AN INVESTIGATION OF THE USE OF A COMPLETELY FILMED CHEMISTRY COURSE IN HIGH SCHOOL TEACHING

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Some high schools are using filmed courses in the sciences. A completely filmed high school course in physics was produced during the 1956-1957 school year. This was the first complete course on sound film ever to be produced in this country, or, so far as is known, in any other. The physics course was less than two years old when a completely filmed chemistry course made its appearance. The physics course, a series of 162 thirty-minute lectures and demonstrations, was conducted by Harvey E. White, a professor of physics at the University of California at Berkeley. The chemistry course, a series of 160 thirty-minute lectures and demonstrations, was conducted by John F. Baxter, a professor of chemistry at the University of Florida. The chemistry course on film was produced during 1958 and the early part of 1959. Both the physics and the chemistry film series represent a first attempt to put an entire year's science course on film. Both film series were financed by the Fund for the Advancement of Education, and they were both distributed by Encyclopaedia Britannica Films, Incorporated.

This study presents an investigation of the use of the introductory chemistry course on film in high school teaching.

Statement of the Problem

This investigation was concerned with discovering whether high school students taught beginning chemistry by means of a completely filmed chemistry course learn more or less as judged by scores attained on a standardized chemistry test than those taught by the conventional method in which some films of the instructor's individual choice are shown; determining what per cent of the gain made in the course will be lost at the end of a ten-month period during which time the students had taken no chemistry courses; noting the relative effect, if any, of certain variables on achievement of the students studied in (1) a group taught by the film method and (2) a group taught by the conventional method; and ascertaining student opinion regarding the effectiveness of the particular method used to instruct their group.

The variables studied included mathematical achievement, reading comprehension, scholastic ability, abstract reasoning ability, ability to apply scientific knowledge, and purpose.

Description of Procedures

The experiment was conducted during the 1959-1960 school year at the P. K. Yonge Laboratory School, University of Florida. The subjects participating were 48 pupils enrolled in the first course in chemistry. Equal numbers of students received instruction in each of two groups. One group was designated the experimental group and the other the control group. The experimental group was taught by the film method and the control group by the conventional method. Student achievement was judged by scores attained on a standardized chemistry test. The chemistry test was administered to the students of both groups at the beginning and at the end of the school year. The chemistry test was given a third time to the students of both groups who were attending the school ten months after the close of the experiment.

The t-test was used to determine if the difference between mean scores of the two groups on the chemistry test, when used as a pretest, a posttest, and a retention test, was statistically significant. The t-test was also employed to determine if the difference in the mean gain of the two groups from pretest to posttest and from posttest to retention test was statistically significant.

The scores students of both groups obtained on tests used to measure the variables listed above were arranged on a scale by rank order and the median point on the scale located. The scores students attained on each test, that is, the entire range of scores for each group or the scores within a range of scores either above or below the median point on the scale, as determined by each hypothesis, were compared with the scores they attained on the Cooperative Chemistry Test (Posttest). The coefficient of correlation was then calculated to determine the degree of relationship between the two sets of scores for each variable measured.

A comparison of the mean gain from pretest to posttest on the Cooperative Chemistry Test was made for students from each group whose scores on tests used to measure the variables listed above fell within a range of scores either above or below the median point on the scale as determined by each hypothesis. The t-test was then used to determine if there was a statistically significant difference between the mean gain from pretest to posttest achieved by the foregoing sub-groups of students.

Experimental Design

The basic experimental design of the investigation, which began with the opening of the 1959-1960 school year, was developed in August, 1959. Subsequent to that date several revisions were made in the design so that new problem areas which became apparent as the study progressed could be investigated.

Hypotheses

Eight hypotheses were formulated for testing. They were as follows:

Hypothesis I. Students taught by means of a completely filmed course will differ in achievement in high school chemistry from those taught by the conventional method.

Hypothesis II. The mean scores of the contrasting groups will be lower on a retention test to be administered ten months after the completion of the chemistry course than they will be on the posttest to be administered at the end of the course.

Hypothesis III. There will be a significant difference in measured achievement in favor of the students taught by the regular classroom teacher (control group) for those students whose scores on a standardized mathematics achievement test fall below the median score of their group.

Hypothesis IV. There will be a significant difference in measured achievement in favor of students taught by a regular classroom teacher (control group) for those students who attain scores on a standardized reading comprehension test that are higher than the median score of their group.

Hypothesis V. There will be a significant difference in measured achievement in favor of students taught by the regular classroom teacher (control group) for those students whose scores on the ACE Psychological Examination fall below the median score of their group.

Hypothesis VI. There will be a significant difference in measured achievement in favor of students taught by the film method (experimental group) for those students who attain scores on a standardized abstract reasoning test that are higher than the median score of their group.

Hypothesis VII. There will be a significant difference in measured achievement in favor of students taught by the film method (experimental group) for those students who attain on a standardized test which measures student ability to apply scientific knowledge (STEP) scores that are higher than the median score of their group.

Hypothesis VIII. There will be no significant difference in measured achievement between students in the experimental and control groups who indicated that they plan to make a career of science.

Results

The results of the study were as follows:

1. Students taught by the film method did not differ in achievement from students taught by the conventional method.

2. The follow-up chemistry test administered ten months after the close of the experiment revealed that no loss had occurred between posttest and follow-up test. Actually there was a slight gain of 0.7 per cent for the experimental group and 1.9 per cent for the control group.

3. When the observed correlation coefficients between the scores students attained on tests used to measure the variables studied and the scores they attained on the Cooperative Chemistry Test (Posttest) were arranged in order of decreasing strengths they fell in the same rank order for both groups of students. For both methods of instruction the following traits, as measured by the testing procedures, are arranged in descending order indicating their relative effect on achievement in chemistry for the student studied:

1. Ability to Apply Scientific Knowledge
2. Mathematical Achievement
3. Scholastic Ability
4. Reading Comprehension Ability
5. Abstract Reasoning Ability

4. Differences in mean gain in terms of measured achievement from pretest to posttest on the Cooperative Chemistry Test for the students in the lower half of their group in mathematical achievement and in scholastic ability, as measured by the testing techniques, favored the control group.

Tests of significance, however, revealed that these differences were not statistically significant at the five per cent level. A comparison of mean gain in terms of measured achievement from pretest to posttest on the Cooperative Chemistry Test of the students in the upper half of their groups in reading comprehension, as measured by the testing techniques, revealed a slight difference which favored the control group. Since the difference in mean gain was statistically significant at a level greater than .450, the results indicate that the two methods of instruction were about equally effective for the students in the upper half of their group in reading comprehension. Differences in mean gain in terms of measured achievement from pretest to posttest on the Cooperative Chemistry Test of the students in the upper half of their groups in abstract reasoning ability and in ability to apply scientific knowledge, as measured by the testing techniques, favored the experimental group. Tests of significance, however, revealed that these differences were not statistically significant at the five per cent level. A comparison of the mean gain in terms of criterion scores obtained by the students from both groups who expressed the intention of making a career of science revealed a slight difference, which favored the experimental group. Since the difference in the mean gain of the two subgroups, however, was statistically significant at a level greater than .450, the results indicate that the two methods of instruction were about equally effective for those students who expressed the intention of making a career of science.

5. Student reaction toward filmed instruction varied. Some students were antagonistic toward filmed instruction throughout the course; some became apathetic and lost interest as the school year progressed; on the other hand, about one-third of them believed that being taught by the use of film provided them with an unusual and gratifying experience. On the whole the students would have preferred performing the experiments which could be performed in the school laboratory with their own hands. Furthermore, most of the students in the experimental group did not believe that their classroom teacher had sufficient time to explain adequately the material presented by the film teacher.

Conclusions

For the students studied, the findings of this study seem to support the following conclusions:

1. Filmed instruction accompanied by good classroom procedures is not superior to conventional instruction in terms of achievement as measured by either an immediate recall or a retention test.

2. The completely filmed chemistry course is an effective instrument for teaching students representing different levels of ability.

3. Students' written reaction pertaining to the effectiveness of the completely filmed chemistry course in teaching their group did not appear to have a significant relationship to achievement as measured by the evaluation instrument used in this study.

4. The completely filmed chemistry course provides an excellent retraining experience for teachers.

5. The classroom teacher using the completely filmed chemistry course must devote more time to the subject of chemistry than the teacher using the conventional method in which some films of his choice are shown.