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SELECTED OUTCOMES OF A SUMMER INSTITUTE FOR HIGH SCHOOL BIOLOGY TEACHERS

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INTRODUCTION

The 1972 University of Iowa Summer Institute for High School Biology Teachers was designed to assist participants in implementing the course, *Biological Science: Molecules to Man* (Blue Version), developed by the Biological Sciences Curriculum Study (BSCS). The program consisted of eight weeks of classroom instruction and was supported by the National Science Foundation. Instruction was planned to provide the participants with an opportunity to improve their competence in biological subject matter and to become acquainted with teaching strategies inherent in materials produced by BSCS. In order to accomplish these objectives, participants were enrolled in three related courses.

One course was structured to involve the teachers with BSCS Blue Version materials directly. The participants performed the BSCS Blue Version laboratory investigations in chapters one through 11 of the text, and additional experiments were encouraged. An in-depth discussion followed the completion of each investigation, and additional related material was dealt with. Teaching strategies employed in this course were consistent with those recommended by BSCS.

Since the BSCS Blue Version emphasizes the chemical nature of life, a second course was set up to provide the participants with basic concepts in organic and biological chemistry. The course consisted of lectures, laboratory work, and special seminars.

A third course was designed to explore inquiry teaching strategies. In this course, participants were able to examine inquiry teaching models and to share ideas concerning inquiry teaching techniques for biology. In addition to seminars, visits were made each week to selected research laboratories on campus. These visits were planned to expose the teachers to the investigative nature of biology and thus support the notion of teaching biology as inquiry.

Since institutes are expensive to operate and since summers are val-

uable to participants, careful evaluation must be a part of the program. This paper reports research designed to evaluate how well the basic objectives of the 1972 summer institute were achieved.

MATERIALS AND METHODS

Selection of participants to attend the institute was completed by the end of April. All teachers accepting an invitation to attend the institute were mailed a packet of materials as soon as the acceptance letter was received. This packet included 35 copies of the *Science Teaching Checklist* (Lehman, 1969), one copy of the *Checklist of Problem Solving Practices* (Obourn, 1956), one copy of the *Instructional Materials Inventory* developed for this study, and a letter of instruction describing the procedures to be used with the materials.

The participants were asked to administer the *Science Teaching Checklist* to their second or only biology class of the day. This was necessary to reduce the chances of the teacher giving the instrument to the best class and to provide a uniform sample of students being taught by these teachers. The teachers were asked to complete the *Checklist of Problem Solving Practices* and *Instructional Materials Inventory* at their leisure. These instruments were designed to assess the number and types of investigative and problem solving teaching practices employed by the teacher and to assess the types of instructional materials used by the teacher.

This same packet of materials was again sent to the participants in December, 1972. The participants were asked to use the same procedure in completing the materials as they did before attending the institute. Pre-test and post-test materials were complete for 32 teachers. Two teachers failed to provide complete pre-test information. Five teachers failed to provide complete post-test information and eight teachers either were not teaching biology before the institute or did not return to a biology teaching position following the institute.

In addition to the three instruments employed in the study above, two other instruments were administered to the participants on the first day of classes and again on the last day of classes. *The Methods and the Procedures of Science: An Examination* (Woodburn, 1967) was administered to assess the participant's ability to identify and use the methods and procedures of science and the *BSCS Blue Version Achievement Test 1 and 2* (Form U, 1968) was administered to assess the participant's knowledge of biological information contained in chapters one through 11 of the BSCS Blue Version text. Questions in

the examinations relating to material beyond chapter 11 were not scored.

Since a control group was not available for this study, the research is a pre-test—post-test, no control group design. This design appears workable since the study was concerned with the attainment of specific objectives rather than a comparison of methods, procedures, or outcomes. Cronbach (1963) recommends designing research studies to determine post-course performance of a well described group with respect to important objectives. The pre-test and post-test data were analyzed by a t-test for related measures (Bruning and Kintz, 1968).

The following four hypotheses were statistically tested:

1. There will be no difference in the abilities of institute participants to identify and use the methods and procedures of science before and after attending the institute as measured by *The Methods and the Procedures of Science: An Examination*.
2. There will be no difference in the institute participants' knowledge of biological information before and after attending the institute as measured by the *BSCS Blue Version Achievement Test 1 and 2*.
3. There will be no difference in the teaching strategies of institute participants before and after attending the institute as measured by the *Science Teaching Checklist*.
4. There will be no difference in the investigative and problem solving teaching practices of institute participants before and after attending the institute as measured by the *Checklist of Problem Solving Practices*.

DATA AND DISCUSSION

The results of the two-tailed test are shown in Table 1. Results indicate that all t values are significant at the 0.01 level except for the pre-test and post-test means of the participants' ability to identify and use the methods and procedures of science. The change was not significant, and thus hypothesis 1 must be accepted.

The participants significantly increased their knowledge of the biological information contained in chapters one through 11 of the BSCS Blue Version text. Hypothesis 2 is therefore rejected.

The teaching strategies used by the participants changed significantly as a result of the institute. The change was toward an increased use of inquiry teaching procedures. Hypothesis 3 is therefore rejected.

TABLE 1

PRE-TEST AND POST-TEST SCORES
ON FOUR CRITERIA MEASURES

Instrument	N	Pre-Test	Post-Test	Mean	t
		Mean	Mean	Gain	
Methods and Procedures of Science	47	29.85	30.17	+0.32	0.47
Biology Achievement Test	47	40.96	45.51	+4.55	6.52*
Science Teaching Checklist	32	17.03	18.25	+1.22	2.84*
Problem Solving Practices	32	89.72	98.66	+8.94	3.72*

* Significant at the 0.01 level

The number and types of investigative and problem solving teaching practices being used by the participants changed significantly. The change was toward a greater use of investigative and problem solving practices by the teacher. Hypothesis 4 is therefore rejected.

In addition to the above data, participants were asked to provide information concerning the types of instructional materials they were using before and after attending the institute. The results of this survey are shown in Figure 1. There was a marked increase in usage of different materials after the institute, and in no case was there a decrease. BSCS supplementary materials were being used to a much greater extent after the participant had attended the institute.

SUMMARY AND CONCLUSIONS

Evidence presented in this study indicates that all t values were significant at the 0.01 level, with the exception of the instrument for measuring methods and procedures of science. Scores on this instrument did not change statistically. Careful examination of this test shows that it contains many items which require critical thought. It may be that this kind of critical thinking cannot be developed in a short period of eight weeks. It is also possible that not enough time in the institute was devoted specifically to critical thinking activities.

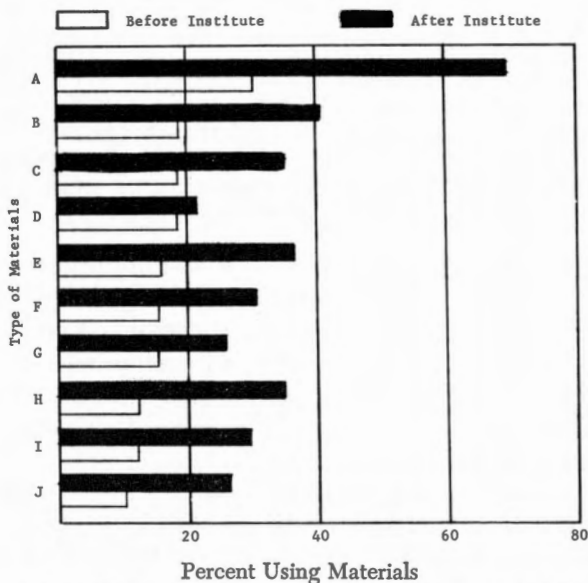
Based on the instrumentation used in this study, it can be said that the major objectives of the institute were accomplished. A similar conclusion was reached in an evaluation of the 1969 University of Iowa Summer Institute using a different set of instruments (Ost, 1971).

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FIGURE 1

PERCENT OF TEACHERS INDICATING USE OF MATERIALS BEFORE AND AFTER ATTENDING INSTITUTE



- | | |
|---------------------------------|-------------------------------|
| A—BSCS Invitations to Inquiry | F—Audio-Tutorial Materials |
| B—Programmed Learning Materials | G—BSCS 35mm Inquiry Slides |
| C—BSCS Laboratory Blocks | H—BSCS Pamphlet Series |
| D—BSCS Inquiry Film Loops | I—BSCS Research Problem Books |
| E—BSCS Achievement Tests | J—Instructional Contracts |

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