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ABSTRACT

The Center for Science and Mathematics Education was established at California State Polytechnic University (Pomona) to: (1) promote the professional development of public school teachers of mathematics, science, and computer education; (2) improve the teaching and learning of science and mathematics in the schools; and (3) promote the study of science and mathematics by all students, particularly females and minority group members. Typical activities through which the center accomplishes these goals are on-site consultation with school districts, delivery of instruction in both content and methodology at the university and by interactive television network to school sites, publication of a quarterly newsletter of practical value to educators, and an annual conference for educators. These activities are conducted by three coordinators, one each for biological sciences, physical sciences, and mathematics and computer education. The center's advisory board consists of university science faculty, school district teachers and administrators, and representatives of local industries. The program is currently funded directly by the university, although outside support has been provided in the past. Its single greatest need is adequate physical facilities. (MSE)

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AASCU/ERIC Model Programs Inventory Project

The AASCU/ERIC Model Programs Inventory is a two-year project seeking to establish and test a model system for collecting and disseminating information on model programs at AASCU-member institutions--375 of the public four-year colleges and universities in the United States.

The four objectives of the project are:

- To increase the information on model programs available to all institutions through the ERIC system
- To encourage the use of the ERIC system by AASCU institutions
- To improve AASCU's ability to know about, and share information on, activities at member institutions, and
- To test a model for collaboration with ERIC that other national organizations might adopt.

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Abstract

There are several persistent problems in the mathematics and science education of children: a severe shortage of qualified teachers in mathematics and science throughout the nation, budget problems which lead to a shortage of lab equipment and supplies, out of date equipment and textbooks, and overcrowded classrooms. School districts need resources which are beyond their internal capabilities to establish and maintain adequate programs in science and mathematics education.

Recognizing these profound needs, Dr. Ray Shiflett, Dean of the College of Science, and Dr. Alice King of the Mathematics Department, in consultation with other faculty members, developed the Center for Science and Mathematics Education (CSME) to bring the resources of the College of Science to assist public schools in meeting this challenge. Dean Shiflett brought together a consortium of teachers and administrators, representatives of local industries, and members of the College of Science, Cal Poly, Pomona as an advisory board for CSME. They defined a formal statement of the goals of the Center:

"The Center for Science and Mathematics Education (CSME) was established as the vehicle through which the College of Science at California State Polytechnic University, Pomona, will serve the educational community.

The Center's purpose is to:

- Promote the professional development of teachers of mathematics, science, and computer education
- Improve the teaching and learning of science and mathematics in the schools
- Promote the study of science and mathematics by all students, with particular outreach to females and minority group members"

Typical activities through which CSME accomplishes its goals are on site consultation with school districts, delivery of instruction (both content and methodology) at Cal Poly, Pomona and via an interactive television network to school sites, publication of a quarterly newsletter of practical value to educators, and the hosting of an annual conference for educators.

CSME is funded directly by the university. While CSME has been primarily successful in carrying out its goals, a persistent need is the establishment of a permanent physical location.

Introduction

This report discusses the Center for Science and Mathematics Education (CSME), a component of the College of Science, California State Polytechnic University, Pomona. After presenting the history of the development of CSME, current activities are discussed. The report closes with an evaluation and look to the future.

Background

School districts need resources which are beyond their internal capabilities to establish and maintain adequate programs in science and mathematics education. To answer this need, universities must establish ties with surrounding school districts. These ties will help the school districts in developing improved curricula in science and mathematics along with implementing more appropriate methodologies. In addition these cooperative ventures will improve the level of preparedness in mathematics and science of students entering colleges and universities. Research by faculty members on issues in science and mathematics education, both at the pre-university and university levels, are practically applied, improving the science and mathematics education of students. Such a cooperative effort in the field of science and mathematics education helps to confirm the comprehensive nature of a university, and reaffirm its position within the educational system as a whole. This effort addresses the concerns expressed in numerous national reports about United States citizens' lack of knowledge of mathematics and science.

There are several persistent problems in the mathematics and science education of children. There is a severe shortage of qualified teachers in mathematics and science throughout the nation; the supply of qualified teachers is not expected to increase appreciably in the forseeable future, in part because of the disparity between salaries in education and in business and industry. Schools also face budget problems which lead to a shortage of lab equipment and supplies. Equipment and textbooks are often out of date. Overcrowded classrooms further complicate problems in presenting mathematics and science in appropriate ways.

Recognizing these profound needs, Dr. Ray Shiflett, Dean of the College of Science, and Dr. Alice King of the Mathematics Department, in consultation with other faculty members, developed the concept of the Center for Science and Mathematics Education (CSME) to bring the resources of the College of Science to assist public schools in meeting this challenge.

Description

In 1984 Dean Shiflett brought together a consortium of teachers and administrators from the school districts in the area surrounding Cal Poly, Pomona, representatives of local industries, and members of the College of Science, Cal Poly, Pomona to plan the development of CSME. These volunteers were initially organized as a steering committee consisting of faculty members from Chemistry, Computer Science, Physics, Biological Sciences, Geological Sciences, and Mathematics, and an advisory committee consisting of individuals from local school districts, business, and industry, including representatives from ARCO, General Dynamics, and NASA's Jet Propulsion Laboratory, among others. Their initial statement of purpose was that "The Center will encourage open exploration of problems and their solutions as well as a mechanism to pursue funding for experimental programs and educational research".

Activities proposed at that time for the Center were:

- Collect, organize, and disseminate information about mathematics and science education methodologies and related educational research
- Retraining programs to qualify teachers from other content areas to teach mathematics and science
- Development of methodologies, and training of teachers, for the application of new tools of technology (computers, video disk, etc.) to teaching and research.
- Develop an inventory of ideas for inexpensive, yet effective, activities and demonstrations for science and mathematics classes
- Assistance to faculty and public school personnel in writing grant proposals and seeking funding for projects designed to help improve science and mathematics instruction
- Work with school districts to identify courses which should be taught to support teacher retraining and skills enhancement
- In addition to courses at Cal Poly, Pomona, provide courses for public school teachers via PolyNet interactive television network (one-way video, two-way audio)
- Provide PolyNet courses for advanced high school science and mathematics students
- Provide guidance and facilities for research into the learning and retention processes in K-12 mathematics and science.
- Develop, with the School of Education, master's degrees in mathematics education and science education, and specialist credentials in programs in elementary science and elementary mathematics

Already, at this early stage of designing and developing CSME, the College of Science was involved with school districts ranging from Los Angeles and Orange Counties north to Lake County (north of San Francisco).

In 1986 the Center formally received the name Center for Science and Mathematics Education. Also defined at this time was a formal statement of the goals of the Center:

The Center for Science and Mathematics Education (CSME) was established as the vehicle through which the College of Science of California State Polytechnic University, Pomona, will serve the educational community.

The Center's Purposes are to:

- **Promote the professional development of teachers of mathematics, science, and computer education**
- **Improve the teaching and learning of science and mathematics in the schools**
- **Promote the study of science and mathematics by all students, with particular outreach to females and minority group members**

To implement these purposes, CSME plans to:

- **Conduct workshops for teachers of science, mathematics, and computer education**
- **Serve as a clearing house for information about current issues and trends in science, mathematics, and computer education**
- **Serve as a resource/learning center in science, mathematics, and computer education**
- **Assist schools in identifying and solving problems related to curricula in science, mathematics, and computer education**
- **Assist schools in identifying and solving problems related to the teaching of science, mathematics, and computer education**

Currently, activities of the Center are conducted by three coordinators (one each for biological sciences education, physical sciences education, and mathematics and computer education); the directorship of the Center rotates among these three. They have the support of a half time clerical

position, and approximately 1/4 time from another individual to support CSME's activities that require desktop publishing and / or extensive use of computers and other instructional technologies.

CSME's recurring costs are for: faculty and support staff reassigned time, reproduction of materials, purchase of educational materials and software, publication and distribution costs for POLYMATH (CSME's newsletter for teachers) and conference brochures, as well as facilities and meal costs for the annual conference.

Results

CSME cannot report results of the kind associated with traditional research projects. The goal of meeting the needs of school districts to assist their teachers to be more effective and their students to be more successful in the areas of science, mathematics, and computer education are translated into specific activities by direct contact with the schools, both through the mechanism of the CSME Advisory Board, and through individual contacts. Activities are developed by CSME in response to the ongoing participation and feedback of local area educators. Their continuing enthusiasm for CSME is an indicator of our success.

Activities carried out to date include:

- Work with Claremont School District to develop a science magnet elementary school
- Development of an assistance program in mathematics for public school students from underrepresented groups
- Delivery of mathematics and science courses and inservice workshops via PolyNet to 17 area High Schools. The College of Science, through CSME, has been the prime provider of instruction over the PolyNet interactive network. In addition to the offerings for students, two-hour broadcasts for their teachers are offered twice a week during the course.
- Publish POLYMATH, a newsletter for teachers of mathematics and science in grades K-8. POLYMATH has articles on issues and research in mathematics and science education, reviews of commercially available resources, and activities that teachers can use with their students. As CSME has grown, so has POLYMATH, from only covering mathematics education, to its current format which includes science and computer education as well. At present POLYMATH is distributed free of charge to educators.
- Conducted a conference for secondary teachers of science, with more planned for the

future.

- Conduct annual Conference on Science, Mathematics, and Computer Education for elementary school teachers. Speakers and session presenters are drawn from throughout the US and cover the gamut from science professionals working in industry, to faculty from several universities, to public school teachers. The conference has grown each year, from 50 participants in 1987 to over 200 in 1989.
- A Summer Institute for elementary teachers, a two week intensive, focusing on one aspect of the area targeted by CSME is in its second year. The 1988 institute covered problem-solving, summer of 1989 dealt with geometry, and probability and science will be the focus for 1990.
- An on-going series of workshops and seminars for Health Services professionals, and students.
- Establishment of a science demonstration materials facility for the use of student teachers and area educators
- Establishment of a mathematics methods laboratory for where teachers can use manipulatives and other materials for the teaching of mathematics. The laboratory also serves as a classroom for Cal Poly, Pomona's courses for individuals preparing to be teachers of mathematics in grades K-12. This facility houses several thousand items for use by student teachers and area educators.
- CSME is the focus of the collaborative efforts of the College of Science and the School of Education. All three coordinators of CSME teach methods courses for the School of Education, as well as content courses within their own department. Reinforcing efforts to provide more effective mathematics instruction in public schools, the School of Education has appointed a mathematics educator who will also teach content courses for the mathematics department and be actively involved in CSME. This level of collaboration between the College of Science and the School of Education is unique within the CSU system, if not beyond.

Conclusions & Recommendations

Of the ten activities suggested by the original planning committee nine have been and continue to be carried out. All of the goals in the formal statement of purpose are being vigorously pursued in the current undertakings of CSME.

CSME has well defined goals, and active, creative individuals capable of maintaining its focus. The single greatest need CSME has at this point in time is the development of adequate physical facilities (offices, demonstration laboratories/classrooms, space for a software/materials library, etc.). Concomitant with the physical establishment of CSME within the University is the need for adequate support staff.

The original funding for CSME came from within the University, and this remains the primary source of funding. Members of CSME spend a substantial amount of time writing grant proposals for funding of specific CSME projects. In the past funding has been obtained from:

- Cal Poly Kellogg Unit Foundation
- National Science Foundation
- State Funding and Federal allocated for programs in science and mathematics education (for example Public Law 98-377, the Education for Economic Security Act).
- A small amount of additional funding is generated by the annual conference for elementary school teachers. Proceeds from the conference are dedicated to the purchase of materials to support other CSME activities.

In general, while funding of CSME has been adequate to support many worthwhile activities, it has been minimal enough to slow the growth of CSME, hamper the development of adequate physical facilities, and divert the time of faculty members of CSME away from research and scholarship activities to handle tasks that would be better dealt with by an (at present virtually non-existent) support staff.

CSME was founded upon, and continues to depend upon, the creativity of a core group of committed individuals. Any institution with such a group, and with funding for at least initial activities, could develop a similar program. A second key condition, after the commitment and creativity of Center members, is the establishment of a close relationship with local school districts. Interested groups or individuals are welcome to contact the Director of CSME for further information.