U.S. Department of Education

MATHEMATICS & SCIENCE EDUCATION EXPERT PANEL

Exemplary & Promising SCIENCE PROGRAMS

2001

U. S. Department of Education
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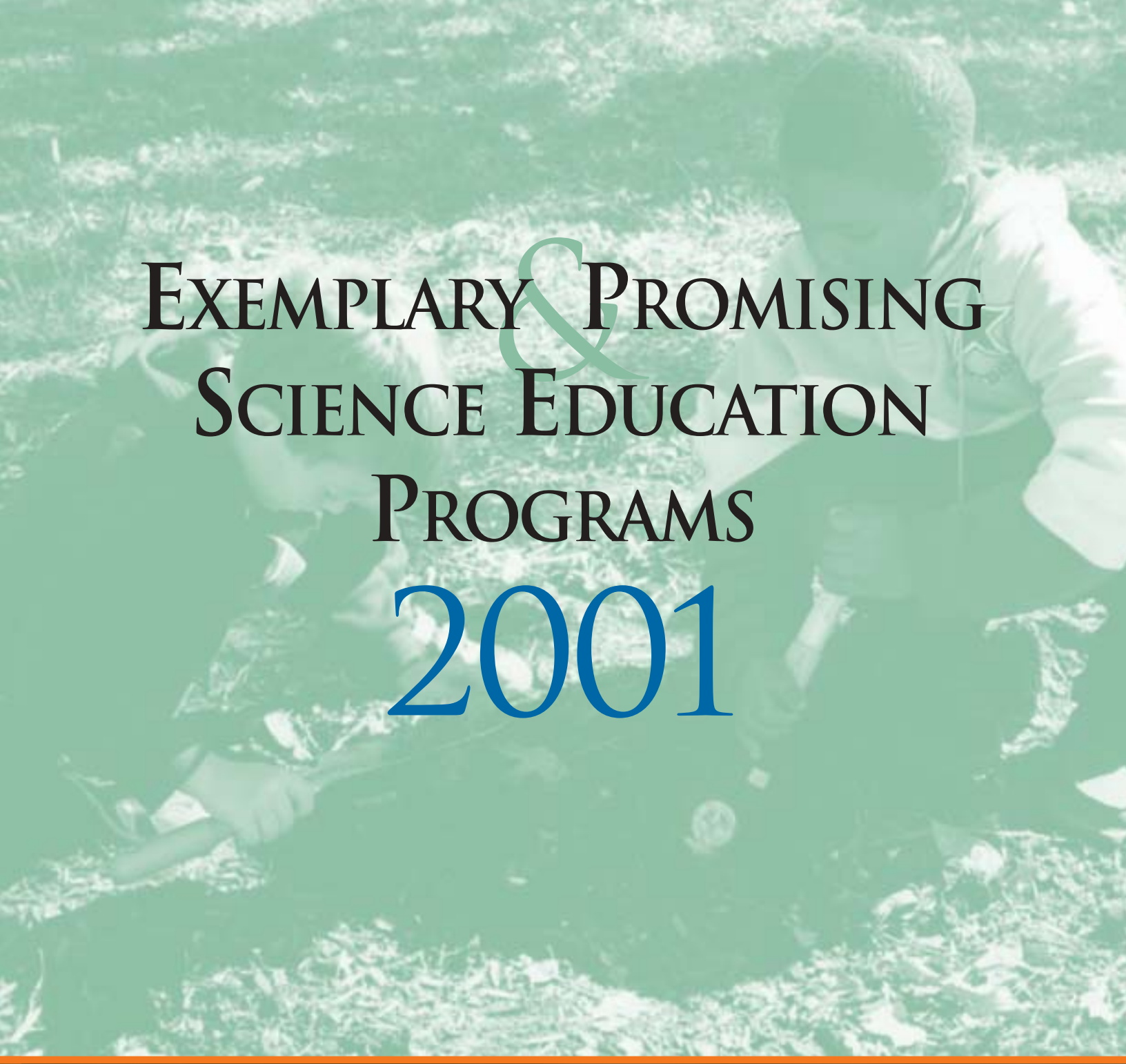

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U.S. Department of Education
Office of Educational Research and Improvement

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October 2001

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Introduction

In 1994, Congress directed the Office of Educational Research and Improvement (OERI) to establish "panels of appropriate qualified experts and practitioners" to help identify educational programs and materials that work. In response, OERI created a system of expert panels to evaluate educational programs in the content areas of mathematics and science education, gender equity, educational technology, and safe, disciplined and drug-free schools; and to recommend to the Secretary of Education those programs that should be designated as exemplary or promising. OERI established the Mathematics and Science Education Expert Panel in 1996, guided by the advice of educators, scientists, mathematicians, and policymakers with extensive experience in mathematics and science education. The intent of the Panel was to provide an informed examination of available mathematics and science education materials that could be used as a tool to assist school personnel in the selection of curricular materials. The Panel developed and monitored a valid and reliable process for reviewing program submissions and materials that included creating criteria under which programs would be examined, developing review protocols, examining the evaluation instrument ratings and comments of field-based reviewers, and making decisions about which programs to recommend to the Secretary as exemplary and promising. The criteria were developed pursuant to OERI regulations that implemented the statutory directive.

The Review Process

In 1998, the first year of operation, the Expert Panel on Mathematics and Science Education examined mathematics education programs. In 1999, the Panel turned its attention to science education programs. As they had done during the mathematics review cycle, the Expert Panel surveyed the field of science education to learn about the curricular frameworks in use across the country. By the end of 1996, 46 states plus 2 other jurisdictions (DC, VI) had completed a state content standards or curriculum framework document for K–12 science education closely aligned with the *National Science Education Standards* established by the National Research Council (NRC) and *Project 2061: Benchmarks for Science Literacy* from the American Association for the Advancement of Science (AAAS). As the Panel set up the process for making determinations, the criteria they established for reviewing science education programs were, therefore, heavily aligned with those standards.

The Expert Panel instituted an open and widely publicized submission process that requested voluntary applications from the field. As part of the submission process to the Panel, science education programs were asked to identify which of three specialty areas—earth science, life science, and physical science—their programs covered. A total of 27 science education submissions were received and reviewed during the 1999 cycle.

Teachers, researchers, and practitioners with expertise in science education were nominated by diverse science education sources to serve as field-based reviewers to examine the quality of the programs submitted to the Panel. Factors such as specialty science area expertise and grade level experience were weighed in determining which candidates were selected as reviewers. Reviewers selected by the Department were diverse in terms of gender, ethnicity, and geographic location. They represented a broad range of areas of expertise and often indicated expertise in multiple professional areas, grade levels, and science content areas. A total of 37 field-based quality reviewers were selected and trained for 3 days in the review process. Reviewers were assigned to review submissions matched with their areas of science expertise and grade level experience.

Each of the 27 science submissions was reviewed by at least 2 field-based quality reviewers. They reviewed the quality of the program, its usefulness to others, and its educational significance based on materials submitted by the developers. Programs that received high ratings from this quality review procedure were then reviewed by program evaluation experts who assessed the rigor of the evaluation data and the claims of effectiveness made by the submitters. The full Expert Panel then examined all of the program submissions and materials along with the ratings and comments provided by the program quality and program evaluation reviewers to determine which science education programs to recommend to the Secretary of Education as exemplary or promising.

Exemplary programs were highly rated on quality, usefulness to others, and educational significance and provided *convincing* evidence of effectiveness in *multiple* sites with *multiple* populations. Promising programs were rated high in terms of quality, usefulness to others, and educational significance and provided *preliminary* evidence of effectiveness in *one or more* sites.

How to Use These Recommendations

This publication provides descriptions of the two exemplary and seven promising science education programs designated by the Department. Contact information for each program is also provided. In the program summaries that follow, the sections "Program Description" and "Professional Development Resources and Program Costs" were prepared based on information provided by the developers. Where needed, developers provided updated information on costs for this publication. The remaining sections—"Program Quality," "Usefulness to Others," "Educational Significance," and "Program Effectiveness and Success"—are based on the assessments of the quality and evaluation reviewers and Expert Panel members.

These recommendations may be used in many ways. They probably will be most helpful to those who are engaged in decision-making about science curriculum materials and can match the goals of the program with their own system's goals. The Expert Panel selection criteria and review process can be used as a basis for analyzing materials and programs under consideration for selection. In another vein, school districts can use the selection criteria and review process as a point of comparison for updating their own curriculum selection process. Or, local school or school district selection committees for science programs and materials may use these recommendations to decide which materials they will review in greater depth. The designated programs and the process for selection are additional tools provided to help schools and districts make the important decisions on appropriate materials and programs for their science courses.

Evaluation Criteria

The following criteria and indicators were used to evaluate the science programs submitted to the Expert Panel.

A. Quality of Program

Criterion 1. ***The program's learning goals are challenging, clear, and appropriate for the intended student population.***

- Indicator a. The program's learning goals are explicit and clearly stated.
- Indicator b. The program's learning goals are consistent with research on teaching and learning or with identified successful practices.
- Indicator c. The program's learning goals foster the development of skills, knowledge, and understandings.
- Indicator d. The program's learning goals include important concepts within the subject area.
- Indicator e. The program's learning goals are achievable with appropriate hard work and persistence.

Criterion 2. ***The program's content is aligned with its learning goals, and is accurate and appropriate for the intended student population.***

- Indicator a. The program's content is aligned with its learning goals.
- Indicator b. The program's content emphasizes a few topics in great depth.
- Indicator c. The program's content reflects important scientific ideas and the processes and nature of scientific inquiry.
- Indicator d. The program's content makes connections within a particular science, across the sciences, and to other disciplines.
- Indicator e. The program's content is culturally and ethnically sensitive, free of bias, and reflects diverse participation and diverse student interests.

Criterion 3. ***The program's instructional design is appropriate, engaging, and motivating for the intended student population.***

- Indicator a. The program's instructional design provides students with a rationale for learning this material.
- Indicator b. The program's instructional design attends to students' prior knowledge and commonly held conceptions.
- Indicator c. The program's instructional design fosters the use and application of skills, knowledge, and understandings.
- Indicator d. The program's instructional design is engaging and promotes learning.
- Indicator e. The program's instructional design promotes student discussions, appropriate collaborative work, and reflection on experiences.
- Indicator f. The program's instructional design promotes multiple and effective approaches to learning.

Criterion 4. ***The program's system of assessment is appropriate and designed to provide accurate information about student learning and to guide teachers' instructional decisions.***

Indicator a. The program's system of assessment is an integral part of instruction.

Indicator b. The program's system of assessment is consistent with the content, goals, and instructional design of the program.

Indicator c. The program's system of assessment encourages multiple approaches and methods.

Indicator d. The program's system of assessment probes students' abilities to demonstrate depth of understanding and to apply their learning.

Indicator e. The program's system of assessment helps teachers select or modify activities to meet learning needs.

B. Usefulness to Others

Criterion 5. ***The program can be successfully implemented, adopted, or adapted in multiple educational settings.***

Indicator a. The program provides clear instructions and sufficient training materials to ensure use by those not in the original program.

Indicator b. The program is likely to be successfully transferred to other settings.

Indicator c. The program specifies the conditions and resources needed for implementation.

Indicator d. The program's costs (time and money) can be justified by the benefits.

C. Educational Significance

Criterion 6. ***The program's learning goals reflect the vision promoted in national standards in science education.***

Indicator a. The program's learning goals and subject matter content are aligned with national standards.

Indicator b. The program's pedagogy and assessment are aligned with national standards.

Indicator c. The program promotes equity and equal access to knowledge as reflected in national standards.

Criterion 7. ***The program addresses important individual and societal needs.***

Indicator a. The program is of sufficient scope and importance to make a positive difference in student learning.

Indicator b. The program contributes to increases in teachers' knowledge of effective teaching and learning.

Indicator c. The program:

- is designed to improve learning for a wide spectrum of students; OR
- serves to meet the special learning needs of underserved students; OR
- serves to meet the special learning needs of high-performing students whose interests and talents go beyond core science education.

D. Evidence of Effectiveness and Success

Criterion 8. ***The program makes a measurable difference in student learning.***

Promising Programs, in addition to satisfying Criteria 1–7, must provide *preliminary* evidence of effectiveness in *one or more sites* for *at least one* of the indicators below:

Indicator a. The program has evidence of gains in student understanding of science.

Indicator b. The program has evidence of gains in inquiry, reasoning, and problem solving skills.

Indicator c. The program has evidence of improvements in course enrollments, graduation rates, and postsecondary school attendance.

Indicator d. The program has evidence of narrowing the gap in achievement or accomplishment between disaggregated groups.

Indicator e. The program has other evidence of effectiveness or success.

Exemplary Programs, in addition to satisfying Criteria 1–7, must provide *convincing* evidence of effectiveness in *multiple sites with multiple populations* regarding *two or more* of the indicators below. The items must include either both indicators from Part I or one indicator from Part I and one indicator from Part II. Providing evidence of two indicators from Part II is not sufficient.

Part I

Indicator a. The program has evidence of *significant* gains in student understanding of science.

Indicator b. The program has evidence of *significant* gains in inquiry, reasoning, and problem solving skills.

Part II

Indicator c. The program has evidence of improvements in course enrollments, graduation rates, and postsecondary school attendance.

Indicator d. The program has evidence of narrowing the gap in achievement or accomplishment between disaggregated groups.

Indicator e. The program has other evidence of effectiveness or success.