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AUTHOR Ost, David H.
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ABSTRACT

Described is the model for science and mathematics elementary teacher preparation at the California State College, Bakersfield. The model is characterized by the approach of unified activities and includes three components: a preservice program, an inservice program, and a student teaching experience. Team teaching of science and mathematics courses is the major portion of the preservice program, with emphases upon problem solving activities, philosophical orientation, and Piagetian studies. Social studies and language arts are equally required for the teacher candidate. The inservice component is carried out through master teachers and supportive staff. Development of teaching strategies and a tolerance to allow preservice teachers to try various approaches for inservice teachers is the main concern. Student teaching takes place under the supervision of master teachers and college supervisors. Attempts to match student teachers with master teachers are found to be effective. Arrangements of teacher preparation experiences in the integrated preservice-inservice approach are concluded as unique. Further modifications are recommended on the extension of the student teaching period and adoption of a clinical approach. (CC)

USMES AND THE PRESERVICE TEACHER EDUCATION PROGRAM: A MODEL FOR CHANGE

David H. Ost
California State College, Bakersfield

The model for the teacher of elementary school science and mathematics being developed at California State College, Bakersfield has three components: a preservice program, an inservice program and a student teaching experience. Portions of this model developed out of an association with the Unified Science and Mathematics for Elementary Schools Project (USMES) begun in the fall of 1971. At that time Cal State, Bakersfield was a test site to use the USMES materials at the preservice level. The thrust of the pilot program was to present the future teacher with the rationale and approach of USMES so that they might attempt using USMES activities during the student teaching experience and in their later teaching. Since the initial stages the model has taken on new characteristics.

Preservice Component

The preservice component is part of the regular program for preparation of elementary teachers. The program consists of the typical professional courses as well as curriculum and instruction courses in social studies and language arts and science and mathematics. I would like to refer primarily to the science/mathematics course which is team taught by specialists in science education and mathematics education.

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Essentially the course has three phases: 1) activities 2) a philosophical orientation and 3) a study of cognitive characteristics of children.

The activities are problems which are posed to students for in depth study. As an example, the teacher candidate might be challenged with the USMES unit: "Make a burglar alarm system which would be both practical and inexpensive to construct." In the process of examining this problem, students will deal with concepts involving science, mathematics, social studies, as well as other disciplines. He will be faced with applying these concepts. He will also design and manufacture the system using materials and tools from an available design lab. Other USMES units such as Lunch Lines, Consumer Research, and Dice Design have been used for the activities portion of the course. The purpose of these activities is to expose the teacher candidates to concrete examples of a model of teaching as well as to examine science and mathematical systems, and finally, to help gain insights into learning the processes of science and mathematics and social science. This knowledge of learning assists in providing examples of materials appropriate for use with elementary children.

One of the distinct values of comprehensive problem solving activities is that they involve in depth study of real problems and emphasize the processes of problem solving. Such processes are similar, if not identical, in science, mathematics and social science. Real problems cut across normal subject matter boundaries typically found in elementary school classrooms and, being activity centered, the students are much

involved in structuring their own learning. The level of problem solving is a function of the sophistication of the student. The result is personalized learning.

The second aspect of the course, philosophical orientation, deals with numerous readings of articles by various authors who have written about schools and children. All discussion takes place in small groups with minimum instructions or discussion led by the instructor. It is felt that students must be exposed to a rationale which is appropriate to the strategy of instruction used in the course. For example, by combining readings concerning inquiry and discovery with experiences which utilize inquiry and discovery it is felt that the students leave the class with a more functional concept of inquiry and discovery as a teaching strategy.

Woven throughout the course is the study of the cognitive characteristics of children with emphasis upon the application of Piaget. Students begin by doing several Piagetian tasks with children and analyzing their results. Throughout the course they are referred back to the Piaget data for interpretation of activities which may be appropriate to a given cognitive level. Writings of Bruner, Gagne and Rogers, to name a few, are also discussed in small groups. The prime focus is the utilization of ideas presented in an elementary classroom.

In addition to the emphasis on comprehensive problem solving in the science/mathematics course, the language arts/social studies course also utilizes USMES materials.

Inservice Component

A common problem facing any new approach to teaching is one of acceptance by the inservice teacher. This was of particular importance

in the development of our program since student teachers were being trained in an open, hands-on-approach to science and mathematics teaching in the elementary schools. This approach was generally not in full agreement with the conservative philosophy of many experienced teachers who serve in the master teacher role.

Efforts were, and are being made, to identify and work with master teachers who are candidates for supervision roles. It is particularly important that the master teacher understand and appreciate the program which the preservice teacher has completed. This includes an understanding of USMES and other similar hands-on-activities, which necessitates that the master teacher be provided with experiences in unified social science, science, and mathematics, as well as open learning environments. A summer workshop similar in intent and method to the preservice methods curriculum course was designed and offered. A professor who teaches the language arts/social studies course and who is an expert in learning characteristics joined the other members of the team to provide some background for potential master teachers. Time was spent on developing communication skills, examining learning characteristics of children, and a brief introduction to supervisory techniques. Emphasis was not only on developing teaching strategies but fostering a tolerance to allow the preservice teacher to try various approaches.

One of the main problems encountered was that the master teacher did not have sufficient guidance in developing an open learning environment for science, mathematics, and social science. Supportive staff from the college provided the master teacher with assistance so that

if he or she was so inclined to use USMES units someone was available for consultation. This staff member's responsibility is to provide support, both emotionally and physically, and to make available science, social science and mathematics manipulative materials. These latter materials are available on loan from the college's Design Laboratory and Curriculum Library.

An ongoing seminar held 14 times throughout the year emphasizes supervisory skills and further base-building in the curricula. This continual dialogue allows for discussion concerning student teacher/master teacher roles for interaction and provides a forum for discussion of ideas related to USMES and USMES philosophy.

Student Teaching Component

The output of the inservice and preservice components is combined with the student teaching component. The student teaching is supervised by two members of the inservice component staff along with a master teacher. The two college supervisors have worked with the student teachers as well as with master teachers prior to the student teaching experience. One supervisor has training in language arts and social studies while the other is trained in science and mathematics. Emphasis and encouragement is always given to comprehensive problem solving techniques when appropriate.

An attempt is made to match student teachers with master teachers using criteria of dogmatism, rigidity, and personality factors measured by tests administered in the inservice and preservice components. The preliminary results suggest that the matching procedure is very effective.

Future Modifications of the Model

Several modifications of the experimental model are projected. For example, it is anticipated that a clinical approach will be applied. Ten to fifteen student teachers will be assigned to a given school. Two student teachers will be assigned to each master teacher. The full time student teaching experience will be extended to two quarters. The supervisory team will be based in the school as clinical professors.

The benefits from such modifications are varied. More flexibility is available for working with individual student teachers as well as with master teachers. The two quarter approach may provide the student teacher with additional diverse experiences such as with multiple ethnic and cultural situations. As changes in staffing patterns occur the model can easily accommodate to new demands such as differentiated staffing and job descriptions. Inservice training may readily be integrated into new components of the program.

Summary

The various parts of the teacher education program described are in their individuality certainly not new. The arrangement of the experiences in the integrated preservice-inservice approach gives it a unique quality. The described model should be able to accommodate to future changes in teacher education.

We believe the model might be a viable approach for the implementation efforts projected for the National Science Foundation's thrust during the upcoming years. Our approach appears to be working for the implementation of USMES and the comprehensive problem solving approach. In this way we see the model as an effective change agent for bringing students a curriculum which is both meaningful and exciting.