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TEXT: Teaching elementary science is not easy, especially in a small school. Elementary teachers in general and rural elementary teachers in particular are asked to teach science when typically they have not been adequately prepared in at least three critical areas: fundamental science knowledge; meaningful preparation in actually teaching science; and instruction as to buying and using pertinent course materials. Further problems for elementary science teachers in small schools occur with respect to inadequate amounts of time, lack of money and library reference materials, too narrow science curriculum guides, and limited district support for facilities and personnel. While

tackling all of these problems is beyond the scope of this digest, suggestions for improving science teaching and ways for small schools to upgrade their programs are provided.

HOW AND WHERE CAN ONE SECURE SCIENCE MATERIALS FROM FREE AND INEXPENSIVE SOURCES?

One way for K-6 teachers in small schools to overcome some of the difficulties in teaching elementary science is to involve children and parents in obtaining free and inexpensive science-related materials. Materials should be collected during the entire year, and can be secured from visits to city institutions (museums, libraries); federal, state, and county offices like the U.S. Forest service and the Soil Conservation Service; and from vacations to national and state parks. Materials can also be obtained from colleges and universities and public interest groups like the Audubon Society, National Wildlife Federation, and regional plant societies. It should be recognized, however, that special interest groups usually have particular points of view and that materials should represent a balance of outlooks. Several inexpensive children's magazines are especially useful in teaching elementary science: RANGER RICK, ZOOBOOKS, AND 3-2-1 CONTACT. Magazine donations from school families can be solicited and can include an array of titles, including NATIONAL GEOGRAPHIC, DISCOVER, SCIENCE 86, SCIENTIFIC AMERICAN, AUDUBON, and NATIONAL WILDLIFE. Moreover, three adult publications are specifically geared to teaching elementary science on a shoestring: SCIENCE AND CHILDREN (each issue has a list of free and inexpensive science materials); TOPS, and EDUCATOR'S GUIDE TO FREE SCIENCE MATERIALS. FREEBIES magazine is more general, but does provide sources for science materials.

HOW CAN THE MATERIALS BE EASILY ORGANIZED?

Free and inexpensive materials need to be arranged in a logical manner in order to be effective and useful. One such arrangement consists of six major categories: Biology, Chemistry, Earth Science, Astronomy, Physics, and Research Processes. While there will be divisions and subdivisions for all categories, the large number of materials related to biology result in many divisions for this subject. Three possible biological divisions include animals, humans, and plants. These can be further divided; for example, animals can be subdivided into birds, mammals, and reptiles.

Legal-size manila file folders can be used to hold the free and inexpensive printed materials gathered for each division with new folders added as new divisions and subdivisions are created. Similarly, nonprint materials should be systematically referenced in file folders and placed in boxes. The cataloging and systematizing processes themselves can provide a scientific framework for the students who, of necessity, should play a major role in sorting, arranging, and filing.

HOW CAN TEACHING MODULES BE DEVELOPED?

Manila folders containing free and inexpensive science materials form the information base for converting raw data into meaningful and useful teaching guides and modules. In order for the folders to become a module, these components need to be completed for each folder.

--The accumulated materials should be listed, including the nonprint materials filed elsewhere. --The way each module integrates with all other modules (e.g., birds with insects) and with other school subjects (e.g., flowers with art) should be specified. --Equipment necessary to more fully study the module (e.g., a microscope) should be listed, along with information on locating equipment. --There should be a list of local places to visit, local resource people to contact, and famous personalities associated with the module (e.g., Marie Curie and the atomic energy module). --Related reference books should be listed with page numbers cited and physical location noted (e.g., the library). --A set of lesson plans and activities of ever-increasing difficulty should be included for each module. --A variety of tests should be included.

Such an ambitious project should not be viewed as something to accomplish in a single year. It might even be coordinated across different grade levels. No module should ever be considered complete; new materials and ideas can be constantly added and unworkable ones phased out gradually or altogether deleted.

HOW ARE THE MODULES USED TO TEACH SCIENCE?

The actual construction of the modules is a teaching and learning experience for teachers and students alike. Modules can be initiated and used immediately from the first free or inexpensive item received and, if successful, can only prove more rewarding with time. As more students and teachers become involved, the more complete the modules will become. Lesson plans begin to accumulate, posters increase in number, and integration with other subjects becomes more apparent. Invariably, this science program is user-friendly because it is constructed by the very individuals who will implement it and who have a practical and theoretical interest in its successes and failures. As new teachers come into the district, they can take up the construction at whatever phase they find it, without having to initiate their own program from scratch.

If the school uses a science text, curriculum guide, or learning kit, it can be supplemented by the modules, permitting a more functional, eclectic, and improved science program. Students learn much more readily when they become involved in developing their own lessons or when two approaches are synthesized into one coherent program.

Since teachers are ultimately responsible for constructing the modules, they must accept the responsibility for devising lessons that correlate with various ability levels

and learning styles of their students.

ARE THERE OTHER WAYS TO IMPROVE K-6 SCIENCE IN SMALL SCHOOLS?

While module building and teaching science from free and inexpensive materials is one way to explore elementary science in small schools, there are several other ways to improve or upgrade existing programs:

--by videotaping television science programs--e.g., OWL/TV, 3-2-1 CONTACT, NATIONAL GEOGRAPHIC specials--and complying with all copyright regulations; --by requesting universities to offer science methods courses specifically for small-school teachers; --by contacting interactive computer networks that specialize in science teaching (in New Mexico, for example, one source is Mr. Jack Gittinger, Co-director, CISCO-Net Project, Department of Science Education, College of Education, University of New Mexico, Albuquerque, New Mexico 87131); --by using the ERIC system to find materials on telecommunication satellite systems that would transmit science news, programs, and career information to schools, and which might provide answers to questions submitted by teachers--a great service to teachers in isolated small schools.

WHAT ARE THE OVERALL CONTRIBUTIONS OF TEACHER/STUDENT-MADE MODULES?

Teaching K-6 science in small schools through teacher/student-made modules from free and inexpensive materials is not a cure-all for the difficulties of teaching science in small schools. Rather, it is a means of providing teachers in small schools with a direct and accessible way to improve their science teaching and to build enthusiasm among students for the many aspects of science.

FOR MORE INFORMATION

EDUCATORS' GUIDE TO FREE SCIENCE MATERIALS. Educators' Progress Service, Inc., 214 Center St., Randolph, WI 53956.

FREEBIES. P.O. Box 20283, Santa Barbara, CA 93120.

Hungerford, Harold R. and Audrey N. Tomera. SCIENCE TEACHING METHODS FOR THE ELEMENTARY SCHOOL: A WORKTEXT. Carbondale, IL: Southern Illinois University, I985. ED 260 921.

RANGER RICK. National Wildlife Federation, 8925 Leesburg Pike, Vienna, Va 22180.

SCIENCE AND CHILDREN. National Science Teachers Association (Membership Dept.), 1742 Connecticut Ave., NW, Washington, C 20009.

Shaffer, Dale E., Comp. SOURCEBOOK FOR TEACHING AIDS...MOSTLY FREE

POSTERS & PAMPHLETS FOR EDUCATORS. 4th Ed. Salem, OH: I984. ED 234 825.

3-2-1 CONTACT. P.O. Box 2933, Boulder, CO 80322.

TOPS. 10978 S. Mulino Rd., Canby, OR 97013.

Williams, Debbie and Hickson, Carol. DEMONSTRATION AIDS FOR AVIATION EDUCATION (Vol. II). Washington, DC: Federal Aviation Administration, 1984. ED 249 048.

ZOOBOOKS. Wildlife Education, Ltd., 930 West Washington St., San Diego, CA 92103.

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