By using encouragement, creative thinking, and the wonders of science, teachers can make science one of the most rewarding school experiences for young people. The following suggestions are easy to implement. No longer will your students say "Yuck" to science!

1. *Be honest and trustworthy.* Lazarowitz, Baird, and Allman[1] asked students in Utah what they thought about science. The most common complaints were "I don't like the teacher; he/she doesn't teach me anything; goes too fast; teaches things that are not true; makes it difficult and complicated; nothing but book work." Accusations related to teachers as persons and to their teaching methods would largely be overcome if they were viewed as honest and trustworthy.

Although the science teacher cannot be expected to be an expert on every topic, he or she must come across as a reliable source of information. A teacher can use many ways of attaining credibility. One of the best methods is to portray oneself as a constant learner. To remain up-to-date and well informed teachers can participate in science workshops and join organizations that relate to their specialty. They should also be familiar with magazines and journals related to science (see Weatherall article, page 31).

Both teacher and students will benefit from a well-stocked school library. Depending too heavily on books for answers has one drawback, however. Students thus learn to be slaves to printed material. While a book may offer quick access to the facts, the information thus gained is retained for only a short period of time. Students also gain the impression that "If it isn't in a book, it probably isn't worth knowing." The teacher should be sufficiently prepared to provide some answers in response to student questions and to suggest other avenues to explore. Answering a student's question often satisfies curiosity but prevents learning. Experiments and further reading teach students to find answers for themselves, answers that will stay with them long after the teacher's explanation is forgotten.

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2. *Be a caring Christian teacher.* A warm, loving Christian teacher who is interested in the student's personal life will be able to provide a perspective that gives real meaning and purpose to science education.

Some time ago I read this statement: "From [Christ's] earliest years He was possessed of one purpose; He lived to bless others. For this He found re-

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sources in nature; new ideas of ways and means flashed before His mind as He studied plant life and animal life."[2] Now, when students study their science lessons, I ask them to look for simple spiritual lessons. For example, nature provides ample opportunity to experience the characteristics of God's love. A small book, *Science Activities for Christian Children*,[3] offers a collection of science experiments with related spiritual lessons. The activities in this book were submitted by my students. Other helpful books include *Windows on God's World*,[4] *Talking Trees and Singing Whales*,[5] and *A Family Guide to Sabbath Activities*.[6] These books are filled with ideas to help students apply science to everyday problems.

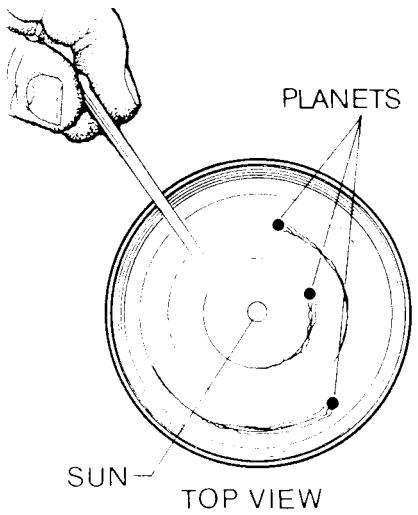
3. *Provide for individualization.* By using demonstrations, experiments, and activities teachers can better provide for individual differences. One of the best ways to individualize learning is to stimulate as many senses as possible using multiple teaching methods.

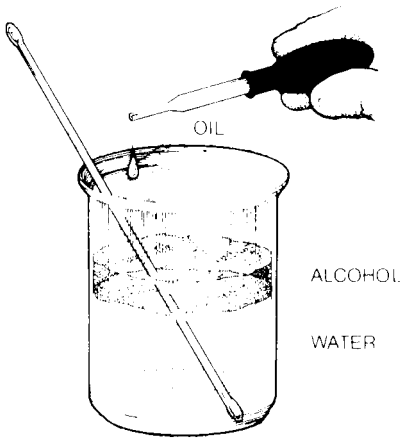
Suppose you have prepared a unit on the solar system. Do you just lecture throughout the class periods, and perhaps draw a sketch or two on the board, or do you prepare a variety of materials and approaches? For example, you could (1) schedule a play,[7] (2) simulate the solar system with a demonstration that employs drops of salad oil suspended on layers of alcohol and water (See Figure 1), (3) set up an activity center with several space science computer programs, (4) ask students to help you create a bulletin board, and (5) schedule a trip to a nearby planetarium. Using varied approaches will help you meet the needs of different students better than just lecturing and assigning workbook exercises.

Students may appear to do better on written tests with the lecture/workbook method, but they will be unlikely to develop any curiosity about science and will probably remember science classes as drudgery. Furthermore, the single-method approach is less likely to teach students how to ask questions or how to investigate puzzling phenomena.

Science has so many different facets that it is impossible for anyone to dislike it. Students only dislike the way science has been taught.

While some students consistently excel in science, others need special help. Alternative textbooks, films, videotapes, tape recordings of the reading assignment for the class's poor readers, games, and other activities described in publications such as *Learning* and *Instructor* can provide just the help such students need.





Drops of salad oil suspended on layers of alcohol and water can be used to illustrate the solar system.

Figure 1

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Peer and cross-age tutoring can also offer significant advantages in science classes. Older students can assist younger ones in understanding science topics. Even students who do not excel can be called upon. By explaining a concept to someone else, the tutor comes to better understand it himself. He or she also learns the joy of helping others.

Students who find science difficult need the opportunity to ask many questions. However, they may be reluctant to "expose their ignorance" to the whole class. To solve this problem, the teacher can provide a question-and-answer box where students submit their questions. Other students can be assigned to provide answers. One teacher achieved excellent results from setting up a telephone answering device, which allows students to leave messages or ask questions.

Individual students and small groups can be assigned a variety of projects dealing with each topic. This helps prevent students from comparing their work with that of others to whom they feel inferior or superior. A student who performs poorly on written exams may be a good actor. If given the opportunity to portray Sir Isaac Newton and the famous story of the falling apple, this student will probably always remember the experience—and the scientific principle.

Several of my students who found the science textbook uninteresting, became enthralled with reading scientific publications when they were asked to find science facts to report each morning over the school's public address system. This activity informed pupils and teachers about interesting scientific facts and made a significant positive impact on our school.

A school science newspaper could also generate enthusiasm about science. As new scientific facts are learned in class or through students' personal reading, they may be published as though they had just been discovered by scientists. In this way, the reporter as well as the one who made the discovery receives recognition. As they do the research required

and write the article in an interesting and understandable way, students learn more about scientific principles and gain important training in technical writing.

Every child needs constant encouragement and rewards for his or her accomplishments. For the brighter student, this might mean a visit to a high school or college lab. For the learning impaired child, it could mean a visit to a learning specialist.

Take time to assess the special needs and interests of each student. This will help you individualize the science curriculum.

4. *Take advantage of community resources.* Doctors, astronomers, farmers, engineers, and others in the community have a wealth of information to share with youngsters, but often have little opportunity to do so. Even the local trash collector could come to class to discuss the amount and type of trash that the community generates, and give a firsthand account of the kinds of problems it causes.

A sanitation engineer or ecologist can then help students analyze the problem. The resulting activities may involve several subjects: writing a letter to a state delegate regarding a bottle-deposit bill, or to various sources for additional information; calculating the amount of trash generated by the community for a week, month, or year and estimating the proportion that could be recycled; researching the problems created by solid waste and pollution, and proposing some solutions. Students could also participate in a community service activity by cleaning up the litter from a nearby road or park.

Other Resources

Don't overlook parents as a resource. Sometimes educating them to the wonders of science will do more for the science program than any attempts to teach the children directly. Family camps, special programs for parents featuring guest lecturers or films, and periodic phone calls just to talk may help the teacher to influence parental attitudes.

Field trips for selected groups of students can enhance the science program. A busy businessperson or college professor may be unwilling to entertain a whole class, but may readily talk with a few students about how science applies to his or her work. Seeing where science happens and what equipment is used can help interest students in the subject. After the field trip the group can report to the class about their experiences.

In planning ways to make science more interesting, teachers need to examine their own attitudes. As I have polled students in my science methods classes, I have found that many, if not most, were turned off by their previous science education. Often this negativism resulted from the trauma of a bad grade, poor self-confidence, tensions relating to testing and grading, and the notion that girls, certain ethnic groups, and the handicapped "can't do science." These attitudes had not only prevented such people from taking more advanced work; in some cases it had also caused them to avoid science in every way possible.

Peer and cross-age tutoring offer significant advantages in science classes.

If you feel uncomfortable with certain areas of science education, try inviting guests to share their enthusiasm about these topics with your class. A doctor, nurse, and pastor team might be better able to deal with sex education than any one person could alone.

5. *Keep constantly aware of each of your students' attitudes and progress.* Pretests can offer insights into student background and experience in the area of science. Watch the body language of your pupils as you present various topics. This will offer clues as to whether you are moving too fast, or if you need to use a sketch or model to illustrate a difficult concept. A sensitive teacher will use students' verbal and nonverbal feedback to encourage positive attitudes and to enhance understanding of scientific principles.

Too much pressure on grades can encourage cheating. Overemphasis on producing the correct results in lab procedures can cause students to compromise their integrity. Once I provided students with aluminum instead of zinc for an experiment showing the generation of hydrogen gas. In describing the process, the lab books mentioned a black precipitate. Every student faithfully reported what he thought he was supposed to see. How much better if someone had had the courage to say, "I expected a black precipitate but couldn't detect one."

At the end of each lesson the teacher should ask for student comments. This helps fill in gaps in understanding and reinforce important principles.

6. *Collect and display unusual items.* In my collection I have a large grass ball, a cucumber inside a glass bottle whose neck is obviously too small for it to fit through, mysterious lights,[8] and other objects that are certain to arouse curiosity. Once you arouse their interest, students are enthusiastic about devoting extra time and effort to science study.

Closely related to this concept is the need to seize the moment. If the children find a tortoise on the playground, then and there ask (and invite) questions about it. For example, is a tortoise a turtle? What does it eat? How can one determine its sex? How does it reproduce? Do turtles and tortoises ever live in water? When students become excited about what they are studying, they will enthusiastically learn scientific methods to discover the answers to their questions.

7. *Involve students in science activities.* One of the surest ways of doing this is to encourage them to work along with you in science-related projects. Rather than buying ready-made electronic equipment or model rockets, purchase a kit and allow several students to help you assemble the item. Repairing toasters, radios, and other electronic equipment from local welfare organizations also helps students see how science relates to daily life. An invitation to an early morning bird walk or another field expedition could be a first step in improving your students' attitudes.

Young people seem always to be intrigued when they are allowed to use microscopes, test tubes, and other pieces of "real scientific equipment." To give them this experience, I usually assign small-group activities. Each group is given a separate but related assignment.

Picture removed

Many schools, because of lack of finances or storage space, have a very limited selection of science equipment. Here is one way to maximize the use of limited resources.

Each pair of students is assigned an experiment. They are not only to perform the experiment, but also to learn as much as possible about the scientific principles involved in the procedure. Each pair produces a pretest and a posttest. They "translate" the teacher's descriptions into "user friendly" language, and take the responsibility for solving any problems others in the class may have in replicating the experiment. Grades are determined in part by how well *others* perform on the pair's assigned experiment. If questions come up, the teacher should discuss them only with the "authorities," who must then explain the answer to the others.

After becoming an "expert" on the assigned experiment, one student of each pair moves to another experiment, where he or she becomes a learner.

Answering a student's question often satisfies curiosity but prevents learning.

After mastering the intricacies of that experiment, the child teaches it to someone else, and so on. The circulation continues until each student has had the opportunity to perform and explain every experiment. Having to *do and explain* helps students understand and remember the scientific principles better than simply hearing them described in a lecture.

Conclusion

Science has recently been portrayed as a discipline in trouble. Rowe stated that "if there were such a thing as an 'endangered subjects' list, science would qualify for emergency help and protection."[9] Secondary and college educators see the following trends: (1) fewer students interested in science, (2) smaller class enrollments, and (3) a decrease in the number of candidates for secondary science teaching. This negative trend can be reversed. *You* can design and present programs that get the "Yucks" out of science. □

FOOTNOTES

[1] R. Lazarowitz, J. H. Baird, and V. Allman, "Reasons Why Elementary and Secondary Students in Utah Do and Do Not Like Science," *School Science and Mathematics*, 85:8 (December 1985), pp. 663-672.

[2] Ellen G. White, *The Desire of Ages* (Mountain View, Calif.: Pacific Press Publishing Assn., 1940), p. 70.

[3] C. A. Keller and J. Appel, *Science Activities for Christian Children* (Auburn, CA: Gazelle Publications, 1986), p. 2.

[4] J. A. Tucker, *Windows on God's World* (Washington, D.C.: Review and Herald Publishing Assn., 1975).

[5] C. C. Case, *Talking Trees and Singing Whales* (Hagerstown, Md.: Review and Herald, 1985).

[6] E. E. Lantry, *A Family Guide to Sabbath Nature Activities* (Mountain View, Calif.: Pacific Press Publishing Assn., 1980).

[7] C. A. Keller and B. Hosford, "Planetary Puppets," *Science and Children*, 17:2 (1979), pp. 44, 45.

[8] C. A. Keller, "Mysterious Lights in Series and Parallel," *The Physics Teacher*, 18:6 (1980), p. 464.

[9] M. B. Rowe, "Elementary Science: A Vanishing Species," *Science and Children*, 18:1 (1980), pp. 19-21.