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ABSTRACT

This 3-week summer project was designed to (1) identify and improve the teaching capabilities of under-prepared junior high school mathematics and science teachers and (2) acquaint college and junior high school teachers with current techniques in mathematics and science at the two different levels (college and junior high) and continue cooperative activities between them. In 1985, 20 teachers participated in a National Science Foundation summer institute. The first 2 weeks were devoted to training in mathematics and science content and teaching techniques. Lectures, demonstrations, and discussions emphasized problem-solving, classroom computer use, discovery techniques, the importance of proof, laboratory techniques, and encouragement of research by students and teachers. During the third week, participants were able to test these concepts and techniques by working with students in the college's annual junior high school math and science camp. Teacher self-evaluation of teaching skills at the beginning and end of the 3-week program showed higher ratings in each of six skill areas upon program completion. Participant ratings of the program were high. In a survey after one semester back in the classroom, each participant described at least five new classroom and professional activities initiated because of experiences at the summer institute. Administrators also attributed increased teacher effectiveness to program participation. (MSE)

IMPROVEMENT OF UNDER PREPARED MATHEMATICS AND SCIENCE TEACHERS

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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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IMPROVEMENT OF JUNIOR HIGH MATHEMATICS & SCIENCE TEACHERS

(Technical Abstract)

Junior high school mathematics and science teachers with less than 20 semester hours of college preparation in mathematics or science will participate in a three week summer project. The first two weeks of the project will be devoted to training in mathematics and science content as well as in teaching techniques. Lectures, demonstrations and discussions will emphasize problem solving, use of computers in the classroom, discovery techniques, the importance of proof, laboratory techniques, and encouragement of research by students and teachers.

The third week of the project will enable the participants to test and evaluate the concepts and techniques emphasized during the first two weeks of the project. This will be done by supervising and working with the junior high school participants in Northern State College's sixth annual "Junior High Math/Science Camp".

The project's effectiveness will be measured by self-evaluation forms to be completed by participants at the beginning and at the completion of the three week training session; by the quality and quantity of materials produced during the first two weeks; and by a report of the effectiveness of the new techniques and approaches after they have been used in the classroom for one semester.

FINAL REPORT

"Improvement of Under Prepared Mathematics and Science Teachers" (TEI-8550109)
William E. Haigh, Director

PROJECT OBJECTIVES

The project "Improvement of Under Prepared Mathematics and Science Teachers" included the following primary objectives:

1. To identify and improve the teaching capabilities of under prepared junior high school mathematics and science teachers.

2. To acquaint college and junior high school teachers with current techniques in mathematics and science at the two different levels (college level - junior high level) and to continue cooperative activities between teachers at both levels.

DESCRIPTION OF PROJECT

In May, 1985, 20 junior high mathematics and science teachers were chosen to participate in the 1985 NSF Summer Institute for the "Improvement of Junior High Mathematics and Science Teachers" on the Northern State College campus. The first two weeks of the project were devoted to training in mathematics and science content as well as in teaching techniques. Lectures, demonstrations and discussions emphasized problem solving, use of computers in the classroom, discovery techniques, and encouragement of research by students and teachers. The third week of the project enabled the participants to test and evaluate the concepts and techniques emphasized during the first two weeks of the project. This was done by supervising and working with the junior high school participants in Northern State College's sixth annual "Junior High Math/Science Camp".

Prior to the 3 week training session, questionnaires were sent to the participants asking the mathematics and science teachers to choose topics and activities which they felt would be most beneficial to improvement of their teaching. Topics most frequently selected by the mathematics teachers included problem solving, discovery techniques, uses of computers in the classroom, examinations and evaluation of computer software, geometry in the real world, mathematics contests, and calculators. The topics frequently selected by the science teachers included problem solving, uses of computers in the classroom, observation and analysis of environment, natural resistance and treatment of disease, controversial topics in science, science fairs, and using word processors. It is interesting to note that most of the topics chosen by the project participants agreed with those that had been previously recommended by school administrators and other teachers' groups.

During the first two weeks of the summer institute (July 8-19), the participants listened to lectures, watched demonstrations, worked in science and computer laboratories, and participated in group and individual activities from 8:30 a.m. until 8:00 p.m. Emphasis was placed both upon mathematics and science content and on teaching techniques. The enthusiasm shown by the participants

was excellent and the institute staff agreed that they had not worked with a more interested or devoted group.

In addition to the content and techniques, participants also made plans for trying out their new found skills on the junior high students that attended the 6th annual Junior High Math/Science Camp at Northern State College (July 21-26). The mathematics and science teachers were given opportunities to work with the junior high students in both group and individual situations. Topics emphasized during the junior high camp included problem solving, discovery activities, laboratory research, computer applications, library research, LOGO programming, and computer programming contests.

SELF EVALUATION BY PARTICIPANTS

At the beginning and at the completion of the 3 week summer institute, the participants completed self evaluations of their teaching skills. They evaluated themselves in their abilities 1) to use computers in the classroom; 2) to teach problem solving; 3) to use discovery techniques; 4) to design classroom activities; 5) to use laboratory techniques; and 6) to do research and encourage students to do research. Ratings were made on a scale of 1 thru 10 with a rating of 1 indicating poor and a rating of 10 indicating excellent. The following table summarizes the results of the self evaluation made by the 20 participants.

SELF EVALUATION OF TEACHING TECHNIQUES BY
1985 SUMMER INSTITUTE PARTICIPANTS

Specific Area Evaluated	Pre-Institute Mean	Post-Institute Mean
Ability to use computers in the classroom	2.90	5.90
Ability to teach problem solving	1.64	6.95
Ability to use discovery techniques	4.75	6.50
Ability to design classroom activities	5.75	7.00
Ability to use laboratory techniques	5.45	6.90
Ability to do research and encourage students to do research	5.50	6.55

It should be noted that the participants, as a group, rated themselves higher in every area at the completion of the three week project (post-institute means) than they did at the beginning of the three week project (pre-institute means).

EVALUATION OF THREE WEEK TRAINING SESSION

In addition to self evaluation, the 1985 summer institute participants were asked to complete questionnaires evaluating the institute. The following is a summary of the results:

ORGANIZATION OF SUMMER INSTITUTE

Eighteen participants rated the institute as well-organized, while 2 participants felt that the institute had some organization; but was not always clear.

SKILLS OF THE STAFF

All 20 of the participants felt that the staff produced steady interest and excellent mastery of material.

QUALITY OF INFORMATION PRESENTED

Nineteen of the participants rated the material as very interesting and beneficial in understanding current happenings in mathematics and science while one participant felt that most of the material was interesting.

FACILITIES

Nineteen of the participants rated the facilities as excellent while one participant rated the facilities as good.

REPORTS OF PARTICIPANTS AFTER RETURNING TO CLASSROOM FOR ONE SEMESTER

On December 26, 1985 the project director sent a letter to each of the 20 participants asking them to describe activities that they had initiated because of their involvement in the 1985 NSF Summer Institute. By February 7, 1986 all 20 participants had responded to the director's request. Each participant described a minimum of five new activities that he/she had initiated because of his/her experiences at the 1985 NSF Summer Institute. The following summarizes the responses with the number inside each set of parentheses indicating the number of participants involved:

1. New Class activities

   (12) Computer activities
   (11) Calculator activities
   (10) Problem Solving activities
   (9) Metric activities
   (9) Educational Games
   (7) Discovery Techniques
   (6) Mold Cultures
   (4) Probability and Statistics activities
   (3) Emphasis on Laboratory Safety
   (3) Geoboard activities
   (3) Estimation activities
   (3) Divisibility Tests

(3) Fraction activities
(3) Acid/Base Experiments
(3) Laboratory Observation Techniques
(2) GCF and LCM activities
(1) Titration; Blood typing; Bacteria; Diseases; Periodic Table; Astronomy; Light; DNA Isolation; Mineral Identification; Flame Tests; Tiling; Casting Out Nines; Area; Magic Squares; and Mental Computations.

2. Participation in Science and Mathematics Fairs:

(4) Placed greater emphasis on science and mathematics fairs
(3) First time school had science fair in several years
(3) Placed emphasis on research rather than construction
(2) Organized science clubs
(1) Participated in "Math Counts"
(1) Attended Science Olympiad

3. New Memberships in Mathematics and Science Organizations

(3) National Council of Teachers of Mathematics
(2) National Science Teacher's Association
(1) South Dakota Science teachers's Association

4. First Time Attendance of Professional Meetings

(2) State Mathematics Conference in Sioux Falls
(2) South Dakota Science Teacher's Association Meetings
(3) South Dakota Academy of Science Meeting

5. Miscellaneous Responses:

Participants of the 1985 NSF Summer Institute reported improvement in the organization of classes; increased confidence in teaching mathematics and science; improvement in the ability to design own classroom activities; increased use of library investigations; increased use of study skill activities; and increased use of mathematics and science journals.

REPORTS OF PRINCIPALS AND SUPERINTENDENTS AFTER PARTICIPANTS SPENT ONE SEMESTER IN CLASSROOM

On December 26, 1985 school administrators, of schools in which the NSF participants taught, were asked to describe the effectiveness of the new techniques and approaches that have been used in the classroom. Eighteen of the 20 administrators that were contacted responded. The following is a summary of the responses with the number inside of each set of parentheses indicating the number of administrators with the like responses:

(8) Participants showed increased enthusiasm and greater sense of confidence;
(5) Participants shared new activities with other teachers;
(5) Increased interest in use of computers;
(4) Increase in use of laboratories and improvement in laboratory experiments;
(2) Improvement in teaching problem solving;
(2) Increased interest in mathematics and science shown by students; and
(2) Increased interest and improvement of science and mathematics fairs.

Copies of the letters sent to the project director by the school administrators are included at the end of this report.

SUMMARY

The project is still underway with teachers in their classrooms making use of many of the topics and activities included in the 3 week summer program. In the few months that junior high schools have been in session this year, Northern State College staff members have been contacted by 1985 summer institute participants for materials on study skills, for references to LOGO activities, for information on chemicals, for in-service help in mathematics, for help in setting up astronomy experiments, for information on science fairs, and for information on meetings of science and mathematics organizations. The 1985 Summer Institute participants are not only doing new things in their classes, but they are also making use of the college faculty and other outside sources.

Special "get togethers" of the project participants and the project staff have been held and will continue to be held at meetings such as the South Dakota Council of Teachers of Mathematics spring conference, the South Dakota Academy of Science annual meeting, and the fall meeting of the South Dakota Education Association. These "get togethers" will allow participants and staff an opportunity to renew acquaintances and to share successful classroom experiences.