An Effective Elementary Science Program

In establishing or improving an elementary science program one must first realize that science is a unique subject. Unlike other subject areas, science can be taught most effectively with materials and can be employed to develop a myriad of important problem-solving skills. Unfortunately though, science is also the one subject that teachers are least familiar with. Realizing this, one can conclude that in-service (or pre-service) education is the first and most important element in establishing an effective elementary science program.

Secondly, each school should have a sound curriculum plan. It may be predetermined by the textbook scope and sequence or established by district guidelines, but should include planned science experiences for all grades (K-6). With a sound design, students will receive comprehensive science instruction with a minimum of repetition. Specified times or periods for teaching science should be provided. When science is scheduled in, there is a greater chance that it will be taught. Recommended times are 120-180 minutes per week.[1]

Science should be a blend of content and process. Textbooks are an important component in supplying the necesary science content. In addition, science can easily be integrated with other academic subjects to greatly increase classroom efficiency. Reading of science textbooks will increase reading skills and also teach science content.

Beyond content is the development of process skills. This is an extremely important component in an effective science class. A substantial amount of active, manipulative, hands-on experiences will provide the foundation upon which abstract thought is built.[2] When working with manipulatives, students may be developing measuring and math skills in addition to learning about natural phenomena (i.e. plant growth). There is sufficient evidence to illustrate that improvements in reading, language arts and math result from teaching more science rather than less. Much of these gains are related to the hands-on experiences that a strong science program provides.[3]

Since chemicals, equipment and live organisms are as important in a science lesson as baseballs and bats are in physical education, an effective science program should also have an annual allocation of funds and a discretionary petty cash fund. These funds should allow for replacement of expendables or resupplying lost or broken equipment. Large and expensive items can be checked out from a central location and smaller items can be kept in individual classrooms. It's best to keep a master inventory list of science items and another list of items that need to be purchased as they get used up. Orders from this second list can be submitted in June for the following school year. By involving the teachers in the selection and purchasing process, you will help ensure their participation in science activities and the success of your program.

On occasion, there may not be enough equipment to go around. There are techniques which can be employed to optimize the use of lab equipment. Let's take an example of a class with only two balances, three graduated cylinders and a handful of rulers. The teacher splits up the class into ten groups of three students each. Instead of having a lab on using the balance, she has a lab on measuring. Each group will spend 3-5 minutes at each of the 10 lab stations and make the required measurements. Typical examples might be:

Station 1: Find the mass (weight) of a battery.
Station 2: Measure the volume of water that a test tube can hold.
Station 3: Measure the width and length of an index card.

[1] Edward Victor, Science for the Elementary School, (New York: Macmillan Publishing Company, 1975), pp. 44-45.

[2] Kenneth R. Mechling and Donna L. Oliver, Science Teachers Basic Skills (Washington, D.C.: National Science Teachers Association, 1983) pp. 9-12.

[3] William K. Esler and Mary K. Esler, Teaching Elementary Science (Belmont, CA: Wadsworth Publishing Company, 1981) p. 5.

The teacher will, of course, go around from station to station beforehand and explain what is to be done and review the procedural techniques with the class. It will also be helpful to give each student a bonus word search or puzzle to work on if they finish a lab early. Each student group must cycle through all 10 stations and everyone will change stations at a predetermined time. For longer labs, you may have 5 similar lab stations where each group will perform only two different activities. Following the lab experience, the teacher can "post-lab" and discuss the results from all groups. In an extreme case, the teacher may only be able to set up one lab station. In this case, student groups can rotate through this station while the rest of the class works on a desk assignment.

Many times the teacher must be creative to successfully perform some activities. If you don't have sinks, you may discover that plastic dish tubs or fish tanks (without fish, of course) will satisfy this need. When ordering equipment, plan your purchases with optimum use in mind. If one teacher already has a good class set of magnets, there's probably no need for you to purchase a set also. Give each teacher a copy of the master inventory list so they know what equipment is available and try to put all science equipment to as much use as possible.

A final element in an effective science program is how the teacher presents the information. Here it is important to realize just how much information is required to get the students on the right path of discovery. Rather than hand out a battery, two wires and a bulb and explain systematically how to light the bulb, it would be far better for the teacher to challenge the students to make the bulb light (then try to light it with only one wire). Research has also been done on "wait-time." This is the amount of time that the teacher allows between asking a question and soliciting a response. A wait-time of three to five seconds or more will improve student response, the number of responses and the confidence of the students. With longer wait-times the teacher will also notice an increase in speculative thinking and even a decrease in discipline problems.[4]

Administrators and teachers alike must realize that science instruction really is unique. It may require not only textbooks and materials, but certainly more effort on behalf of the teachers in both in-service education and set-up time for activities. More and more, educators are realizing that quality science instruction is filling an important void in elementary education. It's providing students with a systematic method of thinking — helping them to solve problems, make wiser decisions and test the limits of their imaginations. Be a part of this new scientific revolution in elementary education. Help put quality into your science program!

[4] Arthur A. Carin and Robert B. Sund, Teaching Science Through Discovery (Columbus, Ohio: Charles E. Merrill Publishing Company, 1980) p. 94.