A SUCCESSFUL MIDDLE SCHOOL TEACHER ENHANCEMENT PROGRAM: PROJECT SEED (SCIENCE EDUCATION THROUGH EXPERIMENTS AND DEMONSTRATIONS)

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Project SEED is a National Science Foundation Teacher Enhancement program that began in Summer 1990, and will continue through post-program follow-up in 1993. It was designed as a course in the basic principles of physics presented through demonstration lectures and experiments, field trips, and guest lectures. The central objective of the project is to present basic concepts and principles of physical science in ways that a diversity of middle school teachers could adapt to the needs of the even wider diversity of students they teach. Special programming time was devoted to a lecture and discussions about how girls learn science.

Northeastern University's middle school teacher enhancement efforts were launched by Professor Michael Silevitch, Director of the Center for Electromagnetics Research. Instructors in the SEED Project are two physicists, Professor Alan Cromer and Dr. Christos Zahopoulos. Dr. Paula Leventman is the project evaluator. This paper highlights the evaluation of Project SEED during and after the summer 1990 pilot. Objectives of the evaluation were to assess (1) how much teachers learned, and (2) how much of what they learned they actually used with their students during the following school year.

METHODS OF EVALUATION

Multiple methodologies were used to evaluate the Project SEED 1990 pilot. PARTICIPANT OBSERVATION was important in helping to understand the flow of the project and in forming the construction of evaluation questionnaires and focus group directed discussion items. FOCUS GROUP DISCUSSIONS were held at the midpoint and the end of the July program and during an April follow-up day on campus. QUESTIONNAIRES were filled out by participating teachers at the end of the July program. Structured telephone interviews with SEED teachers were conducted from February 26 - March 6, 1991.

RESULTS OF THE END OF PROJECT GENERAL QUESTIONNAIRE

As TABLE 1 indicates, all participating teachers rated every aspect of Project SEED very highly.

TABLE 1

Teachers Ratings of Each Aspect of Project SEED
July, 1990

7 point scale(1 = low to 7 = high)

	Mean Scores
Demonstration Lectures	6.3
Activities and Experiments	6.1
Group Discussions and Colleagues' Presentations	6.3
One-on-One Time with Instructors	5.9
N.U. In-House Guest Speakers and Lab Tours	6.4
Field Trips	6.1

All teachers were very laudatory of the project during the end of July focus group.

"Having been in the trenches for 17 years it was refreshing to deal with people who were interested in knowledge for knowledge's sake. They were hard working and engaging. Working with other teachers was also positive."

"Project SEED opened my eyes to the nature of academic research, and heightened my awareness of science and technology."

"SEED expanded my knowledge base in the physical sciences. This program enabled me to build upon my repertoire of hands-on demonstrations and experiences."

RESULTS OF FOLLOW-UP STRUCTURED INTERVIEWS

Most teachers rated their knowledge as moderately to greatly enhanced by each workshop and field trip (as presented in TABLE 11 AND TABLE 111). Whenever they had the opportunity, they increased the use of demonstrations

TABLE 11

Teachers' Ratings of Each Demonstration Workshop Along Three Dimensions - March, 1991

(scale 1 = none to 7 = a great deal)	ENHANCEMENT OF TEACHER'S KNOWLEDGE	INCREASED USE OF DEMONSTRATIONS BY TEACHERS	INCREASED EXPERIMENTS BY STUDENTS
Length and Time Workshop	4.0	4.7	3.9
Area and Volume Workshop	3.9	4.7	4.8
Mass and Density Workshop	4.9	5.3	5.3
Pressure Workshop	5.7	4.8	5.4
Simple Machines Workshop	4.4	2.5	2.5
Motion Workshop	4.9	4.0	3.0
Earth as a Planet Workshop	4.0	3.8	3.8
Elements and Compounds Workshop	3.4	6.7	4.2
Optics Workshop	5.3	2.8	2.3
Heat and Temperature Workshop	4.7	5.2	5.0
Electricity Workshop	4.9	3.7	3.7
Magnetism Workshop	4.7	3.2	3.0

TABLE III

Teachers' Ratings along Three Dimensions of Each Project SEED Field Trip - March, 1991

(scale 1 = none to 7 = a great deal)

	ENHANCEMENT OF TEACHER'S KNOWLEDGE	INCREASED USE OF DEMONSTRATIONS BY TEACHERS	INCREASED EXPERIMENTS BY STUDENTS
Brayton Power Plant Field Trip	6..6	3.0	1.0
Raytheon Field Trip	5.9	3.4	1.0
Plymouth Nuclear Plant Field Trip	5.4	4.0	1.0
Army Natick Research Laboratory	6.4	3.5	1.0
Weston Observatory Field Trip	3.9	1.0	1.0
Haystack Observatory Field Trip	5.3	2.3	1.0

in each area relevant to the curriculum they taught. An increase in the number of experiments by their pupils was reported, particularly in the subjects of area and volume, mass and density, pressure, elements and compounds, and heat and temperature.

All of the teachers rated the field trips highly. The field trip experiences were transmitted to students by their lectures and discussions, rather than through demonstrations and experiments.

POSITIVE IMPACT OF PROJECT SEED ON TEACHING SCIENCE

1. An increased emphasis on hands-on experiences was reported to be helpful for all students but particularly for special needs and lower ability students.

2. All teachers reported that the increased number of experiments helped a full range of students understand the idea of variables and controls. All said that the workshops added to their repertoire of demonstrations and experiments.

3. All teachers reported higher morale and enthusiasm for teaching science as a result of the program.

"We fired 110 teachers in my town last year, and we are going to fire another 50 this year. I was getting pretty negative about education. Project SEED helped my morale."

CONCLUSIONS

1. The formative evaluation of Project SEED revealed how much participating teachers appreciated the hard work and concerted efforts of the instructors on their behalf.

2. All of the teachers were exposed to new subjects and topics and/or gained a better understanding of subjects they had learned in the past. All of the teachers are using more demonstrations and experiments with their own pupils. All of them exhibit a heightened enthusiasm for teaching science.

3. The formative revealed the depth of the need that many middle-aged, tenured, middle school science teachers have for enhancement.

4. The Project SEED team did not appreciate the depth of the teachers' need for enhancement until the April 1991 follow-up session. Teachers had refused to keep journals, take careful lab notes or answer to specifics on evaluation questionnaires. We did not interpret these as clues to the depth of participating teachers' enhancement needs. We all learned a great deal about the distance between the university and the middle school science classroom and are now positioned to build better bridges.