THE "HANDS-ON" APPROACH:
WHAT THE RESEARCH SAYS

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The activities in this book are based on a philosophy of science education in the elementary school that has children involved in doing and thinking about science instead of memorizing a lot of factual information. In short, it is a "hands-on" approach. The choice for using this approach is based on years of research evidence on the effectiveness this approach has in helping children learn science. As pointed out by Thier, children need to think about what they are doing. In other words, "hands-on" science needs to be coupled with "heads-on" science (Thier, 1986).

Unfortunately for most children, the "hands-on" approach is seldom used. Instead, in most classes, the textbook has become the sole basis for instruction. Even if the textbook has activities, there is little evidence of children being taught science through first-hand experiences (Stake and Easley, 1978). Secretary of Education Bennett has also noted this in his remarks on elementary education. About science, he said, "We need a revolution in elementary school science. There is probably no other subject whose teaching is so at odds with its true nature. We have come to think of science as a grab-bag of esoteric facts and stunts . . . we have also given students the impression that science is a dry and arcane matter gleaned solely from the pages of a textbook" (Bennett, 1986).

"Hands-on" elementary school science is not new. You probably know about the activity-oriented science curricula developed in the 60's and 70's. Perhaps you even taught, or are teaching, one. The three most widely known of these curricula were the Elementary Science Study (ESS), the Science Curriculum Improvement Study (SCIS), and Science, A Process Approach (SAPA). How effective were they? Did they get children to use higher-level thought processes? Many research studies have been conducted in the years since their development to attempt to answer questions such as these. An analysis of analyses (termed a meta-analysis) of these numerous independent research studies comparing the above mentioned projects and other "hands-on" curricula to textbook approaches has been done. Shymansky, Kyle, and Alport (1982) surveyed research studies comparing the performance of children in the above three curriculum projects plus other innovative curricula with the more commonly used textbook approach. In an analysis of 105 experimental studies over the past 25 years involving over 45,000 students, they found that children in the "hands-on" approach out-performed children in textbook programs on every criterion measured. These criteria included academic achievement, attitudes, process skill development, creativity, intellectual development, and performance in related school subjects. As a result of their study, Shymansky and his colleagues concluded that children in "hands-on" science programs "achieved more, liked science more, and improved their skills more than did students in traditional, textbook based classrooms."

Bredderman (1982) also investigated the effects of the activity-oriented curriculum with textbooks in an analysis involving the experiences of 13,000 students in over 1,000 classrooms in sixty studies over the past 15 years. His findings state: "with the use of activity-based science

programs, teachers can expect substantially improved performance in science process and creativity; modestly increased performance on tests of perception, logic, language development, science content, and math; modestly improved attitudes toward science and science class; and pronounced benefits for disadvantaged students." Beane (1985) and Rowe (1975) also point out the positive effects "hands-on" elementary science can have on the disadvantaged child.

Wise and Okey (1983), also using meta-analysis, looked at how various teaching strategies affected achievement in science. They concluded that in an effective classroom, "students get opportunities to physically interact with instructional materials and engage in varied kinds of activities." They go on to say that "the effective science classroom reflects considerable teacher planning. The plans, however, are not of a 'cookbook' nature. Students have some responsibility for defining tasks."

Renner (1973) did several research studies involving the effectiveness of SCIS. In one done with fifth graders comparing a "hands-on" approach to one that was not, he concluded that not only were the science processes of manipulating data and interpreting graphs and tables better for the "hands-on" group, but also that the content areas of reading, mathematics and social studies were being enhanced. There seems to be a basic skills development that "hands-on" science does quite well.

In summarizing several research studies, Blosser (1985) concluded that "teachers can help students learn to think scientifically . . . the indirect approach to instruction does appear of value when a teacher's goal is to help students think at a higher level than factual recall."

As a result of the research, Mechling and Oliver (1983) have summarized six important reasons for teaching science from a "hands-on" approach:

1. Students in activity-based science programs out-perform students in non-activity programs. The research studies mentioned previously point this out time and time again. The performance is in content areas as well as in the processes of science.

2. Students who have "hands-on" experiences develop thinking skills. The thinking skills include classifying, inferring, hypothesizing, collection and analysis of data, and designing investigations.

3. "Hands-on" activities help students take responsibility for their own learning. The ignited curiosity about things helps to motivate the child to continue questioning and learning in and out of school situations.

4. "Hands-on" activities reinforce what we know about how youngsters learn. From a Piagetian perspective, children learn best by manipulating concrete objects. Language concepts are learned best by providing the experience first, then the concepts.

5. "Hands-on" activities can reinforce learning in other curricular areas. Wellman (1978) after synthesizing research evidence, concluded that:

a. Active experience with science helps language and logic development.
b. Science instruction appears especially helpful for children who are considered physically or culturally different.
c. Science activities provide a strong stimulus and a shared framework for converting experience into language.
d. Reading skill development stems from language and logic development, which comes after concepts are formed from repeated encounters with objects and events through science activities.

6. "Hands-on" activities help us avoid the "mindless" curriculum. The mindless curriculum is one that forces children to memorize a lot of factual information without regard to how it all fits together. As an example, probably the most saluted man in America is a man named Richard Stans. Each day numerous children rise and 'pledge allegiance to the flag of the United States of America, and to the Republic for Richard Stans . . ."

The challenge you face is to involve your students with this curriculum through a "hands-on" approach. There is much evidence to support this method of teaching if you are interested in bringing science content as well as the methods of science to your students. Challenge them!!

REFERENCES

Beane, DeAnna Banks. 1985. ***Mathematics and Science: Critical Filters for the Future of Minority Students***. The MidAtlantic Center for Race Equity, The American University, Washington, DC.

Bennett, William J. 1986. ***First Lessons, A Report on Elementary Education in America***. Washington, DC: U.S. Department of Education, ED 395.

Blosser, Patricia E. 1985. Meta-analysis research on science instruction. ***ERIC/SMEAC Science Education Digest No. 1.***

Bredderman, Ted. 1982. Activity science-the evidence shows it matters. ***Science and Children***, Vol. 20. No. 1: 3941.

Mechling, Kenneth R. and Oliver, Donna L. 1983. ***What Research Says About Elementary School Science.*** Washington, DC: National Science Teachers Association.

Renner, John W., et. al. 1973. An evaluation of the science curriculum improvement study. ***School Science and Mathematics***, Vol. 73, No. 4: 291318.

Rowe, Mary Budd. 1975. Help is denied to those in need. ***Science and Children***, Vol. 12, No. 6: 2325.

Shymansky, James, Kyle, William Jr., and Alport, Jennifer. 1982. How effective were the hands-on science programs of yesterday? ***Science and Children***, Vol. 20, No. 3:1415.

Stake, Robert E. and Easley, Jack, 1978. ***Case Studies in Science Education. Volume 1.*** The Case Reports. Washington, DC: U.S. Government Printing Office.

Thier, Herbert. 1986. ***Heads on Elementary Science: The Challenge for the Nineties. Monograph and Occasional Paper Series #1***. Council for Elementary Science International.

Wellman, Ruth T. 1978. Science: a basic for language and reading development in ***What Research Says to Science Teachers, Vol. 1***. Washington, DC: National Science Teachers Association.

Wise, Kevin C. and Okey, James. 1983. A meta-analysis of the effects of various science teaching strategies on achievement. ***Journal of Research in Science Teaching***, Vol. 20, No. 5: 419435.