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ABSTRACT

A four-plus semester cooperative school/university science teacher training program at Indiana University is described. This program prepares secondary science teachers with a curriculum that is based on core courses and experiences and minicourses and miniexperiences designed to provide for individual interests and abilities. All of the curriculum components are briefly discussed, especially in relation to the seven stated objectives of the program. (MH)

SCIENCE EDUCATION CENTER

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Secondary Science Teacher Preparation at Indiana University

A Cooperative University/School Model for Secondary Science Teacher Preparation

By

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In 1972, Indiana University received a large institutional grant from the U. S. Office of Education to establish alternate programs of pre-service teacher preparation. The secondary science teacher preparation program is one of the 25 alternatives that have evolved. Many programs were designed as alternatives to existing programs that provided students an opportunity of choice. Since we prepare only 70 secondary science teachers each year, we are phasing out the old program as this one is phased in.

The Old Program

The old pre-service science teacher preparation program consisted of four courses and student teaching, each of which was controlled by a separate faculty. The first course, Introduction to Teaching, was most frequently taught by graduate students under the direction of a single faculty member. we commonly offered 25 sections of this course eacn semester, and the problem of coordinating the program was such that faculty coordinators escaped the assignment as soon as they could. The coordinator was usually a generalist in education. The second course in the sequence, Educational Psychology, was similarly taught and coordinated. The coordinator was an educational psychologist. The third course was the only course taught by a science educator. This course was a science methods course, and all prospective secondary science teachers, irregardless of their major, would take this course. After completing this course as either second semester juniors or first semester seniors, the student could begin his half-semester student teaching experience. All student teaching assignments and all the supervision of student teachers was managed by the Office of Field Experiences. Furthermore, the field supervisors were advanced graduate students and their supervision assignments were geographic

rather than by area of content specialization. Hence, our science students were rarely supervised by a person who had either training or experience as a science teacher. The last course in the sequence, Principles of Secondary Education, could be taken by the student either before or after he student taught. It was taught by faculty of the Department of Secondary Education. Establishing a well articulated program was virtually impossible in this situation.

The articulation problem plus the fact that other major revisions seemed necessary, led us to establish a Division of Teacher Education and charge it (1) to be responsible over all teacher education, (2) to encourage the formation of ad hoc faculty teams who would propose alternate programs that would incorporate early and continuous field experience, develop competency based learning experience, form across discipline education teams and involve Arts and Sciences faculty and secondary school teachers in planning, implementing and evaluating programs, and (3) to continually evaluate efforts of each program.

The New Science Teacher Preparation Program

The description of the new program that follows is organized into four sections. There are Objectives, the Core, the Mini-Program, and Governance.

Objectives

The objectives for the program are our targets. They are expressions of our aspirations, and I will not state that we have accomplished all of them or that we know the best route to their accomplishment. The program is evolving. Considerable emphasis is being placed on evaluation. Efforts

that seem worthwhile are continued. Efforts that fail are modified or eliminated. A brief commentary is provided by each objective.

1. Conduct continuous evaluation. We attempt to evaluate all aspects of the program. Data collected is shared with instructors, advisory boards, and sometimes the pre-service teacher. Three of the papers presented in this session were derived from our evaluation efforts.

2. Create opportunities for early and continuous field experiences for the pre-service teachers. Field experiences are integral portions of each of the four semesters of the program. Additional field experiences can be provided through our mini-course-mini-experience program.

3. Develop replicable competency based learning experiences for pre-service teachers. Attempts are being made to include as much "competency type" material as possible. It is doubtful that the program will ever become entirely competency based.

4. Form an across discipline team of education faculty for the program. The education faculty involved on the team include science educators, an educational psychologist, and a secondary educator. We have discussed adding either a philosopher or a comparative educator to the team.

5. Involve secondary school teachers as planners, developers, evaluators and instructors in the program. Three middle school teachers with assistance from the science education faculty planned and are implementing two-thirds of the first course in

the "core sequence." The supervising teacher selects his/her student teacher in the semester prior to student teaching and together they plan the projects the student will complete during his/her methods course and, of course, the teacher supervises the student teaching experience. Finally, the teachers, school principal, and a science education faculty member will plan and implement the last two courses in the sequence.

6. Establish an advisory board of secondary school teachers to review progress reports and suggest program changes. This is a functional work group.

7. Involve students, Arts and Sciences faculty, Education faculty, and teachers in other advisory capacities as needed. Additional advisory groups have been established. At present they are willing but underworked.

PROGRAM PATTERN

Overall Pattern

The overall pattern of the program is illustrated in Figure 1.

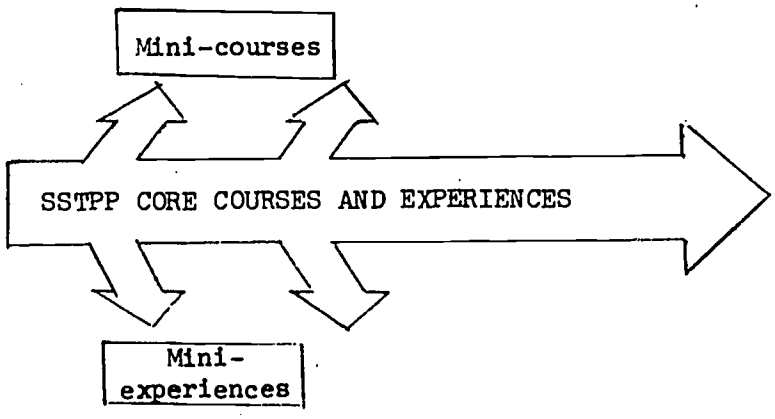

Figure 1. Overall Pattern. Secondary Science Teacher Preparation Program (SSTPP)

The program consists of a core of courses and experiences, and supplementary mini-courses and mini-experiences. The core courses and experiences are designed to fulfill state certification requirements and to provide pre-service teachers the opportunity to develop those competencies that the science education faculty indicate are essential for beginning teachers. The mini-courses and mini-experiences are designed to supplement the core and they have either remedial or enrichment function. All students are required to complete the core courses and experiences. Mini-courses and mini-experiences may be elected by the student, suggested by any of the participating faculty and then elected by students or in some instances, they will be prescribed and become requirements. (For example, a mini-course on the metric system will be prescribed for all students who cannot pass a metric system test). At best, our mini-course/mini-experiences can be labeled a modest attempt to provide students some opportunity to plan their preparation. Most of the "minis" involve minimal faculty time and they can be completed by students at their convenience (vacations, summers or whatever).

The SSTPP Core Courses and Experiences

The core of courses and experiences is illustrated in Figure 2. The program is a four semester sequence of courses and experiences. It is

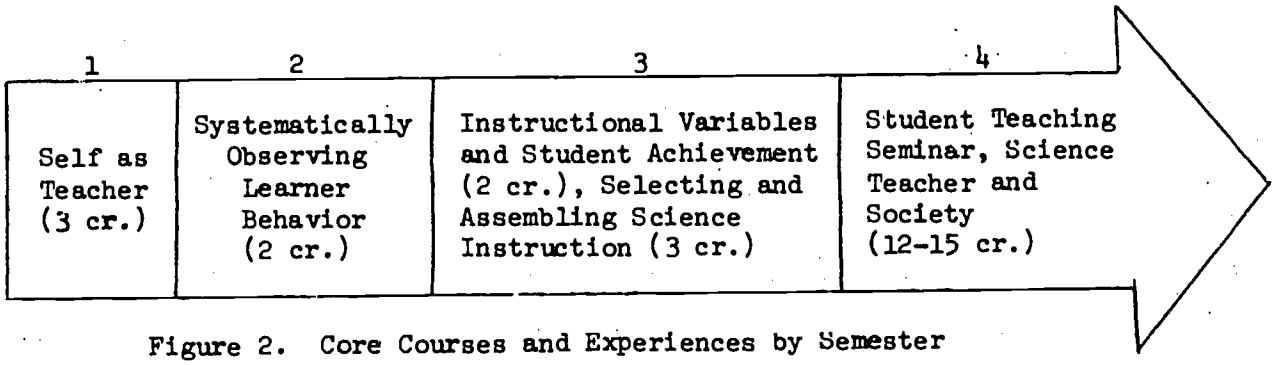

Figure 2. Core Courses and Experiences by Semester

generally completed over a six or seven semester span. The core could be completed in three semesters by a student who decided to become a science teacher during the first semester of his/her junior year.

In Figure 2, the course and experience sequence is illustrated. It is this illustration (Figure 2) that is provided students. As these courses are described, you will realize that the program has three parts. In Part One, we attempt to get the student to decide if he/she wants to become a science teacher and describe what effective science teachers do. In Part Two (semester three), the pre-service teacher studies the psychology of learning and teaching methods and plans implementation strategies. In Part Three (semester four) the student is provided supervised practice.

Self as Teacher (3 cr.) This three credit introduction to teaching is most frequently taken by students in their sophomore year. It is divided into three parts.

Part One is an attempt to help the student begin deciding if he/she wishes to be a teacher. It is taught on campus by a science education graduate student, and it is primarily a reading/discussion class.

Part Two of this course is taught by a middle school teacher who will supervise Part Three. This is an introduction to ISCS and particularly those ISCS chapters that middle school students will be studying when the pre-service teacher begins Part Three of this course. Initially this part of the course was taught in the middle school classroom. It was moved to the science education facility at the request of the pre-service teachers.

Part Three is entirely field based. The students travel by bus (provided) or car to the middle school where their Part Two teacher

teaches and assists the teacher in the classrooms. Initially the pre-service teacher is assigned to work with one or two pupils.

During the 20 hours of classroom participation, the number of pupils is gradually increased to approximately 15 pupils. (We feel fortunate that ISCS is being used in our middle schools because it provides an excellent setting for early field experience. This phase of the program and its evaluation will be described by Linda Knight).

Systematically Observing Learner Behavior (2 cr.) This course consists of 15 hours of campus based instruction and 15 hours of field observation. Students completing this course should be able to construct hypotheses relating teacher behaviors and media characteristics to behaviors exhibited by secondary school students. Our purpose in offering this course is to get our pre-service teachers to focus attention on and ask questions about teacher behaviors and media characteristics that either "turn on" or "turn off" secondary school students. We hope that our students begin realizing that teachers dramatically influence learner behavior through their actions.

Instructional Variables and Student Achievement (2 cr.) and Selecting and Assembling Science Instruction (3 cr.) These two courses are essentially Educational Psychology and science methods. The methods course contains instruction on science teaching, philosophy, objectives, science curricula, teaching strategies, evaluation, professional organizations, etc. Its major focus is on preparing students to locate and implement existing curricula materials. (We decided that we would emphasize implementation in our undergraduate program and design in our graduate program). The psychology course is being designed to complement and supplement the methods course. For example, when objectives are planned and written in the methods course, developmental psychology would be examined in the psychology course.

When teaching strategies are studied in methods, motivation including behavioral modification would be examined in psychology. It is planned that these two courses will be taught on campus. However, very early in this semester the match between the pre-service teacher and his/her supervising teacher will be made. The supervising teacher will identify the topics that the pre-service teacher will most likely be teaching during student teaching.

The planning activity of these courses will involve the pre-service teacher in preparing for his/her specific student teaching assignment.

Student Teaching (8 cr.), Principles of Secondary Education (3 cr.) and Science Teaching Problem Seminar (2 cr.) The first student teachers will enter this phase of the program next fall, and because their numbers are small they will follow the old program pattern rather than the new. The new program will be initiated in the spring semester. The new program will be described here. The new program will include three basic changes. The student teaching period which was formerly eight weeks will extend over the entire semester and the students will complete at least two courses at the field site instead of returning to campus. One course, Principles of Secondary Education, which is mandated by the state and has been taught as a very general course, will be given a specific orientation. The new course will be team planned by the school principal, a department chairman, and a science educator, and its new orientation will lead the student toward an understanding of the specific school, its organization, its faculty, and its administration. Whenever possible, the principal and the department chairman will be involved in the instruction of the course. The third change is the addition of a science teaching problem seminar to the curriculum. This change may not seem dramatic to most because you have probably followed student teachers into the field for years. We have not

done this at Indiana. It is the first time that science educators will formally visit with their students after their methods semester since 1960. These seminars will have two purposes: (1) assisting students in solving specific teaching problems and (2) orienting the faculty toward specific problems our students will face. This last function, educating the science educator, will undoubtedly be the most important to us as we strive toward continued program improvement.

As mentioned earlier, the purpose of the core courses and experiences is to prepare students to implement existing curriculum materials. This orientation was purposefully selected for two reasons: (1) we do not have enough time to treat both implementation and design, and (2) we feel that students should learn about material that is available to implement before they rush into curriculum development and once again reinvent the wheel. Students interested in development are encouraged toward pursuing a master's degree in science education with a development emphasis.

Mini-courses and Experiences

The "mini" course and experience portion of the program is being designed to provide for individual differences of interest, ability and experiential background of our students at a lower cost than traditional instruction. Most of the mini-courses are self-instructional and may be completed by students at times of their choice. Several of the mini-courses demand that students have enroute and follow-up discussions with either a regular faculty member or one of the teaching associates. As indicated earlier, students may elect, follow a suggestion, or have a mini-course or experience prescribed for them. We hope to avoid prescribing "minis" to sutdents, but if a student fails to elect or follow through on suggestions from teachers, the appropriate "mini" will be prescribed.

Students are informed of the mini-course program in their introduction to the program and may begin pursuing them at their convenience. To facilitate choice, a catalogue of mini-course descriptions has been prepared and copies of them are located throughout the science teaching center. This catalogue contains a table of contents listing the "mini" titles (see Appendix A) and descriptions of each "mini." The descriptions include: the title, developer's name, a general objective, rationale, time requirement estimate, general description, a statement of evidence that the student must submit, the instructor's name, and the credit value (Appendix B is a sample mini-course description).

At the present time, only about 30 mini-courses have been developed, and most of these are in early experimental stages.[1] As these are used and evaluated, they will be revised and hopefully improved. A conservative estimate is that we will need at least 100 "minis" for our undergraduate program, and if the SSTPP "mini" concept is extended into graduate programs, our needs may be doubled.

Governance

The responsibility for the management of the program lies in the hands of the director, associated faculty, and teaching associates. Two advisory boards, chaired by the director, have been established as illustrated in Figure 3.

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[1]As one might expect, most of the mini's that have been developed are either traditional or representative of what may be termed the "party line" of the science education center. A mechanism to incorporate a wider range of thinking into the mini-course development effort is needed if the goal of producing divergent idea options for our students is to be reached. Mechanisms presently being considered include involving colleagues of other programs or mini-course exchanges with colleagues at other institutions.

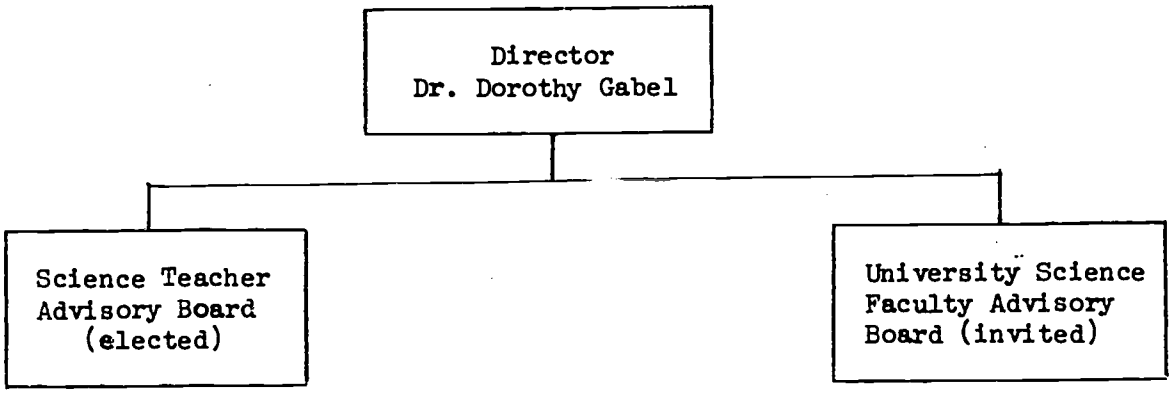

Figure 3. SSTPP Director and Advisory Boards

The science teacher evaluation board is responsible for reviewing procedures, suggesting and reviewing evaluations, and providing their own evaluations of the ongoing program. They are the main link between the director and the participating teachers. They may also suggest mini-course titles, program, or personal changes.

The University Science Faculty Advisory Board functions to review the program in its entirety. It is also hoped that they will participate in suggesting, designing, or directing the design of mini-courses. It is also hoped that they will suggest changes in their programs that will facilitate the development of better science teachers.

Summary

This paper describes a four plus semester cooperative school/university science teacher training program that is evolving at Indiana University. For more information on this program, you should contact Dr. Dorothy Gabel, Science Education Center, Indiana University, Bloomington, Indiana 47401.

Appendix A

TABLE OF CONTENTS

Mini-course

Appendix B

SSTPP

Mini-course or Mini-experience

Title: The Enquiry Model for Teaching Science

Developer: Edwin T. Brooks

General Objective: This mini-course is designed to acquaint you with a model of teaching science, the enquiry model. When you have finished this course, you will be able to identify steps of the enquiry sequence--a sequence which is one recipe for successful science classes. This course will enable you to:

1. identify the four basic steps of the enquiry sequence
2. master the skills necessary in handling the enquiry sequence

Rationale: It is especially important for new science teachers to be equipped with certain basic teaching and organizational skills to handle their first classes. Models are convenient ways to organize many different aspects of teaching skills into packages such that a new teacher has a capsule view of the tasks involved in instructing a class. It is hoped that this "strategy package" called the Enquiry Model will equip pre-service teachers with one set of skills that they will find practical and useful as they start their teaching careers.

Approximate Time Requirement: 15-20 hours total

General Description: The mini-course consists of:

1. pretest--with answer key
2. a tape-slide presentation on the enquiry sequence--with guide sheet
3. posttest (to be graded pass/fail).

The pretest is a short self evaluation which will give you examples of some of the tasks you will be learning; it will not be used to evaluate your success but rather to show you what has to be mastered. An answer sheet is also supplied

The instruction consists of a tape-slide presentation entitled The Enquiry Sequence. To accompany this instruction a guide sheet has been prepared which will help guide you through the instruction. It should take approximately 4-5 hours of your time to go through the whole procedure--from pretest to instruction to posttest.

Developmental Stage: First Edition

Credit Value: 1/2 credit

Instructor: Edwin T. Brooks

Evidence Student Will Submit: When you feel you have mastered the objectives of the course, you can take the posttest which will be graded by the instructor.