A STUDY OF COLLEGE SCIENCE COURSES DESIGNED FOR GENERAL EDUCATION

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This investigation was begun in the spring of 1948 and completed in the spring of 1949. It has been sponsored by the Cooperative Committee on the Teaching of Science and Mathematics of the American Association for the Advancement of Science.

The purpose of this study was to determine the status, trends, objectives, content, procedures of instruction, problems, and values for general education of college-level science courses which are especially designed for students who desire a general and not specialized training in science. Many of these courses have previously been designated by such terms as survey, generalized, orientation, integrated, or foundation. All of the above-named types of courses have had in common the inclusion of subject matter from more than one specialized field of science. In addition to these courses, the study includes single-subject courses that have been modified for the purposes of general education. All types under investigation are herein referred to as *general education science courses.*

In order to secure information on the types and prevalence of courses, an inquiry was sent to the administrators of 967 four-year colleges, universities, and teachers colleges in the United States. Replies were received from 660 schools. In addition, a survey of 600 college catalogs gave information concerning 60 more schools. Thus, information is available from 74 percent (720 schools in all).

To secure detailed information about the specific courses designed for general education, a seven-page questionnaire was sent to a selected group of 300 science teachers. Usable course descriptions were received for 150 courses distributed among 103 schools of all sizes.

The data supplied on the questionnaires were supplemented in a number of ways. For many courses either outlines, syllabi, textbooks, or published articles were available for study. Furthermore, the writer investigated by personal visits 28 of the 150 courses that were studied. A student opinionnaire was administered to 1200 students in 14 courses.

Of the 720 schools for which information is available, 59 percent offer some type of general education science course. Most of these schools offer courses that cover both the physical and biological sciences, although there are some that neglect one area or the other. General education science is much more prevalent in teachers colleges than in other types of schools: it is offered in over 80 percent.

A comparison of these figures with those of pre-war studies shows that g e n e r a l education science courses are now much more widespread than at any previous time. They have increased in number

rapidly in the post-war years. Furthermore, a majority of the schools that do not have general education courses appear to be interested in developing them.

Of course, there is some opposition to this trend. The most obvious reasons are the satisfaction with the regular introductory science courses for purposes of educating the non-science major, and the difficulty of securing qualified teachers for the newer courses.

Ninety-two percent of the courses are planned specifically for the freshman and sophomore years. About half the colleges require one year of science of the general student. The remainder require more, usually two years. Most schools require work in both the physical and biological sciences.

In classifying courses on the basis of content, four principal types are revealed: (1) the general courses which include materials selected from all the areas of natural science, (2) the courses including subject matter selected from the fields of physical science, (3) those with material from biological science, and (4) the courses in single subjects, as physics or botany. Few new courses of the first type are being organized. The single-subject courses are multiplying more rapidly than the other types, especially in the large universities. However, there are fewer of these courses than any of the other types.

The common methods of subject-matter presentation are, in their order of frequency: (1) the survey of the subject matter of the area covered, (2) the more intensive study of selected units from the subject matter area, (3) the study of selected problems, and (4) the historical approach.

In the 103 schools offering the 150 courses that have been studied in detail, the average enrollment in general education science was approximately 400 students per school in 1947-48. This represents about one-third of the freshmen and sophomores. In separate schools the number of students that take the courses varies from a small group to 100 percent of the students.

Individual course enrollments in 1947-48 ranged from as few as 8 to more than 4000 students. The largest enrollments were in the biological science courses; the smallest were in the single subjects. There was a somewhat larger percentage of men than women enrolled in the courses.

Approximately 75 different objectives were reported for the courses. Of these, 7 are especially prominent. They are, in the order of frequency of mention:

1. To develop an understanding of the scientific method and facility in its use.
2. To provide acquaintance with, or mastery of, the leading principles, laws, and concepts of science, particularly those that have a bearing upon the daily life of the individual.
3. To provide a core of scientific knowledge or to give a broad understanding and general knowledge of science.
4. To develop various scientific attitudes of mind and appreciations of the values of science.
5. To give an insight into the relationships between science and the problems of living and to develop the ability to apply scientific knowledge to the solution of these problems.
6. To develop a greater joy in living through a more complete un-

derstanding and appreciation of the natural environment.

7. To stress cultural aspects of science and to show how science has contributed to civilization.

A majority of the teachers reported clearly defined objectives that are compatible with the main purposes of science for general education. However, in some courses there were apparently no special objectives beyond the desire to teach science.

The most frequently used methods of determining subject-matter content are, in order of prevalence:

1. Determination of the needs of the students.
2. Selection of a textbook.
3. The interests of students in the class.
4. To survey a field of science.
5. Analysis of the objectives and how to accomplish them.

The subject matter of the biological science courses varied widely, as did that of the physical science courses. There seems to be no ideal content for a general education course in science. Teachers have yet to agree upon any one common core of factual material, or upon a uniform method of presentation. Probably neither is to be desired.

Although many of the teachers in charge of general education courses are scientists and educators of note, a majority of the teachers in the courses do not have a Ph.D. degree and are in the lower professorial ranks. Twenty-two percent are assistants with no rank. Only 40 per cent are employed specifically for general education and only 30 percent devote full time to this work. Ninety-one percent of all teachers are specialists in one or another of the fields of science. Very few received college training designed to prepare them for teaching general education science.

In considering the common characteristics of the courses, we find that the typical course is one year in length and offers three credits per term. It is given by two or more teachers who use demonstrations, visual aids, field trips, and laboratory exercises in addition to lectures and discussions.

The most important problems that arise in giving general education courses are concerned with procuring teachers, providing suitable laboratory experience, securing acceptable textbooks, and selecting and limiting the subject matter.

There is considerable but not universal enthusiasm for the general education type of science course. In schools where such courses exist, the administrators, above all others, favor them. The courses in most schools were inaugurated by deans or presidents.

Among college faculties opinions vary from energetic advocacy to definite antagonism and from strong interest to a complete lack of understanding of the nature of general education.

A large majority of the persons who teach in the courses like them and work diligently to make improvements. Some teachers have been assigned the courses against their will; in the main, these teachers are subject-matter specialists whose interests lie in their specialties. Also they feel that they are inadequately prepared for teaching in a broad field of science.

Among science teachers there are some who oppose the general education courses because they take students away from their own speci-

alized courses. On the other hand, there are those who believe that the general education courses are an excellent means of interesting students in following a scientific career.

There is a tendency for some scientists to look down upon the courses and their teachers. This attitude may have been justified in former years when the courses were sometimes elementary and superficial, and the teachers poorly prepared. Although these conditions still exist, they are not common. Most of the courses are well developed and many of the teachers rank among the best.

The teachers report that most of the students like the courses. Various student appraisal studies corroborate this viewpoint. However, there are some students in every course who dislike science or find it difficult.

In the student opinionnaire investigation, 77 percent of the students rated the courses above average in the choice and use of the instructional materials and procedures. Seventy-five percent said the courses were above average in imparting useful information. Fifty-six percent rated the courses above average in making a positive contribution to their college education.

Most of the students were enthusiastic about their teachers. Eighty-eight and 85 percent respectively rated their instructors above average in knowledge of subject matter and in enthusiasm for their courses.

In general, the courses, the procedures of instruction, and the teachers were given a high rating. The conclusion must be drawn that a large majority of the students believe the courses to be highly satisfactory.

General education science is rapidly occupying a position of importance in college curricula. It is growing in prevalence, popularity, and respectability. Ambitious young science teachers can expect to look to this field for a career that will offer the same rewards as a teaching career in one of the separate sciences.

In this relatively new area of science teaching there is a tremendous challenge to teachers to perfect techniques for presenting science to the non-scientist. On all sides the challenge is being met by teachers who are improving old procedures and experimenting with new ones. From their efforts are coming methods that will be of value in all types of science courses.

General education science is firmly established and widely accepted. We can confidently expect that in the near future there will be an even greater extension of the courses in American institutions of higher education. In this scientific age, we can look forward to an increase of literacy in science that will benefit both the individual and society and smooth the path for the progress of science.