

## ● Making Hands-on Doable

by **John G. Upham**

*John G. Upham received his master of science in education from the State University of New York. For the last 26 years, he has taught middle school science at Norwood-Norfolk Central School District, in New York.*

**I**t is widely accepted that hands-on experiences are a vital part of a child's education. This is especially true in the sciences. However, the vision of students engaged in meaningful scientific exploration in a modern lab environment can be difficult to translate into reality. While lab equipment and supplies become more expensive with each passing year, classroom budgets also seem to be continually shrinking. So how do we teach hands-on science to students without breaking our classroom budget on expensive lab equipment and supplies?

There are many strategies you can use to provide an educational, fun, exciting, and most of all, inexpensive lab-based science program for your students. All it takes is flexibility, a willingness to plan ahead, and a little creativity.

### Preparing the Classroom

In this day of overcrowded schools and tight budgets, many science teachers find themselves teaching in classrooms that were not designed for science classes. In many cases, this means a lack of the most basic laboratory needs, such as faucets, sinks, and lab tables.

Among these obstacles to an effective lab program, perhaps the easiest to overcome is the lack of a water source. An inexpensive solution is the use of plastic dishpans and milk jugs for carrying and storing water. Large plastic dishpans are available at most grocery and discount stores. They are durable and will last for years. These bins can also double as storage containers, and they stack conveniently when not in use. One-gallon milk jugs can be used to transport water from the faucet, and they also make a portable water supply for each lab setup. I have found that one jug per lab group is sufficient for almost any lab in the middle school curriculum.

The design of the average middle school classroom usually means no lab tables. This is a serious problem because normal student desks are too small. Pushing desks together is a poor substitute for lab tables because they tend to separate easily, creating an unsafe lab area. A quick look at the price of suitable tables from a classroom furniture catalog is enough to cause heart palpitations.

### **Making Hands-on Doable** *continued*

An inexpensive solution is to build tabletops and set them on top of several student desks, creating one large, portable lab table. These tabletops cost less than new furniture, and you can design them to meet specific needs. In my classroom, I have students work in small groups. Therefore, I chose a design that covered three student desks pushed together. Materials are readily available at your local lumberyard. I recommend particleboard and plastic laminate, which is inexpensive and light enough for students to lift.

If you don't have the time or expertise to build tabletops, you may have them built for you. With the approval of your school's maintenance supervisor, a member of the custodial staff may be able to build them for you. Be sure you have a workable design—a table that is large enough for students to work on but small enough to be easily removed and stored.

### **Securing Lab Equipment**

Another concern for teachers is securing the proper equipment for the lab experiments. As every middle school science teacher knows, lab equipment has a way of getting broken or lost or simply disappearing. Replacing all those thermometers, test tubes, and Petri dishes takes time as well as money.

To reduce costs and to get the most out of the equipment you do have, consider that many items can be made using items that would normally be thrown away. For example, a collection of graduated cylinders is a necessary part of any laboratory. These small containers are expensive and can be easily broken. But, homemade counterparts are easy to make. Using one commercially manufactured set, you can make extras with plastic pill bottles and a permanent marker. Simply fill the graduated cylinder to the desired measurement, transfer the liquid to the pill bottle, and use a marker to carefully label the level of liquid in the pill bottle. Putting your class to work on this project for half an hour will supply students with graduated cylinders for an entire school year. Ask students to bring in empty pill bottles, or ask a local pharmacy to donate them.

A soft-drink bottle can also be used to make a couple of essential pieces of science lab equipment. The lower half of the bottle can be made into a large measuring container, while the top half can become a "free" funnel, allowing for fewer spills in the lab. Place a coffee filter in the funnel, and you have a filtration device. These funnels are so inexpensive to make that they can be thrown away once they are too soiled.

### ● **Making Hands-on Doable** *continued*

#### **If You Can't Buy It, Borrow It**

Some pieces of lab equipment are just too complex to make and too expensive to buy. The logical solution is to borrow the equipment. Probably the nearest source of such equipment is your own high school science department. Many teachers shy away from this resource because they feel middle school teachers and high school teachers are in competition for school funds and supplies. By pointing out to a high school science teacher that your students are tomorrow's high schoolers and that the students' use of the equipment will make them more prepared for high school science, you may go a long way toward loosening a teacher's grip on some prized equipment.

The willingness of high school teachers to loan materials can be encouraged by the coordination of curricula. This is something many states and school systems are doing anyway. Coordinating the curriculum of the middle school with the curriculum of the high school creates a greater understanding of what content is covered in the respective years, and it promotes cooperation between middle school teachers and high school teachers.

Other good resources for lab equipment and supplies are your local colleges and universities. Many such institutions, especially those with teacher-education programs, are very willing to loan or donate needed equipment. Get to know the professors, and seek their assistance. Professors are usually very willing to loan equipment and donate supplies, and they or their students may come to visit your classroom to talk about their field of expertise or to perform a science demonstration.

Lab equipment can also be shared between neighboring school systems. You might be surprised to learn how much is out there if you are willing to look for it.

One idea is to work together with teachers from adjacent schools to set up a database of loanable lab equipment. This is similar to an interlibrary-loan system. It takes some effort to get started, and it may be best to begin with an informal arrangement among a small group of teachers. Over time, a list of supplies and equipment available for loan can be compiled. The database can then be made available to a wider group of teachers.

There are negatives to borrowing equipment. It takes time to coordinate and transport equipment back and forth. Also, when borrowing equipment, you must be flexible as to when you will use it. The teachers involved have to discuss the timing of the various units being taught. If cooperating teachers can schedule their classes to stagger instruction, more classrooms can get full use of essential equipment.

### ● Making Hands-on Doable *continued*

#### Additional Help

There are many additional resources to help teachers create an effective and inexpensive lab program. These resources include television shows, teacher workshops, the Internet, and books.

Science television shows are a readily available source for cheap lab ideas that can be used or adapted for use in the classroom. Especially useful are reruns of *Mr. Wizard* and *Bill Nye the Science Guy*. Both shows contain lab segments geared for children. They are fun and interesting, and they usually require a minimum of supplies and equipment. These labs can be done at home or can easily be adapted and expanded for use in the classroom.

Teacher workshops are also an invaluable source of information on inexpensive labs. The workshops I have found most useful for developing a lab program in my classroom have been arranged by local schools, colleges, and BOCES (Board of Cooperative Educational Services). These workshops, which are conducted by teachers, emphasize a sharing of ideas and information. Teacher-run programs are an excellent resource for lab ideas because the ideas discussed have been conceived, designed, and tested in the classroom.

During the past few years I have found myself relying more on the Internet for new lab ideas. Many teachers post information about their lab programs on school Web pages. An evening of browsing the Internet, using search engines with key phrases such as “hands-on science” and “middle school science,” will produce a huge volume of relevant information.

Of course, the most important resource for new ideas is our own creativity. The more innovative and interesting our lab ideas are, the more our students will benefit. Middle school students, being naturally creative and imaginative themselves, respond enthusiastically to creative labs. This increases students’ academic involvement and achievement. Getting your students engaged in meaningful hands-on experiences will also result in fewer discipline problems and lower job-related stress. For me, the most important result of the extra effort I have put into creating an exciting and creative lab program is a job that is still fun after 26 years!