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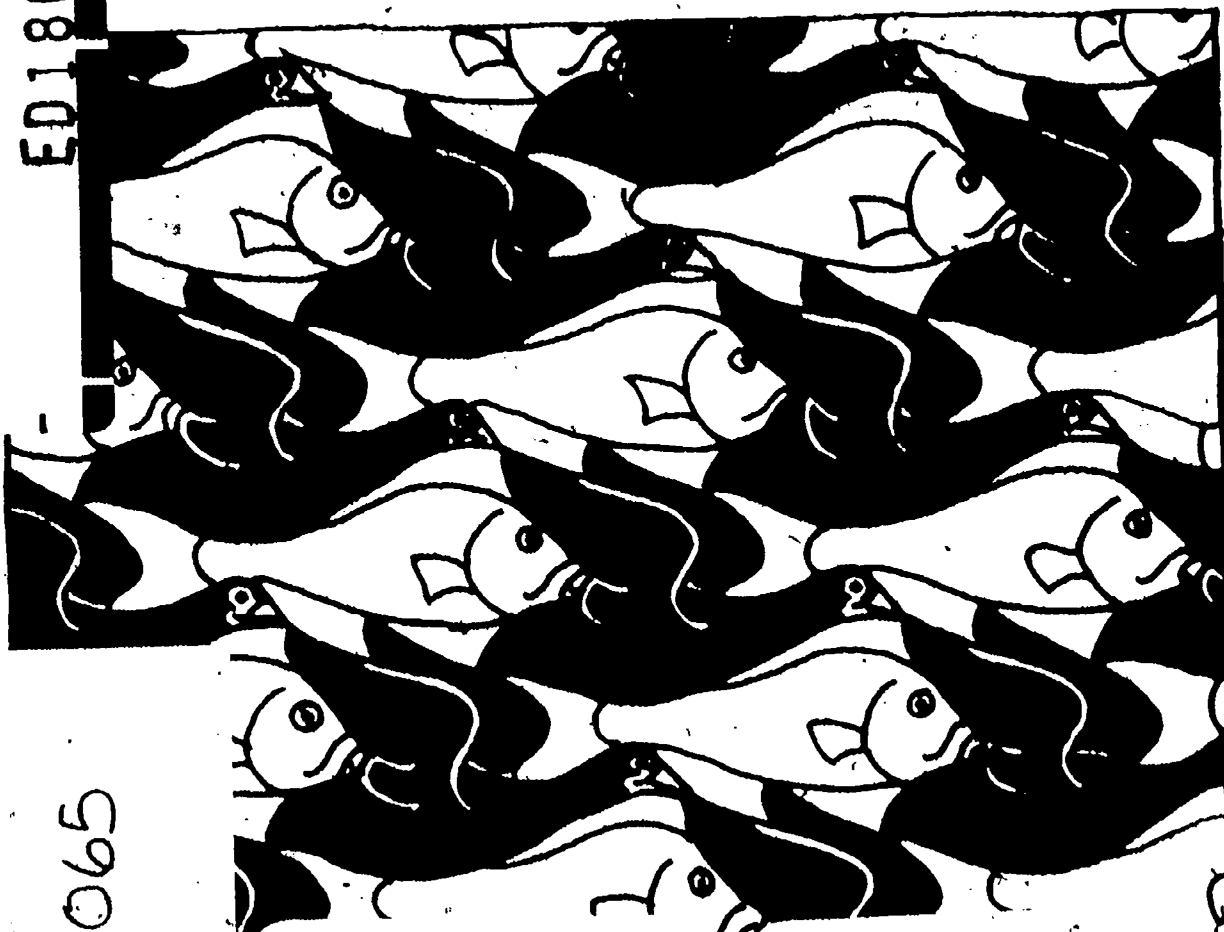
ABSTRACT

The interdisciplinary components of science instruction at two-year colleges are examined as revealed by curriculum offerings in environmental science, integrated science, and the history of science. Part I of the report reviews the literature concerning the rationale, objectives, course content, and instructional methods of interdisciplinary science courses, as well as the components of and instructional practices in environmental sciences. Part II summarizes the findings of a study of catalogs and a survey of science instructors at 175 colleges. These studies were conducted to analyze the science courses offered in the 1977-78 academic year and to assess the instructional practices used. Major findings outlined in this section show that: (1) while interdisciplinary and environmental science courses made up 4% of the science courses listed, 89% of the colleges included one or more of these courses in their schedules of classes; (2) 70% of the environmental science courses listed were designed for environmental technology majors; and (3) interdisciplinary science instructors were predominantly experienced, full-time teachers using a variety of non-traditional techniques. Part III provides summary observations pointing to the small percentage of colleges offering integrated sciences in vocational curricula, the lack of goal clarification in interdisciplinary offerings, and the value of interdisciplinary sciences in developmental education. (JP)

Science Education in Two-Year Colleges

ENVIRONMENTAL SCIENCES



Center for the Study of Community Colleges
and
ERIC® Clearinghouse for Junior Colleges

SCIENCE EDUCATION IN TWO-YEAR COLLEGES:
ENVIRONMENTAL SCIENCES

by
Sandra J. Edwards

January 1980

Center for the Study of Community Colleges

and

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PREFACE

This monograph is one of a series of twelve publications dealing with the sciences in two-year colleges. These pieces are concerned with agriculture, biology, chemistry, earth and space sciences, economics, engineering, integrated social sciences and anthropology, integrated natural sciences, mathematics, physics, psychology, and sociology. Except for the monograph dealing with engineering transfer programs, each was written by staff associates of the Center for the Study of Community Colleges under a grant from the National Science Foundation (#SED 77-18477).

In addition to the primary author of this monograph, several people were involved in its execution. Andrew Hill and William Mooney were instrumental in developing some of the procedures used in gathering the data. Others involved in tabulating information were Miriam Beckwith, Jennifer Clark, William Cohen, Sandra Edwards, Jack Friedlander, and Cindy Issacson.

Field Research Corporation in San Francisco, under the direction of Eleanor Murray, did the computer runs in addition to printing the instructor survey employed in that portion of the project dealing with instructional practices. Bonnie Sanchez of the ERIC Clearinghouse for Junior Colleges and Janice Newmark, Administrative Coordinator of the Center for the Study of Community Colleges, prepared the materials for publication. Carmen Mathenge was responsible for manuscript typing. Jennifer Clark did the final compilation of the various bibliographies for each monograph.

Florence B. Brawer coordinated the writing activities and edited each of the pieces. Arthur M. Cohen was responsible for overseeing the entire project.

In addition to these people who provided so much input to the finalization of this product, we wish to thank Dr. Robert McCabe of Miami-Dade Community College who reviewed the manuscript and Ray Hannapel and Bill Aldridge of the National Science Foundation, who were project monitors.

Arthur M. Cohen
Project Director

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Publications Coordinator

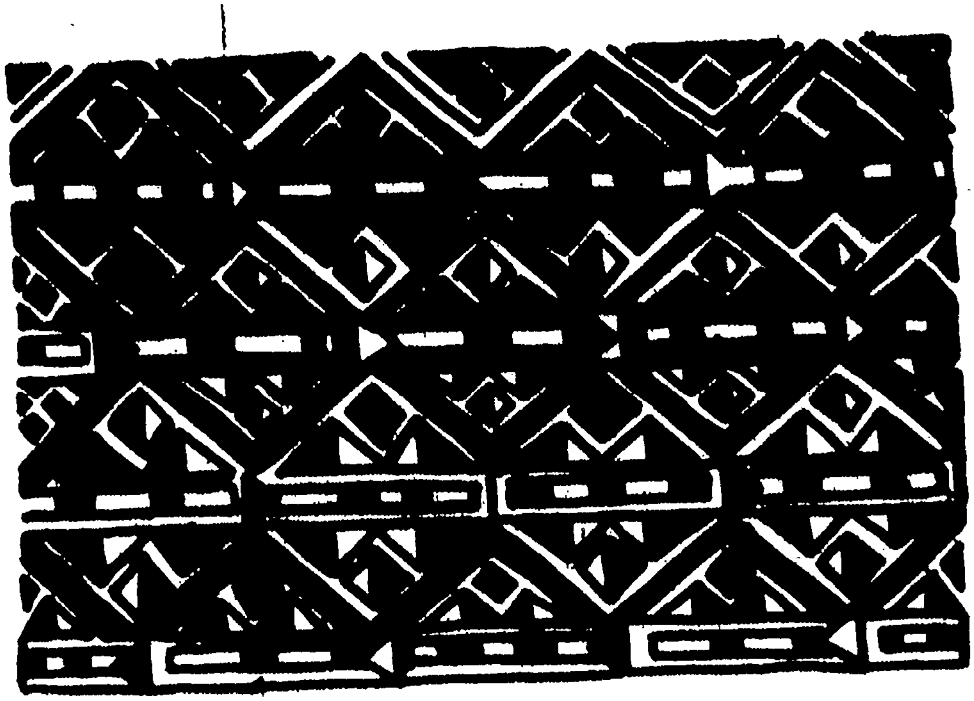
SCIENCE EDUCATION IN TWO-YEAR COLLEGES: ENVIRONMENTAL SCIENCES

C. P. Snow's famous essay, "Two Cultures" (1964), defined the gap between the literary and scientific cultures. Sputnik and the spectacular technological breakthroughs of our era are often cited as the factors that determined the prominence of the sciences in educational curricula. But there are those who find the breach between cultures arbitrary and the emphasis on science without a corresponding emphasis on Humanities unhealthy. This recognition represents the philosophical underpinnings of the interdisciplinary approach to learning.

Interdisciplinary offerings are well suited to the community college, which encompasses diverse educational goals and caters to diverse student abilities and needs. These students, who do not usually come to the community college seeking an education in a narrow, specialized academic discipline, often view education as peripheral to a focused occupational goal. Yet, the community college defines one of its missions to broaden and liberalize the thinking of all students who enroll. The interdisciplinary course or program may provide the means to achieve that mission.

This monograph examines the interdisciplinary perspective that has penetrated the two-year college science curriculum. The forms of the interdisciplinary approach that will be discussed are interdisciplinary courses, including the history, philosophy, and sociology of science and integrated science courses, and environmental science, which is interdisciplinary in the sense that it draws from a variety of disciplines to define and solve environmental problems. The literature in these two areas will be reviewed in Part I. Part II includes a discussion of the information collected in curriculum studies undertaken by the Center for

the Study of Community Colleges under a grant from the National Science Foundation. Conclusions and recommendations for further research and program improvement in interdisciplinary sciences in Part III complete the monograph.



PART I

THE LITERATURE

INTERDISCIPLINARY SCIENCES

Since studies of enrollment trends, instructional practices, and course success or failure are not reported on a global scale, this literature review depends primarily on reports of the planning and execution of specific courses. This review will also draw from discussions of four-year college course offerings and from discussions of interdisciplinary humanities; both sources speak to issues pertinent to interdisciplinary sciences in the two-year college. This section treats interdisciplinary courses, including such non-science areas as the humanities, and integrated sciences.

Initially, the distinction between the terms "interdisciplinary" and "integrated" needs clarification. As used here, "interdisciplinary" refers to a course that combines one or more science disciplines with a discipline outside the sciences, such as a humanities or social science discipline (Baez, 1976). This may be accomplished explicitly in a "Physics and History" course, or implicitly in a theme-oriented course such as "The Ascent of Man." "Integrated sciences" designate a narrower range of courses, which combine disciplines within science, such as the physical science survey course. Both interdisciplinary and integrated sciences are most often theme or problem-centered, but may include a case study or an historical approach to science (Gratz, 1966; Hall, 1972).

In a comprehensive study of interdisciplinary sciences, Fuller (1967) found that 47 percent of the two-year colleges that he surveyed offered what he termed a "multidisciplinary" science course. Interdisciplinary* sciences most often appear in the curriculum as isolated offerings, as, for example, the "Ascent of Man," a course based on Bronowski's television series (Hoachlander, 1977; Rein, 1975). These courses may satisfy a general education need of a non-science major or may fulfill the related science requirement of an occupational student. Other interdisciplinary sciences serve as part of a program of general education offerings, as, for example, Rio Hondo's Exploratory College (Cohen & Brawer, 1975), De Anza's Mini College (Palmer, 1975), or Miami-Dade's General Education Program (Lukenbell & McCabe, 1978).

Why an Interdisciplinary Offering?

The literature yields isolated descriptions of interdisciplinary courses that attempt to bridge the gap between the "two cultures," but no evidence indicates that the course or program rationales expressed are generally accepted. The reported reasons for creating these interdisciplinary courses range from altruistic concerns about student abilities to

*Interdisciplinary will be used as the more general term designating both interdisciplinary and integrated sciences as defined above.

cope with the future (Dehnart & others, 1977; Steelman, 1975; Vinson, 1975) or "saving the world from going to hell on roller skates" (McAlexander, 1976) to the more self-serving goals of attracting new students to the college (Epstein, 1975; Rein, 1975) and increasing enrollments in the sciences (Babski, 1976; Epstein, 1975; LaBianca, 1975; MacMillan, 1975; Zander, 1975). In some cases, particular college or faculty members' commitment to interdisciplinary education (Butzek & Carr, 1976; Collins, 1977) or the improvement of the liberal arts (MacMillan, 1975) stimulated the development of an interdisciplinary course (Carhart & Collins, 1973; Palmer, 1975). Overcoming the fragmentation of material and students' disjointed views of sciences provided the impetus to create an integrated science course at Howard Community College (Chapdelain, Friedman & Poch, 1977). Another rationale for interdisciplinary innovations may be the success of a previous similar offering (Epstein, 1975; MacAlexander, 1976).

Most of these rationales reflect the traditional concern of education to meet society's needs for an educated populace. Yet, general education in the community college is beset with difficulties stemming from the increase in the role of occupational education (from student enrollment of 13% in 1965 to nearly 50% in 1976) (AACJC, 1976) and changes in the composition of the students to include more part-time students, students over twenty-five, women returning after an extended absence, senior citizens, students from minority groups, and academically "unprepared" students (Knoell, 1973). These changes have influenced the curriculum design of general education programs. Part-time students, for example, have difficulty in becoming totally immersed in a comprehensive general education program, since conflicting pressures may cause erratic college attendance. Students attending the community college to take very definite courses may have no intention of completing any one particular program and/or no interest in a general education program. This situation underscores the potential importance of the interdisciplinary course to offer students exposure to a general education. Some

recognition of these and other problems related to student diversity in the community college is evident in the literature (Babski, 1976; Hackett, 1973).

General education in science includes an appreciation of the importance of studying science and the ability to reason and to communicate on scientific issues (Gratz, 1966), as well as the study of the interrelation between science and other social activities (Eiss, 1966; Hurdy, 1970). The interdisciplinary approach to general education "is defended with the argument that when faced with problems affecting their lives, people do not think as sociologists, scientists, or psychologists; they grapple with the issues in holistic fashion" (Cohen, 1978, p. 25).

The science survey course, the problem-centered approach, as well as other interdisciplinary approaches all signify attempts at effective science general education instruction. The science survey course illustrates the adoption of the widely-accepted distribution requirement approach to general education, such as Parsegian's (1969) "Introduction to Natural Sciences." This type of offering does, however, risk charges of superficiality by those who favor the narrow, specialized approach to science (Dale, 1973). The interdisciplinary science literature does not adequately explore the role of this type of offering in the community college general education curriculum.

Interdisciplinary sciences may serve as part of a basic studies curriculum, providing students who have achieved little academic success with a general education foundation, as well as assisting them with career plans. Interdisciplinary science courses may serve as terminal courses, or they may be the beginning of further educational undertakings (Farrell, 1973; Johnson, 1970; Leyden, 1966). The needs of academically underprepared students have been addressed at New York City Community College through the application of basic skills modules of instruction to a target freshmen science course (Tuosto & Beitler, 1975) or through the utilization of science-related materials for reading instruction (Beitler, 1976). The

combination of the interdisciplinary approach with basic studies curricula may stimulate enthusiasm toward science and facilitate reading, writing, and mathematic skill development. One criticism of providing high-risk students with special general education is that students take additional courses that do not count toward their degree, while not necessarily achieving success in grades or completing more credit hours (Farrell, 1973). Yet, this idea has not been discussed in much detail in the reviewed literature.

Nor does the literature discuss the merits of using integrated sciences as an approach to teaching science concepts to occupational students. Students in technical programs may benefit from the flexibility that an understanding of the theoretical or conceptual approach to science can bring to them (Eiss, 1966). Meek (1972) describes a workshop where an integrated course was assigned to provide allied health students with basic science instruction. Zubiari (1973) reports the successful use of interdisciplinary science to provide academically deficient nursing students necessary science knowledge to complete associate nursing requirements. Students preparing to be elementary school teachers also have a special need for interdisciplinary sciences (Fuller, 1967).

Pressures from outside the college may influence the development of an interdisciplinary science course. If the local four-year college offers interdisciplinary science, the two-year college may be obligated to offer a similar course to facilitate student articulation. This type of course may provide an ideal means to meet the general science requirements of the four-year college or it may handicap the transferring student, if the four-year college considers the "mix" of disciplines inadequate. With the increase in occupational programs, community colleges also need to be cognizant of the requirements of vocational licensure boards and state departments of education, as well as responsive to the suggestions of vocational advisory boards in course planning.

Course Objectives

Once the rationale for an interdisciplinary course offering is ascertained, specific course objectives are determined. These objectives are often as general as the course rationale: to improve students' scientific literacy (McAlexander, 1976; Schroeer & Spencer, 1976) or to introduce students to science as a new subject through a more familiar subject. The adoption of a process approach (Eger, 1972) or teaching the scientific problem-solving techniques with application to humanities or social science problems represent approaches to scientific literacy. A course developed by Lerner and Gosselin (1975) compares physics and history, thereby acquainting students with the processes of both scientific and historical inquiry. Value formation and affective objectives may also be included (General Education Committee, 1977). These goals demonstrate the concern of course developers to ground the study of science in real world issues underscoring the applied nature of interdisciplinary offerings (Parsegian, 1969). Available reports do not indicate whether general agreement on course objectives exists from college to college.

The methods for choosing those disciplines to include in a course and course objectives seem to be haphazard, reflecting particular interests of the course developers. Choice of objectives may be dictated by the students for whom the course is intended, whether these students are non-science majors (Decker, 1974), allied health students (Hackett, 1973), or some combination of liberal arts and occupational students (Chapdelaine et al., 1977). Despite some identification of the targeted student populations, the literature does not discuss differences that might be found in courses designed for various student clienteles. A more systematic approach to course conception was taken through a poll of Bergen County Community College (New Jersey) faculty and students to determine the course topic. Extensive library research then identified course subtopics and potential instructors (Epstein, 1975). MacMillan (1975) described the use of the Delphi technique to determine program objectives for the

interdisciplinary program at Mendocino College (California).

The general nature and haphazard selection of course objectives may undermine the interdisciplinary approach itself. Ill-defined goals and objectives may contribute ~~to~~ discipline-oriented science faculty's lack of support of interdisciplinary undertakings (Maxwell, 1968). Chapdelaine et al. (1977) found that, as they defined objectives for these integrated science courses more clearly, they achieved a higher rate of student retention.

Course Content

Fuller (1967) examined the course content of multidisciplinary courses by analyzing the inclusion of chemistry, biology, physics, geology and mathematics in these offerings. Physical science surveys, including chemistry, physics, geology, and astronomy occurred more frequently in the two-year colleges (64%) than in the four-year colleges (42%); two-year colleges also more frequently include a geology component in the physical science survey. Only a small number of multidisciplinary courses in two-year colleges combined the physical sciences and biology (17%). Fuller attributed this to the dearth of good textbooks treating those disciplines together. Sixty-eight percent of the multidisciplinary courses required laboratory work and most multidisciplinary courses did not qualify as prerequisites for more advanced courses in Fuller's study.

Since many of the articles cited throughout this monograph consist of descriptions of particular courses and programs, they provide information on the specific disciplines and topics covered (e.g., Carhart & Collins, 1973; Chapdelaine et al., 1977; Dehnart et al., 1977; General Education Committee, 1977; Hoachlander, 1977; McAlexander, 1976; Rein, 1975; Schroeer & Spencer, 1976. Goldsmith's (1967) analysis of the chemistry topics taught in physical science courses in two- and four-year colleges provided a more comprehensive look at course content.

Teaching the Interdisciplinary Course

Team teaching predominates in interdisciplinary courses. The number of community colleges reporting general use of team teaching as an instructional method increased from 22 percent in 1970 to 45 percent in 1974 (Cross, 1975). Except for a study of students in a general physical science course at El Reno Junior College (Oklahoma) (Garner, 1974), no studies were found in which team-taught courses were compared with single instructor interdisciplinary science courses. Garner reported no significant differences in achievement between students exposed to more than one instructor and those in sections with only one instructor.

Course developers, who choose faculty for their course or program, note that all instructors should demonstrate interest in the interdisciplinary approach and should be able to teach creatively (Arnfield, 1968). The presence of the whole faculty team during each class period is also crucial (Lerner & Gosselin, 1975; Zander, 1975). The team structure may involve all faculty as equal members or one faculty member may serve as the team coordinator, bringing in guest speakers and taking responsibility for leading student discussions (Collins, 1977; Stellman, 1975). Courses offered on television, which often have larger budgets, may feature eminent scholars or individuals uniquely qualified to teach a particular area (Epstein, 1975; Rein, 1975).

Certain problems may result from the adoption of team teaching. Because of the discipline orientation of faculty, differences may arise over choice of program or course goals. The presence of more than one instructor in the classroom may prevent students from identifying with a teacher, and students may be confused, rather than enlightened, by different opinions (Palmer, 1975). Team teaching presents administrative difficulties in the all-important numbers game. A team-taught course may require double the enrollment to justify the presence of two or more instructors (Fuller, 1967). Although issues surrounding team teaching are brought out

in the literature, only enough information is presented to allow minimal analysis of its strengths and weaknesses as a teaching mode for interdisciplinary studies.

With or without team teaching, course preparations for interdisciplinary courses are very time consuming since instructors often deal with unfamiliar topics and new approaches to a familiar subject. Twenty-six of 67 colleges with no interrelated humanities course offerings surveyed in Florida, Georgia, and North Carolina indicated they did not have faculty trained for such courses (Edwards, 1971; see also Lockwood, 1967). The situation appears no different in the sciences. Some colleges have included release time for preparation, such as Saddleback's (California) Interdisciplinary Program (Cantor, 1978), but the amount of time may not be sufficient to allow faculty released from only one section to teach an interdisciplinary course that requires knowledge of new disciplines. Not only do individual instructors find themselves overburdened with time constraints (Butzek & Carr, 1976), but with a team approach, the problem is compounded by college administrators' reluctance to provide release time for a whole team of instructors (Zander, 1975).

Besides the amount of time required in course development, faculty may feel a sense of incompetence or discomfort in embarking on unknown terrain. When introducing scientific values, for example, a faculty member may face an initial propensity toward "the one-sided view of the science/value interface" (Galloway, 1977). A science seminar program developed at a small community college in North Carolina provides an approach to stimulate broader science faculty interests. Through the presentation of papers by science faculty, other faculty members, and invited guests, interaction occurs between various areas of specialization (Lea & Derrick, 1976).

Awarding Credit

Assignment of credit poses a problem for interdisciplinary courses. In some instances the course is cross-listed under two separate

departmental headings, such as listing a science fiction course as both physics (since the instructor was from the physics department) and English (Zander, 1975), or listing the "History of Science and Technology" as "History 101" and "Biology 30" (Palmer, 1975). In these instances students may choose whether they receive credit toward science or humanities requirements. In other cases, students may meet twice as many hours in order to receive both humanities and science credit. Credit may also depend on whether a student opts to include a laboratory component. In the "Science and Society" course at Central Piedmont Community College (North Carolina), students who do not take the laboratory receive humanities credit and students who include the laboratory receive science credit (McAlexander, 1976). At two California colleges, Mendocino (MacMillan, 1975) and Los Mendanos (Carhart & Collins, 1973) students enroll in an entire program for which they receive credit towards the English, social science, and natural science requirements.

One problem related to awarding credit is the transferability of interdisciplinary offerings. Some course and program developers report efforts to insure transferability (Morrison, 1977). Many students who enroll in interdisciplinary programs expect to transfer. In Saddleback College's Interdisciplinary Studies Program, for example, 60 percent of the enrolled students designate transfer intentions (Cantor, 1978). Involvement in a consortium with a four-year college can prevent duplication and also legitimize a course for transfer (Epstein, 1975). How serious are these credit and transfer problems to the health of an interdisciplinary course or program? Which solutions to the problems work best? Despite their importance, these questions are not adequately addressed in the literature.

Program or Course Evaluation

Program or course evaluations can further elucidate the objectives of

interdisciplinary offerings. Some evaluations, which measure faculty or student satisfaction with the course, yield such general responses as the course was "academically challenging," "very rewarding," or "worthy of being offered again" (De Anza, 1974). Occasionally these student satisfaction evaluations also assess more specific aspects of the course offering, such as instructors, field trips, assignments, and guest speakers (Johnson, 1970). Assessment of characteristics of students enrolled in the course and the extent to which students enroll in further science offerings indicate whether courses attract students to the sciences (Zander, 1975).

Course content may be examined in evaluations that measure changes in student thinking (San Jose City College, 1974) or in competency-based assessments (Miami-Dade, 1970). Measuring student achievement can determine the effectiveness of particular instructional modes, such as Brantley's (1974) comparison of the lecture discussion and the audio-tutorial approach in a physical survey course or Decker's (1974) examination of norm-referenced and criterion-referenced teaching in physical sciences. This smattering of evaluation attempts offers some indication of the success of course objectives, but it also underscores the need for more comprehensive course and program evaluation to assess the validity and reliability of these findings.

Other Characteristics of Interdisciplinary Offerings

Lecture and discussion components are almost always included in interdisciplinary science offerings. Course requirements may also involve field experiences, such as Oakton Community College's use of metropolitan Chicago in its interdisciplinary offering (Butzek & Carr, 1976). Many courses are built around instructional media, most notably television. These include Bronowski's "Ascent of Man" series (Hoachlander, 1977; Rein, 1975), "Man and Environment," a package of twelve television modules (McCabe, 1971), or "Science and Society, A Humanistic View," a joint effort between Bergen

Community College in New Jersey and CBS Television (Epstein, 1975). "Ascent of Man," for example, represents the development of an interdisciplinary offering by two institutions, Miami-Dade Community College and the University of California at San Diego. By preparing an instructional package that can be purchased for $15.95, the "Ascent of Man" offers a way around the faculty time and expense usually involved in interdisciplinary course development. Hoachlander (1977) reported the uses and outcomes of the series and found an innovative and successful attempt at combining the television and course content. Sixty community colleges had taken advantage of this course package by 1975 (Rein, 1975).

Program offerings vary in their structure. Los Mendanos College's General Education Program includes a one-unit generic course and then students select traditional discipline courses, which include a heavy orientation toward the implications of the discipline to the individual and to society (Carhart & Collins, 1973). Phillips (1971) maintains that a unified, coherent program is needed to avoid the narrowness of specialized discipline offerings. Yet, the development of a program asking students to attend an entire block of courses, such as the Tarrant County (Texas) program (Johnson, 1970), as previously mentioned, may not address the needs of the growing number of part-time students (Knoell, 1973). When an independent program is undertaken, as California's Rio Hondo Exploratory College or De Anza's Mini College, the danger of isolation from exposure to different views on campus may arise. By separating themselves from the mainstream, such programs can reduce acceptance by administrators and faculty that is crucial for the continuation of the program (McAlexander, 1976; Palmer, 1975).

The innovative interdisciplinary program may suffer from afflictions similar to those of the experimental college. These include the waning enthusiasm of students and faculty, insufficient time for course or program planning (Palmer, 1975), a large student population that drops in and drops out and, thus, precludes program coherence, and drying up of such

resources as administration support or special program development funds (Cohen & Brawer, 1975). The incorporation of an interdisciplinary course or program into the regular curriculum or as a degree requirement can be interpreted as a sign of its success. At the community college, where funding is tied to enrollment, high enrollment in a particular course may be the mark of success.

Summary of Interdisciplinary Science Literature

Most interdisciplinary course developers conceive of their programs as innovations within the general education curriculum, sharing general education goals, objectives, and problems. Course goals seek to prepare students for the future, increase scientific literacy, or help students understand science as a unified, coherent identity. Most interdisciplinary courses ground these concerns in the problems and issues science addresses within society. Due to their interdisciplinary nature, these courses encounter difficulties, especially with faculty who have very specialized discipline training and no direct training in course integration or with administrators who have difficulty justifying the cost of experimentation. Students, who usually express enthusiasm for innovative courses, may find conflicting demands dictating their concentration on specific requirements that lead to career goals, rather than on courses with no tangible occupational reward. Since both the course structure and the teaching approach of these courses are not typical, it comes as no surprise to find a wide variety of instructional practices, mostly involving use of television and field trips.

The literature review provides sketchy evidence for these conclusions. While a few general evaluations of interdisciplinary studies have been undertaken (Cantor, 1977; Cohen, 1975; Miller, 1967; Palmer, 1975), mainly focusing on the humanities, interdisciplinary sciences have not received comprehensive treatment. The unique student body and position in post-secondary education of the community college does not receive careful

consideration in this literature. Interdisciplinarity in science has been viewed from a micro-perspective, which will doom it to a provincial and uninformed existence.

ENVIRONMENTAL SCIENCES

Rachel Carson's Silent Spring. The Environmental Education Act of 1970. What do these two milestones have in common? The first represents a landmark in the public's awareness of the environment. Carson's book (1962), dealing with pollution and pesticides, graphically points out human dependence on the environment. The second event, a piece of congressional legislation stemming from a new sensitivity to environmental issues, marks the beginning of a national commitment to educating the public in a systematic way about environmental problems. This portion of the monograph examines the literature on the community college's response to the new awareness of and commitment to environmental education.

Reflecting its diverse goals, the community college's response to this national priority manifests itself in several different ways. Interdisciplinary courses developed around an environmental theme and directed at non-science majors take their place in a number of general education curricula. Environmental technology programs respond to manpower needs in pollution control. Environmental institutes, usually cooperative efforts between community colleges and government agencies, provide service to assist community efforts to solve environmental problems.

The number of environmental technology programs has grown. Prior to 1965 few community colleges offered specific programs in environmental technician training. In the succeeding five years, approximately 150 two-year colleges had undertaken some type of program (derived from list of occupational curricula in environmental education in Pratt, 1971). Carsey and Schwarz (1971) found about 70 offered associate degree programs and estimated that another 50 to 100 community colleges were in the planning

stages of similar programs. More current statistics on environmental offerings in two-year colleges were not found.

Much of the literature on environmental science in the two-year college concentrates on the environmental technology program. This situation reflects the manpower needs to which the community college can respond, as well as a more general increase in the proportion of occupationally-related programs at the two-year college (AACJC, 1976). The figures in our course survey, which will be discussed in detail in Part III, reflect this observation, since 30 percent of the environmental courses were of the general education type compared to 70 percent of the environmental technology type.

Environmental Studies as Part of General Education Programs

Much of the discussion of the environmental studies component of general education programs would be a repetition of Part I of this monograph, since the interdisciplinary nature of environmental offerings raises issues and problems similar to other interdisciplinary courses. Several possible approaches can be taken to environmental education as general education. Consideration of the environment can be integrated into all disciplines (Pratt, 1971). Environmental education can become the foundation of an entire curriculum, as occurred at the University of Wisconsin, Green Bay. Finally, the approach that appears to be implemented most often is the development of an interdisciplinary course dealing with man and the environment that satisfies general education requirements (Brooks, 1973; Reed & Cloud, 1973).

The most widely disseminated example of the latter approach is the "Man and Environment" course, which originally was Miami-Dade's contribution to instructional television as the culmination of efforts of 22 community colleges in developing a general education environment course. The two-semester course, which consists of 30 half-hour documentaries on social themes with corresponding printed material, seeks to assess student

recognition of man's interdependence with the environment and responsibility for it (Garnet & Thompson, 1972; McCabe, 1970, 1971; Miami-Dade Junior College, 1970). The modular format of the course allows flexible sequencing and interchanging of modules to accommodate a variety of course designs. The course also has been used to convey basic concepts to environmental technology majors.

Environmental studies originate from various departments. Physical science departments have often been initiators, and biology departments are also active. The biology department at Wilbur Wright Community College in Illinois, for example, offers a course entitled "The River," which takes the Des Plaines River and its drainage area in Chicago as a source for studying man's relationship to the urban environment (Berry, 1975). Social science departments and occasionally an English department offer environmental courses (McCabe, 1971). Environmental offerings by science departments illustrate faculty attempts to find a solution to the "indifference and hostility of teaching science to non-science majors" (Morrison, 1977). The rationale for these course offerings supplements the emphasis on environmental awareness.

The literature in this area does not provide information on enrollment trends, or whether environmental education has become a significant part of the general education curriculum, or on the factors that are important to course development. But the literature does reveal attempts to insert a relatively new area of study into a tradition-bound portion of the curriculum. <u>The American Biology Teacher</u> devoted its February 1975 issue to interdisciplinary environmental education, although none of the articles was specifically directed toward the two-year college. Some evidence of a collaborative attempt to include environmental studies in the general education curriculum, e.g., the "Man and Environment" course, is apparent. Also some evidence of careful course planning, such as Morrison's surveys to determine transferability and adequacy of his course

in meeting certain educational goals, is reported. Finally, environmental topics, such as pollution and the world food crises (MacMillan, 1975), are described as part of more general interdisciplinary courses.

Environmental Technology Programs

The literature yields more information about career-related environmental programs than general education environmental offerings. Directories of occupational programs enumerate environmental technology program offerings (California Community Colleges, 1976-1977; Technician Education Yearbook, 1975-1976). Much of the discussion centers around manpower need assessments, but discussions of particular issues are also found.

Many environmental technology programs were organized during the decade of the 1960s. They were either specialized, dealing with air pollution or water treatment, or more general, dealing with the entire field. Some evidence suggests that the more specialized programs are currently better than the general programs, which have a tendency to be too broad (Carsey, 1977). Some programs are engineering oriented, and may be found in civil engineering divisions; others are science oriented, and may be offered in biology or chemistry departments.

Environmental Technology's Response to Manpower Demands. Since most of the program development in environmental technology is a response to manpower needs (Aley, 1973; Barnett, 1975; Carsey, 1974; Schultz, 1973; Turner, 1970), it is no surprise that advice on program development includes assessment of employment opportunities as the initial step (Boudreau & Purcell, 1964; Brooking, 1977; Newton, 1970-71). This approach to program development indicates the extent to which environmental technology meets the community college mission of responsibility to the community. Such job opportunity assessments spawn mining programs in Kentucky (Barnett, 1975) or wastewater programs in Michigan (Fisher, 1976) and indicate the community college's sensitivity to regional concerns.

One tool recommended as important to a manpower assessment, as well as to curriculum decisions and determination of necessary facilities, is the formation of an advisory committee composed of local people (Boudreau & Purcell, 1964; Newton, 1970-71). Formation of an advisory board can help alleviate the problem of "little coordination with industry" in program development and the ensuing lack of realistic manpower data (Carsey, 1977).

Energy Programs as an Example of Environmental Technology. With energy concerns in the news almost every day, it is not surprising to find energy-related technology programs discussed in a significant portion of the community college literature on environmental education. Over 200 community colleges had some type of energy-related course, program, or project underway in 1976-77 with perhaps 100 additional campuses planning some type of offering in 1977-78 (Carsey, 1977). Public institutions involve themselves in energy education significantly more than private two-year colleges (Doggette, 1976). The programs are concentrated in four areas: technician programs, courses, seminars and workshops, and incorporation of energy conservation into existing programs. Cayemberg et al. (1977) report that their national survey of community colleges, state departments of public instruction, several federal agencies, industries, and individuals in the energy field indicates that of these four program areas, only the technician programs did not appear feasible since no apparent job opportunities exist at the technician level. Others dispute this assessment of technician needs (Carsey & Schwarz, 1971), and indeed, the technician needs may vary by geographical regions. Noting a lack of employee recognition of the need to save energy, industry representatives in Cayemberg's study (1977) suggested that students in engineering and technical fields need a general energy course. A recent workshop of community college leaders and staff members from the Federal Energy Research and Development Administration (Myran, 1977) underscored the community college's role in energy education on the local level.

One feature of energy education is the cooperative effort between

community colleges and energy or environmental agencies. In Michigan, for example, ten community colleges joined the Environmental Research Institute of Michigan (ERIM) to provide a technical delivery system to small businesses, homeowners, and local government (Brown, 1976-1977; Myran, 1977). Each College acts as an "extension institute" or "retailer" to provide local training. Not only does the local community benefit from the community college offerings, but the ERIM scientists and engineers provide short-term workshops for community college faculty members on current technical assistance techniques. Cooperative efforts offer technical expertise and can more effectively survey the need for occupational education programs to train technicians.

Instructional Practices. Little research or review has been undertaken to assess program content, teaching techniques, or program outcomes since Pratt's 1971 book on environmental education in the community college. A series of publications by the ERIC Center for Science, Mathematics, and Environmental Education provide case studies of programs in environmental science but concentrate on the four-year college (see McCabe, 1971; Schoenfeld & Disinger, 1978). Other information can be gleaned from discussions of specific programs or program proposals.

Pratt (1971) discusses the importance of a core curriculum in environmental technology, which can be supplemented by more job-specific clusters of courses. This career ladder concept takes into account student diversity in career goals, and also provides the college with curricular flexibility. The specialized clusters may be directed towards a particular career option, such as wastewater technology, or specialty options may be offered in mathematics, biology, or chemistry (Greiginger, 1969). The core courses provide students with an understanding of fundamental principles, social framework, and underlying issues of environmental sciences.

Specialized programs discussed in the literature, which lead to an Associate in Applied Science, often include a component of basic courses in science, mathematics, and liberal arts, usually ranging from 20 to 25 percent of the curriculum (Newton, 1970-71; Turner, 1970). A general

survey in environmental technology and courses in the specialty area comprise the rest of the program.

A number of programs supplement classroom learning by on-the-job experience or field exercises (Carsey, 1974; Schultz, 1973). Substitution of transfer courses, which satisfy baccalaureate requirements, may be allowed in certain programs (Greiginger, 1969; Turner, 1977). Besides the use of lecture, laboratory, and field experiences (Carsey, 1974; Schultz, 1973), Zinn (1974) reports the use of instructional computing in environmental studies. In addition, one course developer discusses a gestalt approach to air pollution where students adopt assigned positions that special interest groups have towards air pollution and present that position in an open hearing (Nelson, 1974).

Instructor Preparation. Although some team teaching is undertaken in environmental science (Carsey, 1974), most instructors are specialists in their field. Two teacher training programs are reported to prepare instructors for community college environmental studies teaching. Under the auspices of the National Science Foundation, the Program of Teacher Education for Environmental Technology (POTEET, 1968) works with community colleges to determine the particular kinds of experiences that would best prepare the trainee for teaching. The training, conducted at the University of Michigan Public Health Department, is combined with actual teaching experience. A similar program training environmental health instructors represents a cooperative effort between the State University of New York at Buffalo and the City University of New York (Ratner, 1967). Besides university study and practice teaching, trainees in these programs participate in course development and student recruitment with community college personnel.

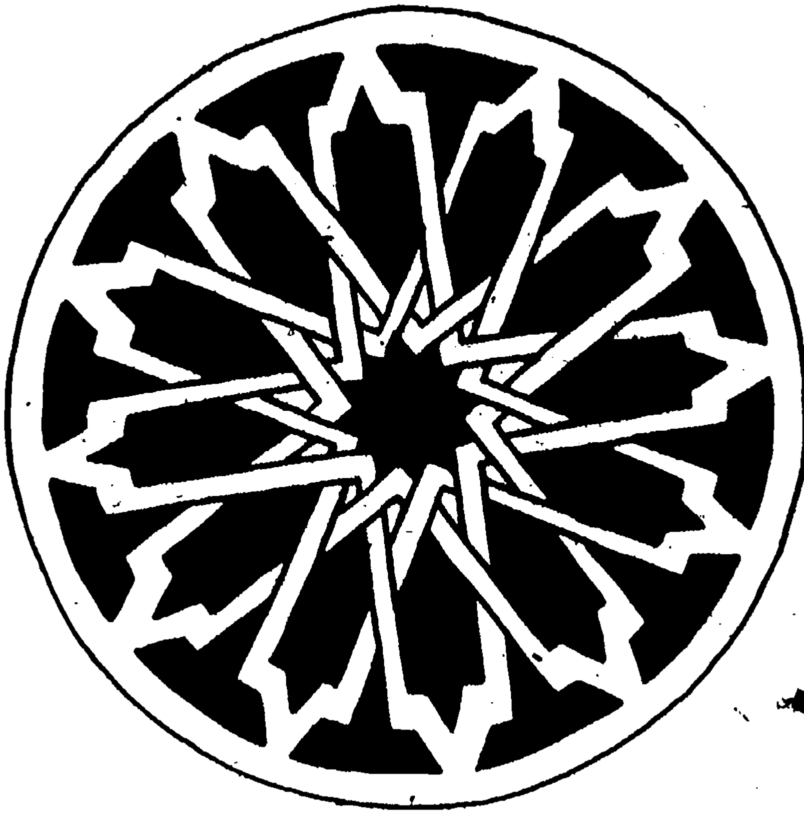
Program Evaluation. Evaluations of environmental technology programs give further evidence of major program concerns. Follow-up to the manpower needs assessment undertaken upon course or program development leads to evaluations of graduates' ability to find jobs and the level of responsibility and pay received. Whether graduates successfully pass certification examinations serves as another indicator of student

achievement and program success (Carsey, 1974). For programs directed toward transfer curriculums, the transferability of courses to four-year programs and the success of community college transfer students may be assessed (Greiginger, 1969). Doran (1977) describes the "embryonic" state of the measurement of environmental education outcomes. Most evaluation attempts are undertaken by college personnel, but at Raymond Walters College in Cincinnati, consultants annually review the environmental technology program (Schultz, 1973).

Program Funding. In his discussion of program development Newton (1970-71) emphasizes the considerable financial investment of environmental programs. Funding of programs comes from a number of sources. Charles County Community College (Maryland), for example, developed its programs under federal sponsorship, including the National Science Foundation (Carsey, 1974). Pratt (1971) enumerates other sources, including the United States Office of Education, Department of Labor, private foundations, private consultant groups, university and community college consortia, and, in one instance, public television.

Summary of Environmental Programs

In 1977 Carsey cited "too much diversity and overproliferation resulting primarily from a lack of definition of what an environmental technologist should do, where he should work, and how he should be trained" (p. 12) as a problem in developing environmental programs. This condition is reflected in the two-year college environmental education literature, which dwells on discussions of manpower needs, and, since Pratt's 1971 study, only presented scattered discussions of instructional practices, faculty characteristics and training programs, approaches to program evaluation, and funding sources. Currently two-year college curriculum planners must depend on four-year college literature for guidelines in program and course development.



PART II

CURRICULUM AND INSTRUCTION STUDIES

The lack of broadly-based studies of the magnitude of two-year college effort in the sciences, course goals, materials, and equipment, and instructional patterns led the Center for the Study of Community Colleges, under a grant from the National Science Foundation, to undertake a study of science curriculum in the two-year college. Interdisciplinary and environmental sciences, however, constitute only a small portion of the science curriculum. Thus, while our study's findings are suggestive of important trends in these areas, further in-depth research may be more conclusive. Our research includes two parts: the Curriculum Study, which provides analysis of courses offered in the 1977-78 academic year, including a classification scheme and data on

frequency of course offering, course prerequisites, and instructional modes, and the Instructor Survey concerning instructional practices.

THE CURRICULUM STUDY

Methodology

The first step in studying the curriculum in two-year colleges was to assemble a representative sample of colleges. (For a full methodology of this study, see Hill and Mooney, 1979.) The technique used in this study produced a balanced sample of 175 two-year colleges. As a starting point, we used an earlier study conducted for the National Endowment for the Humanities by the Center for the Study of Community Colleges. This study had already assembled a sample (balanced by college control, region, and size) of 178 colleges. Using this sample as the initial group, the presidents of these colleges were also invited to participate in the National Science Foundation-funded study. Acceptances were received from 144 of the 178 colleges.

At this point a matrix was drawn with cells representing nine college size categories for each of six regions of the country. Using the 1977 Community, Junior and Technical College Directory (AACJC, 1977), the ideal breakdown for a 175-college sample was calculated.

The remaining 31 colleges were selected by arraying all colleges in the under-represented cells and randomly selecting the possible participants. The following table (Table 1) shows how close our sample is to the percentage of the nation's two-year college population. The list of participating colleges is found in Appendix A.

College catalogs and class schedules for the 1977-78 academic year were obtained from each of the 175 schools. The curriculum phase of the project utilized a unique system for analyzing, classifying and reporting the course offerings. The Course Classification System for the Sciences (CCSS)* in Two-Year Colleges was developed specifically for this project

*See Hill and Mooney (1979) for the complete CCSS system.

Table 1

Percentage Breakdown of 175-College Sample Compared to National Percentages by Size, Region and Control

Size by Enrollment	1-499	500-999	1,000-1,499	1,500-2,499	2,500-4,999	5,000-7,499	7,500-9,999	10,000-14,999	15,000 plus
National Percentage	15	18	13	17	17	8	5	5	4
Sample	13	16	13	17	19	9	5	6	4

Region	Northeast	Middle States	South	Mid-West	Mountain Plains	West
National Percentage	7	13	32	21	10	17
Sample	6	12	31	22	13	16

Type of Control	Public	Private
National Percentage	84	16
Sample	84	16

to deal with science courses in terms of both the unique features of the two-year colleges and the traditional science disciplines.

Classification of Interdisciplinary and Environmental Sciences

The general structure of this system and the procedure for classifying a course are briefly described here as a preface to the detailed description of the categories within interdisciplinary natural sciences. Based upon the catalog course description, each science course listed in the catalog was placed into one of six major curriculum areas:

- Agriculture
- Business
- Engineering Sciences and Technologies
- Mathematics and Computer Sciences
- Physical Sciences
- Social and Behavioral Sciences

These areas were chosen because they closely reflect the instructional administrative organization of two-year colleges as well as the organization of national and international science agencies, such as the National Science Foundation.

The second level of classification was executed primarily by the major subject field disciplines within the broad area. The integrated and environmental science courses were listed with the physical sciences; history, philosophy, and sociology of science and other interdisciplinary science courses were listed with the social and behavioral sciences as follows:

- Chemistry-Introductory
- Chemistry-Advanced
- Geography
- Geology
- Other Earth and Space Sciences
- Physics
- INTERDISCIPLINARY NATURAL SCIENCES
- ENVIRONMENTAL SCIENCES AND TECHNOLOGIES

- Anthropology and Archaeology
- Psychology
- Sociology
- Economics
- Interdisciplinary Social Sciences
- HISTORY, PHILOSOPHY, AND SOCIOLOGY OF SCIENCE

The scattering of the interdisciplinary offerings within the classification scheme reflects the nature of this type of course in bridging the disciplines. This characteristic may indicate the suitability of the interdisciplinary offering to the community college curriculum which crosses traditional disciplinary boundaries in programs for particular occupations.

The proliferation of course titles in interdisciplinary sciences made it necessary to form categories that would encompass closely-related courses. The following breakdown explains which interdisciplinary and environmental science courses are included in this study. It should be noted that courses were included in a particular category based upon the catalog description.

INTEGRATED SCIENCES

Courses within this category combine two or more specialized areas of science and serve as an introduction or survey of the sciences for general education students and/or students entering career programs. Specialized areas include chemistry, physics, geology, astronomy, and other physical sciences, as well as certain biological topics. Courses covering scientific measurement, science teaching methods, and forensic science also fall within this category.

Integrated sciences for non-science majors
Physical science surveys
Science for allied health occupations
Science for engineering and industry-related technologies
Measurement and metrics
Science teaching methods
Forensic science
Preparatory and special courses for science majors
Other general science courses

ENVIRONMENTAL SCIENCE

These are environmental science courses both for general education students and students in environmental or related technologies.

Both general survey courses and courses examining specific environmental issues (e.g., air, water, and noise pollution) and the identification and prevention of environmental problems form this category. Courses in the technological curricula dealing with personnel and facility management are not included.

- Environmental science for non-science and non-technology majors
- Environmental technology
- Air pollution
- Water pollution
- Noise pollution
- Solid waste disposal
- Nuclear radiation control
- Agricultural pollution
- Other environmental studies

HISTORY, SOCIOLOGY, AND PHILOSOPHY OF SCIENCE

These courses adopt an interdisciplinary focus on science applying historical, philosophical and sociological approaches to science and/or technology. Also within this category are courses on the origins of man, the future, science and religion, and science and literature. The courses tend to satisfy general education requirements.

- History of science and technology
- Philosophy of science
- Science, technology and society
- History, philosophy, and sociology of science
- Science and the humanities
- Science and literature

For a complete description of the above subcategories, see Appendix B.

RESULTS OF THE CURRICULUM STUDY

Course Survey

After all the science courses were classified, class schedules for the 1977-78 academic year were inspected, and the number of sections offered (day, evening and weekend credit courses) for each term was determined. Prerequisite requirements and instructional mode (e.g., lecture, lecture-lab) were also determined from the catalogs. The following table presents the interdisciplinary natural science and environmental sciences curricula offered in two-year colleges for the 1977-78 academic year:

Table 2

Course Distribution of Interdisciplinary Natural Sciences in the Two-Year Colleges, 1977-78 Academic Year

Type of Course	Percent of Colleges Listing This Type Course in Catalog (n=175)	Percent of Colleges Listing This Type Course in Class Schedule (n=175)	Percent of Total Int. Nat. Sci. Courses Listed on Schedule (n=539)	Percent of Total Int. Nat. Sci. Sections Listed on Schedule: Lecture (n=1326)	Laboratory
Integrated Sciences	81	76	49	60	
Environmental Science	55	51	41	33	
History, Philosophy, and Sociology of Science	31	18	10	7	

The interdisciplinary natural science course is a widespread phenomenon: 93 percent of our sample list one or more courses of this type in their catalog and 89 percent actually scheduled this type of course in the 1977-78 academic year. The integrated science course is the most prevalent, which probably is attributable to the popularity of the physical science survey as part of general education offerings. In our study this course accounts for nearly one-quarter (23.7%) of the whole area of interdisciplinary natural sciences and 41 percent of this group when environmental science is excluded. The data do not reflect wide use of integrated science courses to present science concepts in occupational programs. The history, philosophy, and sociology of science, which also include interdisciplinary courses combining the sciences and the humanities, accounts for less than one-third of the interdisciplinary natural science offerings.

Over half the colleges sampled offer environmental science, which the literature indicated to be a growing area. Twenty-nine percent of the colleges listed environmental technology courses in their catalogs; 25 percent listed them in their schedules. As previously stated, this type of course, which usually forms part of an environmental technology program, represents 70 percent of the environmental courses compared to 30 percent of the environmental offerings that were directed towards nonmajors. A review of course catalogs of colleges offering environmental courses showed that 21 percent of the sample offered either an associate degree or certificate in environmental technology. Nearly one-third (30%) of these programs were designed to train water or wastewater technicians. Two colleges listed environmental technology courses as requirements of an associate degree in civil engineering.

Pratt (1971) indicates that he found several colleges listing environmental technology programs in their catalog but not actually offering them. He cites this as a potential weakness of environmental education in the two-year college. Nearly one-quarter of our sample (22%) listed environmental technology in their catalogs but did not schedule the courses in the 1977-78 academic year.

The high number of colleges offering interdisciplinary natural sciences may mislead the casual reader to think that this type of course is prevalent. Interdisciplinary natural sciences, however, represent only four percent of science courses offered.

Prerequisites are noted more frequently than the literature would have us believe (see Table 3). Twenty-five percent of the integrated physical sciences directed towards science majors either require prerequisites in mathematics or were themselves the second course in a sequence in which the students had to enroll in a designated order. More than half of the integrated science courses for allied health majors required mathematics or constituted part of a sequence. The integrated sciences for other occupational programs often expected students to have some basic knowledge of the occupation before undertaking the science course. Environmental science, with the exception of water pollution courses, appears less demanding of prerequisites. Forty-seven percent of the water courses required other courses within environmental technology or some mathematics background (see Table 4). Among the history, philosophy and sociology of science courses, one-quarter to one-third of the courses had a prerequisite (see Table 5). Because of the low number of courses in each of these categories, these prerequisite percentages may appear inflated.

Lecture-laboratory courses are the predominant mode among the integrated sciences. Individualized instruction is restricted to integrated science for nonmajors and courses in metrics, which frequently include a laboratory component. Instruction is mainly delivered by lecture in environmental science and interdisciplinary science, although more specialized environmental technology courses (e.g., water pollution and solid waste) are offered with a laboratory component. A notable lack of the inclusion of field work appears in the environmental science area, despite discussions in the literature of the importance of field experiences (Carsey, 1974; Schultz, 1973). The use of television was listed in the catalogs of eight percent of the nonscience environmental areas. Since schedules may list television courses differently and catalogs

Table 3

Integrated Sciences in the Two-Year Colleges, 1977-78 Academic Year

Type of Course	Percent of Colleges Listing This Type Course in Catalog (n=175)	Percent of Colleges Listing This Type Course in Class Schedule (n=175)	Percent of Total Integ. Sciences Courses Listed on Schedule (n=262)	Percent of Total Integ. Sciences Sections Listed on Schedule: Lec (n=794)	Percent of Total Integ. Sciences Sections Listed on Schedule: Lab	Percent of This Type Course Having a Prerequisite	Percent of Courses of This Type by Instructional Mode: Lec	Lec-Lab	Lec-Field	Indiv Instr	Lab
Non-Science Majors	16	9	7	9		19	29	47		18	6
Integrated Physical Sciences	55	47	49	54		25	42	56		2	
Allied Health Occupations	15	17	6	3		55	15	80	5		
Engineering & Industrially Related Technologies	8	5	4	4		31	25	75			
Measurement & Metrics	28	20	14	16		12	77			20	3
Science Teaching Methods	14	9	7	4		35	50	44	6		
Forensic Science	10	7	5	5		47	64	36			
Prep. & Special Courses for Science Majors	8	6	5	3		15	46	23			31
Other	8	6	4	3		10	90	10			

Note. 1. 141 colleges (81% of sample) list one or more integrated sciences courses in the college catalog.
2. 133 colleges (76% of sample) list one or more integrated sciences courses in schedules of classes.

Table 4

Environmental Sciences in the Two-Year Colleges, 1977-78 Academic Year

Type of Course	Percent of Colleges Listing This Type Course in Catalog (n=175)	Percent of Colleges Listing This Type Course in Class Schedule (n=175)	Percent of Total Environ. Science Courses Listed on Schedule (n=223)	Percent of Total Environ. Sciences Sections Listed on Schedule		Percent of This Type Course Having a Prerequisite	Percent of Courses of This Type by Instructional Mode				
				Lec (n=435)	Lab		Lec	Lec-Lab	Lec-Field	T.V.	Other
Non-Science Majors	39	33	30	52		3	66	11	4	8	9
Environmental Technology	17	13	19	18		12	53	39	2		6
Air Pollution	10	8	9	5		18	53	35			12
Water Pollution	22	17	35	20		47	41	64			5
Noise Pollution	2	2	1	1		0	67	33			
Solid Waste	5	4	3	2		0	17	83			
Radiation	2	1	1	1		0		100			
Agriculture & Soil	2	2	1	1		0	67	33			
Other	1	1	(0.4)	(0.2)		0	100				

Note. 1. 96 colleges (55% of sample) list one or more environmental sciences courses in the college catalog.

2. 89 colleges (51% of sample) list one or more environmental sciences courses in the schedules of classes.

Table 5

History, Philosophy, & Sociology of Science in the Two-Year Colleges, 1977-78 Academic Year

Type of Course	Percent of Colleges Listing This Type Course in <u>Catalog</u> (n=175)	Percent of Colleges Listing This Type Course in <u>Class Schedule</u> (n=175)	Percent of Total Hist., Phil., & Soc. <u>Courses</u> Listed on Schedule (n=54)	Percent of Total Hist., Phil., & Soc. <u>Sections</u> Listed on Schedule Lec (n=97)	Lab	Percent of This Type Course Having a Prerequisite	Percent of Courses of This Type by Instructional Mode: Lecture	Lec-Lab	Other
History of Science and Technology	4	3	15	12		29	100		
Philosophy of Science and Technology	6	3	9	6		20	100		
Science Technology and Society	9	5	22	19		33	84	16	
General History, Philosophy, and/or Soc. of Science	9	6	22	27		33	58	33	8
Science & Humanities (other interdis. courses)	10	7	30	35		7	87		13
Science & Literature	1	1	2	1		0	100		

Note. 1. 54 colleges (31% of sample) list one or more history, philosophy, and sociology of science courses in the college catalog.

2. 32 colleges (18% of sample) list one or more history, philosophy, and sociology of science courses in the schedules of classes.

may not indicate that a course is televised, accurate information on the number of television courses is unavailable.

When compared to the regional distribution of our sample overall, the interdisciplinary natural sciences are offered more in the West, Midwest and Middle States. More colleges in the West offered courses in environmental science and history, philosophy, and sociology of science than do those in other geographical areas. Although this trend also exists among western colleges for courses designed for occupational students, it is not maintained for integrated science courses for nonmajors. The fact that 52 percent of the colleges in the West fall into the large size category partially accounts for this finding. Yet, this finding lends support to the hypothesis that the West offers more fertile soil for nontraditional offerings, since the integrated science category for nonmajors, which showed a disproportionately lower number of offerings in the West, consists mainly of the traditional physical science survey. The colleges in the South show an opposite tendency in their course offerings with proportionately more colleges in this geographical area offering integrated sciences for nonmajors and fewer offering courses in other categories. Environmental sciences appear particularly infrequently in southern colleges (see Table 6).

Public colleges tend to offer proportionately more interdisciplinary natural sciences than private colleges. This distinction exists particularly for environmental sciences (see table 7).

Size of a college relates to the probability that it will offer interdisciplinary natural sciences; large colleges offer a disparate share of these courses. Contributing to this tendency is the high proportion of this type of course listed in the catalogs of small colleges that were not actually scheduled in 1977-78. For example, small colleges only scheduled 44 percent of the integrated sciences and 38 percent of the history, philosophy, and sociology of science and other interdisciplinary sciences that they listed in their catalogs.

Our data shed further light on several courses discussed in the literature. The "Ascent of Man" course was listed in four percent of

Table 6

Percentage of Interdisciplinary Natural Science Colleges Scheduled in Academic Year 1977-1978 by Region and Size

		Region						Size		
	Total Sample	Northeast	Middle States	South	Midwest	Mountain Plains	West	Small 1499	Medium 1500-7499	Large 7500+
Regional Distribution of the Sample N	175	11	21	54	38	23	28	72	78	25
Integrated Sciences	147	73%	81%	78%	74%	78%	86%	74%	76%	96%
- for non-science majors & transfer students	108	36%	71%	67%	61%	61%	57%	64%	63%	72%
- for occupational students	84	45%	57%	30%	58%	39%	71%	33%	55%	92%
Environmental Sciences	96	36%	57%	31%	71%	48%	79%	32%	58%	96%
- for non-science majors	66	36%	43%	19%	50%	30%	64%	26%	38%	68%
- for environmental technology students	50	9%	33%	17%	37%	26%	46%	11%	36%	56%
History, Philosophy, & Sociology of Science	54	36%	33%	20%	34%	22%	36%	18%	32%	52%

Table 7

Percentage of Public and Private Colleges Listing Interdisciplinary Natural Science Courses in Their Catalogs

	Total Sample (n=175)	Public (n=147)	Private (n=28)
Integrated Sciences	141	83%	68%
Environmental Science	96	63%	18%
Interdisciplinary Sciences	54	32%	25%
Interdisciplinary and Environmental Sciences	163	95%	82%

the catalogs surveyed, but only one percent of the colleges actually offered it. "Man and Environment" courses were offered by approximately 20 percent of the colleges in our sample, although only a few colleges listed a television course. The number of basic studies courses within this classification was very small; only five courses were so designated. None of these course types was widely offered in the 1977-1978 academic year.

THE INSTRUCTOR SURVEY

Methodology

The same random sample of 175 colleges was used in the study assessing instructional practices in the sciences. Each college president who agreed to participate in the study was also asked to name a contact person at the school, who was given the title "on-campus facilitator." All communication and correspondence between the Center for the Study of Community Colleges and the sample schools was conducted through the 175 on-campus facilities.

Once the college catalogs were obtained from each school, Center staff read each course description in the catalog and put courses in the appropriate category according to the Course Classification System for the Sciences.

The next step in the process involved counting the science course offerings in the Fall 1977 day and evening schedule of classes. Each college's schedule was reviewed one section at a time. Using the course list developed from the college catalog, research assistants could determine which courses were properly categorized as science courses for inclusion in the study. Each science course section was then underlined. A list was developed for each college showing the courses that were offered and the number of sections of that course listed in the schedule of classes.

The selection of individual class sections was done by drawing every thirteenth section in each of the six major science areas. After randomly selecting the first college, the system was automatically self-randomizing.

Using this procedure, every thirteenth section was pulled off the schedule of classes and recorded on a checklist for the facilitator at each school. This checklist included the name of the instructor listed as teaching the section, the course title, section number, and the days and time the class met. A copy of this checklist was kept at the Center to tally the surveys as they were received.

A survey form for each instructor was mailed to the campus facilitator, together with instructions for completing the questionnaire and a return envelope addressed to the same facilitator. The return envelope had the instructor's name listed as the return address and was clearly marked "Confidential." This enabled the on-campus facilitator to keep an exact record of who had responded without opening the envelope. This technique guarantees confidentiality to the respondent while also enabling the facilitator to follow up on the retrieval of surveys from non-respondents.

Questionnaires were mailed to 1,689 instructors. Because the surveys were mailed out between February 20 and April 10, 1978 (after the completion of the Fall term being surveyed), 114 surveys were not deliverable due to faculty dismissal, retirement, death, etc. An additional 77 sections had been cancelled. Of the 1,492 deliverable surveys, 1,275 were returned, a response rate of 85.5 percent. Questionnaires were retrieved from 100 percent of the faculty samples at nearly 69 percent of the colleges. Table 8 shows the relationship between completed surveys in the different disciplines and the total number of class sections offered in these disciplines in the 1977-78 academic year.

Instructor Survey Results for Interdisciplinary Sciences

Twenty-nine responses were received from interdisciplinary natural science instructors. The sample largely represents the general education focus to the interdisciplinary natural sciences, since only a few of the randomly chosen sections were part of an applied science or technical program. Due to the small sample size, the following results must be viewed cautiously, indicative of instruction trends rather than representative.

Table 8

Percentage of Class Section Survey Returned from Each Discipline Compared to the Percentage of Courses Offered in that Discipline

Discipline	Returns on the Class Section Survey--% of Total (n=1275)	77-78 Academic Year--% of Total Lecture Sections (n=49,275)
Agriculture	3.0	3.0
Biology	12.5	10.5
Engineering	11.3	11.0
Math/Comp. Sci.	30.8	32.5
Chemistry	6.4	5.1
Earth/Space	3.6	3.6
Physics	3.5	3.2
Interdisciplinary Natural Science	2.3	2.7
Anthro & Interdis. Soc. Sci.	2.4	3.0
Psychology	11.2	11.6
Sociology	7.4	8.1
Economics	5.4	5.6

Who Teaches Interdisciplinary Science? More integrated science sections were taught by experienced faculty; only one section had an instructor with less than three years' experience. Since the interdisciplinary approach is not the usual form of teaching, more experienced teachers motivated to make changes in their teaching approach and secure enough in their teaching position to attempt innovation appear to have become involved in nontraditional offerings. This explanation also accounts for the predominance of full-time faculty. Ninety-two percent of the sections were taught by full-time faculty; a higher than average percentage of department or division chairpersons (13.8 percent of the integrated science instructors compared to 7.2 percent of the total sample) teach this type of course.

Which Institutions Offer Interdisciplinary Science Courses? All of the interdisciplinary offerings in our sample were at public colleges (96.6%). The data from the instructor survey corroborate the finding in the course survey that more interdisciplinary science courses are offered in large (37.9%) or medium-sized colleges (58.6%) than small ones (3%). In addition, more integrated science courses were offered by colleges charging more than $200 or more tuition. The data support the contention that integrated sciences emerge in the curriculum of the larger institutions, which can support innovative, nontraditional courses more readily than the smaller, private two-year colleges.

Enrollment. The average class in interdisciplinary sciences initially enrolls 26 students; an average of 20.7 students complete the course. Although the initial class size is smaller than the science average of 31.8, the completion rate is similar.

The discrepancy between males and females enrolled in interdisciplinary natural sciences was small, unlike other fields under study where a discrepancy existed, e.g., more males than females in engineering, economics, and agriculture, more females than males in biology (attributable to the greater number of women in allied health programs) and psychology. Some skewing of the sample may be attributable to the few sections surveyed in technical areas, such as environmental technology.

The faculty report that interdisciplinary courses are designed primarily for transfer students in a non-science major (75.9%). Also nearly 40 percent of the faculty surveyed indicate that their course was "designed as a general education course for nontransfer and nonoccupational students." Both of these responses are closer to the responses of earth and space science and social science faculty (e.g., economics, psychology, and anthropology). Few of these faculty perceive their courses as designed for transfer science majors or occupational students. Again the few responses from environmental technology account for this response distribution weighted towards general education concerns.

Course Objectives. The data indicate that the faculty who teach interdisciplinary science courses see the relationship of science to society as the focus of their courses, as reported in the literature by Parsegian (1969). Nearly three-fourths (72.4%) desire that their students "understand/appreciate interrelationship of science and technology with society," and want their students to achieve the ability to "relate knowledge acquired in class to real world systems and problems." The faculty respondents from integrated sciences composed the highest percentage of faculty in the survey to express a desire to have their students develop an appreciation/understanding of the scientific method (10.3% of integrated science faculty compared to 2.2% of other faculties). Compared to responses of faculty from the other science disciplines, the achievement of understanding problem-solving techniques (20.7%) and discipline-specific principles, concepts, and terminology were of nominal concern to these faculty members. Over one-half of the interdisciplinary faculty (55.2%) was concerned with students developing "the ability to think critically" and over one-third (34.5%) expressed interest in students gaining qualities of mind useful in further education. These questions were framed as forced choices (see Questionnaire, Appendix C), so instructors were limited in their responses to the course goals listed on the questionnaire. The responses described here reflect the trends in the literature (Chapdelaine et al., 1977; Parsegian, 1969).

<u>Prerequisites</u>. Only ten percent of the integrated sciences faculty surveyed require prerequisites for their courses. This response again aligns this faculty with the earth and space science and the social science faculties. The course survey yielded a higher percentage of required prerequisites (19%), but this figure still placed this science area among the least demanding of prerequisites.

<u>Instructional Techniques</u>. Faculty response to a question regarding use of instructional techniques indicates that, compared to other science faculty, interdisciplinary faculty use a greater variety. Interdisciplinary science faculty make use of guest lecturers, class discussion, film or taped media, field trips, and lecture-demonstration experiments by students. Yet, they do not actually devote more time to any of these instructional techniques than other science faculty. The use of lecture-demonstration experiments is similar to the use of that technique by chemistry and physics faculty, and the use of laboratory also is comparable to their use in the natural science areas. Since the faculty concerns for student achievement are similar to social science faculty concerns and the courses are not designed for science majors, the use of experiments may serve a different purpose than they do in the natural sciences. Experiments, rather than demonstrating scientific techniques that students are expected to learn, may be used to illustrate certain scientific ideas and concepts.

The use of media by over three-fourths of the interdisciplinary science faculty compares with the heavy use of media in the interdisciplinary humanities, as noted by Cantor (1978). Another question on the survey assessing the frequency of use of instructional media indicated that virtually all media types, including films, audio tape-slide-film combinations, slides, filmstrips, videotapes, television, scientific instruments, and lecture or demonstration experiments, were used more frequently in this area than in most others. More than [illegible] percent of the instructors frequently used the latter two modes, scientific instruments and lecture or demonstration.

Instructional Materials. Faculty use an assortment of instructional materials, including laboratory materials and workbooks, collections of readings, reference books, journal and/or magazine articles, and newspapers. The use of newspapers is comparable to their use in the social sciences and agriculture, and reemphasizes the faculty concern for relating science to society. Interestingly, nearly three-quarters of the interdisciplinary science faculty (70.6%) report developing their own laboratory materials and workbooks as compared to 38 percent of the average science faculty. This individual development of material may provide evidence for a difference in interdisciplinary science faculty's objectives for laboratory experience, so that existing materials do not suffice. Since 62.9 percent of physics faculty in one study also report preparing their own laboratory materials, it would seem good laboratory materials may not be available for the physical sciences.

Classroom and Out-of-classroom Activities. Students in 50 percent of the interdisciplinary class sections wrote papers outside the class, while papers written in class were least likely to be included in determining students' grades. Nearly three-quarters of the faculty report that quick score/objective tests/exams count 25 percent or more towards the course grade. More than half frequently use multiple response and nearly 40 percent emphasize essay questions. In evaluating students faculty look for the following achievements: acquaintance with concepts of the discipline (79.3%), understanding of the significance of certain works, events, phenomena, and experiments (65.5%), ability to synthesize course content (51.7%), and relationship of concepts to student's own values (37.9%). Almost half (44.8%) of the respondents reported mastery of a skill was not an important requirement.

Out-of-classroom activities are more often recommended in interdisciplinary science courses than in classes in most other areas. These activities include on-campus educational films, other films, field trips, television programs, visits to museums/exhibits/zoos/arboretums, volunteer service, and outside lectures. Only a small percentage, however, actually require such activities for course credit.

Course Improvement. When interdisciplinary faculty were asked what could have made their courses better, more than half (51.7%) reported "instructor release time to develop course and/or material"; 48.3 percent responded "availability of more media or instructional materials." More than one-third (34.5%) indicated they would like more professional development opportunities for instructors and better labdratory facilities. Over half (51.7%) of this faculty group would prefer students better prepared to handle course requirements, although half the faculty in the entire survey were also concerned with their students' preparation. Faculty concerns with more release time to develop course materials and more professional development opportunities support the literature, which cites such problems as insufficient time to develop courses and inappropriate faculty training (Palmer, 1975).

SUMMARY

What is the condition of the interdisciplinary sciences and environmental sciences in the two-year college curriculum?

Course Survey and Classification. Interdisciplinary and environmental sciences represent four percent of the total number of science courses in our sample of 175 colleges. Eighty-nine percent of the colleges sampled list one or more interdisciplinary natural science courses in their schedules of classes. These occur mainly in large, public two-year colleges, most often in the West. Integrated sciences consists primarily of physical science survey courses, which are not designated for any particular occupational group and account for nearly one-quarter (23.7%) of interdisciplinary natural sciences generally. History, philosophy and sociology of science and other interdisciplinary sciences are listed in catalogs of 31 percent of the colleges in the sample and were actually scheduled in only 18 percent of the colleges in the 1977-78 academic year.

Thirty percent of the environmental science courses listed are designated for nonmajors; 70 percent are environmental technology courses. The environmental science field has flourished; the 150 or so colleges offering environment courses as of 1971 (Pratt, 1971) grew to 55 percent

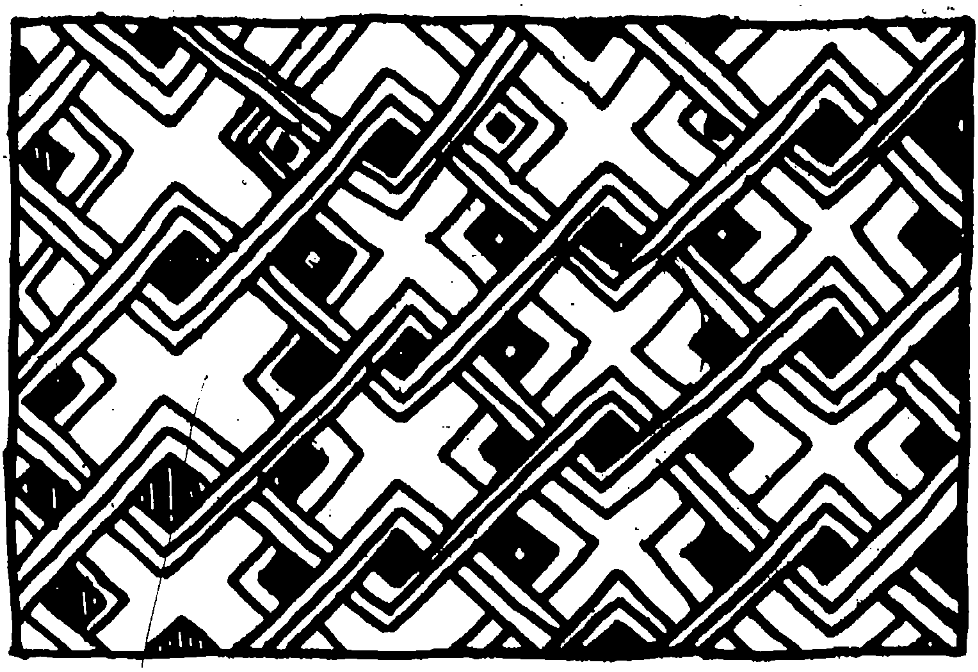
of the colleges in our study in the 1977-78 academic year listing courses. One notable finding in the data on instructional mode is the dearth of courses with a field work component, despite the discussion in the environmental science literature of the importance of field experience (Carsey, 1974; Schultz, 1973).

National curriculum efforts, such as the "Ascent of Man" course (Rein, 1975) or "Man and Environment" offerings, have had mixed acceptance. "Ascent of Man" was scheduled in only one percent of the colleges surveyed. "Man and Environment" courses appeared in 20 percent of the colleges studied, but not many of those offerings appear to be the televised package developed by Miami-Dade Community College (McCabe, 1971).

This classification of courses was the least demanding of prerequisites compared to the other sciences.

Instructor Survey. The instructor survey provides some indication that interdisciplinary science general education courses are more often taught by established, full-time faculty. These instructors report general education concerns similar to those expressed in the literature (e.g., Chapdelaine et al., 1977; McAlexander, 1976). They desire students to develop the ability to think critically, understand the scientific method, and relate science and technology to the real world.

This faculty demonstrates a willingness to use a variety of instructional techniques, which corresponds to the many experimental and innovative courses within this classification (Palmer, 1975). In line with this innovative teaching, faculty identify a need for more release time for course development. Especially heavy use of media is reported by faculty respondents, who indicate a desire for the availability of more media and instructional materials. The interdisciplinary science faculty's use of laboratory time does align them with the natural science faculty, even though their course goals may be different. This difference in course goals may be reflected in the finding that 71 percent of the interdisciplinary science faculty develop their own laboratory materials. This faculty often recommends out-of-classroom activities, such as films, field trips to industrial plants, research laboratories, television programs, museums, and exhibits.



PART III

CONCLUSIONS AND RECOMMENDATIONS

The end of Part I contains conclusions derived from literature reviews of interdisciplinary sciences and environmental sciences, respectively. Part II concludes with a summary of findings from our studies of curriculum and instructional practices. Based on this information, this section reiterates some of those conclusions and offers some recommendations for further research and program improvement.

Our data indicate the prevalence of interdisciplinary natural sciences in the two-year college, despite the fact that it accounts for only four percent of the overall science courses examined in our curriculum. The literature attests to the existence of a wide scattering of isolated

undertakings in interdisciplinary sciences. Environmental technology programs represent a separate entity from the general education interdisciplinary offerings and need independent consideration. Most of the following remarks will be directed towards the general education component.

INTERDISCIPLINARY SCIENCES

With the exception of the traditional physical science survey, interdisciplinary sciences enjoy the special consideration and suffer the problems of experimental, nontraditional programs. The nontraditional nature of interdisciplinary science, while limiting their numbers, seems to spawn a greater variety of instructional practices. Our Instructor Survey suggests that more secure and experienced faculty involve themselves in interdisciplinary science offerings, indicating their willingness to risk an innovative undertaking. The predominance of established faculty raises another issue often confronted by experimental programs. This type of offering may be instructor-centered to the extent that the instructor becomes the charismatic leader, the force holding the course together. Should this leader lose interest in the innovative offering, the result may be the demise of the entire endeavor.

Furthermore, interdisciplinary sciences are more likely found in larger colleges which can support experimentation. Like their experimental counterparts, interdisciplinary sciences may be subject to hostility from college administrators and other faculty. Administrative difficulties cannot be expected to improve in the future with continual budgetary restraints in the forecast. More investigation of the political dynamics in course or program development would be of great value in securing the existence of nontraditional courses.

Our data indicate that such national curriculum efforts as the "Ascent of Man" or the "Man and Environment" series were not widely offered in the 1977-1978 academic year. Such joint ventures, however, do provide a means for the smaller, private college to provide innovative offerings without prohibitively high development costs. The use of

integrated science modular units for occupational programs developed at large (Stack, 1975) or medium-sized (Hackett, 1973) colleges provides flexibility for adaptation to smaller college curricula.

A Response to Student Diversity

It is not clear from the literature or the study that course developers address the student diversity that is a central feature of the community college. Some of the block program offerings may be suitable for transfer students, but the part-time, working, and occupational students probably do not find this type of arrangement feasible. Our classification scheme (CSCC) reflects the diversity of vocational needs that must be considered by faculty seeking a solution to providing a comprehensive science perspective. One core course may not be appropriate for students with different educational goals, such as those who seek to satisfy a program requirement, have no definite occupational goal, or lack adequate academic preparation. Perhaps a traditional course may not be the answer to the general science component of certain occupational programs and an integrated science module, offered as part of a more specific vocational course, may prove to be more successful.

The data indicate that physical science surveys, which are usually part of the distribution requirements of general education programs, account for a high percentage of interdisciplinary offerings. In the light of the drop in the number of students transferring to four-year colleges (Knoell, 1976) and the growth of occupational programs (AACJC, 1976), the physical science survey's orientation in the future may be directed toward providing a science foundation to vocational students. Our data indicate only a small percentage of colleges offer integrated sciences as the vehicle for presenting science concepts to students in occupational programs. Longitudinal data are needed to determine if a trend in this direction may be developing. The complexity of such curricular considerations is compounded when the realities of a funding system that is based on enrollment are included.

Part of the dilemma in tailoring the curriculum to student diversity includes the faculty's orientation to the curriculum. The Instructor Survey provided some evidence that faculty concerns are, indeed, centered around general education goals: "understand/appreciate interrelationship of science and technology, with society," "develop the ability to think critically," and "gain qualities of mind useful in further education." A distinction in goals may exist between integrated sciences, seeking to provide students with basic science concepts, and interdisciplinary science, focusing on the relationship between two disparate ways of thinking. The lack of adequate goal clarification in interdisciplinary offerings (Maxwell, 1968) and the improvement of courses through more rigorous goal identification (Chapdelaine et al., 1977) expressed in the literature signals the need for further discussion of the general education goals that can be met through an interdisciplinary science offering.

Developmental Studies

Can the general education goals for an interdisciplinary science course be incorporated into basic studies offerings? Our course survey yielded few interdisciplinary science courses identified as part of a basic studies curriculum. Basic or developmental studies frequently are restricted to reading, writing, mathematics, or study skill development. As mentioned previously, the effectiveness of an interdisciplinary science course as the forum for basic skill instruction has not been adequately explored. By involving academically underprepared students with a scientifically-related problem, such as pollution or energy, some of the unproductive traditional learning patterns of these students may be avoided, thereby facilitating skill development. The low number of required prerequisites indicates that community college instructors are not now expecting a high level of student preparation for interdisciplinary science, which further indicates the feasibility of including interdisciplinary science in basic studies curricula.

Curricular Decision-making

Another interesting issue confronts the dean of instruction who makes decisions about the curricular structure in a community college. The dean may decide that bringing departments together to offer an interdisciplinary course may improve science education for certain groups of students. Or an interdisciplinary course may be necessary to meet changes in transfer requirements from a local four-year institution or new certification requirements from a particular vocational licensing board. Yet, these changes may undermine a particular department by increasing enrollments in the interdisciplinary course at the expense of enrollments in specific discipline courses. A move towards interdisciplinary courses may, however, serve the best interests of a science curriculum responsive to student needs. Juggling departmental demands with science curriculum needs may prove a delicate task for the dean.

A Vehicle for Faculty Development

Development of an interdisciplinary course can be the focus of a faculty development program, which not only deals with the mechanics of course development but also can stimulate dialogue among the science faculty. Such an undertaking responds to faculty needs, as expressed in the Instructor Survey for more professional development and preparation time for course development.

ENVIRONMENTAL TECHNOLOGY

Environmental technology programs are offered in approximately 55 percent of the community colleges. These programs follow the general trend toward more occupational education (AACJC, 1976) and, after 15 years of growth, environmental education has asserted itself as more than just a "hot" area of the curriculum. The daily assault of newspaper headlines about environmental problems indicates a continuing need. The literature on environmental technology indicates that manpower demands in this growing field may militate against rational program planning. Although regional priorities may vary, educators must keep vigilance that thoughtful curricular decisions are made.

Gaps still exist in our knowledge of environmental technology faculty. Are they like other science faculty? Our data do not tell us. Is Pratt's (1971) suggestion of a core curriculum still feasible and appropriate? Some evidence indicates that a core curriculum is a viable approach (McCabe, 1977; Schoenfeld & Disinger, 1978). Comparisons of environmental programs that have and have not incorporated Pratt's model would provide some guide to continued curriculum development in this direction. Have the weaknesses in environmental programs that Pratt (1971) enumerates been overcome? Are programs still "patchwork" in nature, devoid of work experience components and unresponsive to local manpower needs? More investigation of these questions will steer environmental technology to rational curriculum planning.

In sum, then, as a forum for a variety of instructional techniques and approaches to scientific literacy, the interdisciplinary sciences are an important, albeit small, part of the science curriculum. Faculty undertaking such courses can experiment in an atmosphere not overburdened by tradition, even if some bureaucratic hurdles may need to be crossed. This type of course keeps the community college vital and responsive to its unique student population.

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APPENDIX A

Region I NORTHEAST

Connecticut

Greater Hartford
Mitchell
Quinebaug

Massachusetts

Bay Path
Bunker Hill
Mt. Wachusett

Maine

University of Maine/
Augusta

New Hampshire

New Hampshire Tech.
White Pines

New York

Cayuga County
Genesee
Hudson Valley
North Country

Vermont

Champlain
Vermont Col. of
Norwich U.

Region 2 MIDDLE STATES

Delaware

Delaware Tech. and C.C./
Terry Campus
Goldey Beacom

Maryland

Dundalk
Hagerstown
Harford
Howard
Villa Julie

New Jersey

Atlantic
Middlesex County

Pennsylvania

Allegheny County/Boyce Campus
Delaware County
Harcum
Keystone
NortHampton County
Northeastern Christian

West Virginia

West Virginia Northern
Potomac State

Region 3 SOUTH

Alabama

James Faulkner State
John C. Calhoun State
Lurleen B. Wallace State
Northwest Alabama State

Arkansas

Central Baptist
Mississippi County
Westark

APPENDIX A (continued)

Florida

Brevard
Edison
Florida
Palm Beach
Seminole
Valencia

Georgia

Atlanta
Bainbridge
Clayton
Floyd
Georgia Military
Middle Georgia
South Georgia

Kentucky

Southeast

Mississippi

Itawamba
Mary Holmes
Mississippi Gulf Coast/
  Jefferson Davis Campus
Pearl River
Southwest Mississippi
Wood

North Carolina

Chowan College
Coastal Carolina
Edgecombe Tech.
Halifax City Tech.
Lenoir
Richmond Tech.
Roanoke-Chowan Tech.
Wake Tech.

South Carolina

Greenville Tech.
University of South Carolina/
  Lancaster

Tennessee

Jackson State
Martin
Morristown
Shelby State

Texas

Angelina
Lamar University/Orange Branch
San Antonio
Vernon Regional
Weatherford

Virginia

Central Va.
Northern Va./Alexandria
New River
Southern Seminary
Tidewater
Thomas Nelson
Wytheville

Region 4 MIDWEST

Illinois

Central YMCA
Danville
Highland
Kishwaukee
Lincoln Land
Oakton
Waubonsee
William Rainey Harper

Iowa

Clinton
Hawkeye Institute of Technology
Indian Hills
Iowa Lakes
Marshalltown
Southeastern

APPENDIX A (continued)

Michigan

Bay de Noc
Delta
Kalamazoo Valley
Kirtland
Monroe County
Oakland
Suomi

Minnesota

Austin
North Hennepin
Northland
University of Minnesota Tech.
Willmar

Missouri

St. Paul's
Three Rivers

Nebraska

Metropolitan Tech.
Platte Tech.

Ohio

Edison State
Loraine County
Northwest Tech.
Shawnee State
Sinclair
University of Toledo
Comm. and Tech.

Wisconsin

District One Tech.
Lakeshore Tech.
Milwaukee Area Tech.
University Center System/Sheboygan
Western Wisconsin Tech.

Region 5 MOUNTAIN PLAIN

Colorado

Arapahoe
Community College of Denver
Auraria Campus
Morgan
Northeastern

Kansas

Barton County
Central
Coffeyville
Hesston
St. John's

Montana

Miles

North Dakota

North Dakota St. Sch. of Science

Oklahoma

Connors State
Hillsdale Free Will Baptist
Northern Oklahoma
South Oklahoma City
St. Gregory's

South Dakota

Presentation

Utah

College of Eastern Utah
Utah Tech.

Wyoming

Central Wyoming

Region 6 WEST

Alaska

Ketchikan

Arizona

Cochise
Pima

California

American River
Butte
Citrus
College of San Mateo
College of the Desert
College of the Sequoias
Fresno City College
Hartnell
Lassen
Los Angeles Pierce
Mendocino
Merced
Mt. San Jacinto
Saddleback
San Bernardino Valley
San Diego Mesa
Santa Rosa

Nevada

Clark County

Oregon

Chemeketa
Mt. Hood
Umpqua

Washington

Green River
Lower Columbia
Peninsula
South Seattle

APPENDIX B

INTEGRATED SCIENCES

Courses within this category combine two or more specialized areas of science and serve as an introduction or survey of the sciences for general education students and/or students entering career programs. Specialized areas include chemistry, physics, geology, astronomy, and other physical sciences, as well as certain biological topics. Courses covering scientific measurement, science teaching methods, and forensic science also fall within this category.

- Integrated sciences for non-science majors
- Physical science surveys
- Science for allied health occupations
- Science for engineering and industry-related technologies
- Measurement and metrics
- Science teaching methods
- Forensic science
- Preparatory and special courses for science majors
- Other general science courses

INTEGRATED SCIENCES FOR NON-SCIENCE MAJORS

Courses provide a broad perspective of scientific concepts for non-science majors fulfilling general education science requirements. Courses include a combination of topics from the biological and physical sciences and may emphasize the interrelationship among the scientific disciplines. Courses preparing students for the GED examination and developmental science courses are also included.

PHYSICAL SCIENCE SURVEYS

Courses for non-science majors treat some combination of physics, chemistry, geology, astronomy, and/or other earth and space sciences. Courses may have a thematic orientation such as the impact of physical sciences on man and on everyday life or the physical sciences from a Biblical point of view.

SCIENCE FOR ALLIED HEALTH OCCUPATIONS

Basic physical science and/or biological science courses designed for allied health occupational students comprise this category of courses. Courses include scientific topics and mathematical concepts which relate to the body, prevention and control of disease and infection, and general hospital situations. Courses may be designed for the allied health occupations generally or for a specific health technology program, such as nursing or respiratory therapy.

SCIENCE FOR ENGINEERING AND INDUSTRY-RELATED TECHNOLOGIES

Courses treat two or more of the physical sciences and relate to engineering and industry-related technologies generally or select those physical science topics of particular interest to a given technology. Examples include fire science, science of photography, and color theory, presenting the physics, physiology, and chemistry of color for interior design majors.

MEASUREMENT AND METRICS

Courses present the metric system as it applies to the needs of technological programs or everyday life. Courses cover such concepts as area, volume, temperature, and conversions from the English system. Measurement courses such as basic review of measurement or measurement systems which apply to the treatment of scientific data also fall within this category.

SCIENCE TEACHING METHODS

Courses designed for prospective teachers provide scientific (and mathematical) concepts, materials, techniques, and experiences that can be used to teach and stimulate interest in science for preschool and elementary school children. Laboratory and field experiences may be included. Courses may also cover science and/or mathematics teaching methods.

FORENSIC SCIENCE

Courses examine the physical and chemical tests used in the crime laboratory as part of administration of justice programs. Courses cover the use of the laboratory for microscopic and chemical analysis, and photographic techniques in identifying and comparing physical evidence. Demonstrations and laboratory experiments may be included.

PREPARATORY AND SPECIAL COURSES FOR SCIENCE MAJORS

Courses which present techniques and concepts from two or more sciences, or mathematics, designed to prepare students for advanced science courses. This category also includes special courses cutting across scientific disciplines such as applied math and statistics, concepts of the science lab, data collection techniques, glassblowing (for scientific glass), scientific photography, and the use of scientific materials.

OTHER GENERAL SCIENCE COURSES

Courses deal with general scientific topics such as the scientific aspects of energy, consumer science, the introduction to basic scientific products, and the future advances of science. Such courses are usually general interest courses and do not serve as requirements for any specific career program or science major.

ENVIRONMENTAL SCIENCE

These are environmental science courses both for general education students and students in environmental or related technologies. Both general survey courses and courses examining specific environmental issues (e.g., air, water, and noise pollution) and the identification and prevention of environmental problems form this category. Courses in the technological curricula dealing with personnel and facility management are not included.

- Environmental science for non-science and non-technology majors
- Environmental technology
- Air pollution
- Water pollution
- Noise pollution
- Solid water disposal
- Nuclear radiation control
- Agricultural pollution
- Other environmental studies

ENVIRONMENTAL SCIENCE FOR NON-SCIENCE AND NON-TECHNOLOGY MAJORS

These courses provide a general overview of the environmental and natural resources on a global, national or regional basis, primarily for non-science majors. Man and environment courses examine how man interacts with the environment through the study of human population, food and energy resources, pollution and its control, the impact of social structures and technology, and urban and suburban growth.

ENVIRONMENTAL TECHNOLOGY

These courses are designed for students in environmental science and technology or related majors. These introductory or survey courses deal with all types (air pollution, water analysis and treatment, etc.) of environmental problems. General studies of environmental resources, sources and control of pollution, occupational hazards and safety, instrumentation and measurement of environmental conditions and governmental regulations are also included.

AIR POLLUTION

The courses examine the sources, classes, measurements and metereology of air pollution. Topics include the effects of air pollution on health, animal and plant life as well as the means of prevention and control. Also included are courses dealing with specific air pollution problems and methods of control such as mine ventilation. Includes courses primarily designed for environmental and other technology programs.

WATER POLLUTION

The courses deal with the environmental aspects of water, including water sources, distribution and use, and waste water disposal. As part of water technology career programs, courses include water analysis and treatment and waste water treatment, including studies of instrumentation used for analysis and treatment. Field trips and laboratory time are often included.

NOISE POLLUTION

The study of the physics of noise, biological effects of noise, and instrumentation for noise evaluation, especially within occupational environments, designed for industrial or environmental technology or related programs.

SOLID WASTE DISPOSAL

The scientific aspects of solid wastes, including the study of classes and sources of solid waste together with methods of handling, storage, and disposal provide the content for these technical career courses.

NUCLEAR RADIATION CONTROL

These courses deal with the methodology for evaluating radiation and radiation contamination control and protection of personnel. Courses are included within industrial or environmental technology programs.

AGRICULTURAL POLLUTION

The courses examine sanitation problems related to soil and food, including pesticides and other chemical problems, milk and food processing, and insect and rodent control. These courses may be part of an environmental or health technology program or they may serve to stimulate general community awareness.

OTHER ENVIRONMENTAL STUDIES

These courses deal with other environmental problems and the control or prevention of such problems assigned for students within technology programs.

HISTORY, SOCIOLOGY, AND PHILOSOPHY OF SCIENCE

These courses adopt an interdisciplinary focus on science applying historical, philosophical and sociological approaches to science and/or technology. Also within this category are courses on the origins of man, the future, science and religion, and science and literature. The courses tend to satisfy general education requirements.

- History of science and technology
- Philosophy of science
- Science, technology and society
- History, philosophy, and sociology of science
- Science and the humanities
- Science and literature

HISTORY OF SCIENCE AND TECHNOLOGY

The courses within this category provide a historical perspective of technology and the sciences generally or by discipline, e.g., biology, psychology. These courses seek to place present day scientific and technological issues into perspective, usually for science majors or students enrolled in technological programs, but also as a general education course.

PHILOSOPHY OF SCIENCE

These courses examine the concept and methods of science and the belief system presupposed by scientists. They include methods of analysis, such as analysis of causal relations, the role of hypotheses, the use of statistics and other aspects of inductive logic. Ethics courses investigate the moral problems in medicine and biology and include topics of current concern, e.g., abortion, food distribution, experimentation on human subjects. These courses are designed for science and philosophy majors as well as general education students.

SCIENCE, TECHNOLOGY AND SOCIETY

These courses relate science to the everyday world and examine the social, political and humanistic ramifications of science. Most courses emphasize man's influence in a society with finite resources and how society deals with technological problems. Besides general elective courses, this category includes courses such as technological assessments of society for purposes of urban planning as part of an urban planning curriculum.

HISTORY, PHILOSOPHY, AND SOCIOLOGY OF SCIENCE

This category includes courses which combine history, philosophy and/or sociology of science to satisfy general education requirements. These courses often approach science by examining the contributions of famous scientists.

SCIENCE AND THE HUMANITIES

The interdisciplinary courses within this category deal with such subjects as the ascent of man, the future, man and nature, and science and religion. These general education courses often adopt a thematic approach, such as a consideration of the Bible and evolution, or time, space, and deity.

SCIENCE AND LITERATURE

These courses approach science through literature, most often through science fiction. The themes and trends of the literature are combined with a discussion of the scientific background. Science and literature courses attempt to deal with the cultural implications of science and technology.

Center for the Study of Community Colleges

INSTRUCTOR SURVEY

Your college is participating in a nationwide study conducted by the Center for the Study of Community Colleges under a grant from the National Science Foundation. The study is concerned with the role of the sciences and technologies in two-year colleges — curriculum, instructional practices and course activities.

The survey asks questions about one of your classes offered last fall. The information gathered will help inform groups making policy affecting the sciences. All information gathered is treated as confidential and at no time will your answers be singled out. Our concern is with aggregate instructional practices as discerned in a national sample.

We recognize that the survey is time-consuming and we appreciate your efforts in completing it. Thank you very much.

1a. Your college's class schedule indicated that in Fall, 1977 you were teaching:

(Course) 11-13 (Section)

If this class was assigned to a different instructor, please return this survey to your campus facilitator to give to the person who taught this class.

If the class was not taught, please give us the reason why, and then return the uncompleted survey form in the accompanying envelope.

b. Class was not taught because: (explain briefly)

Please answer the questions in relation to the specified class.

2. Approximately how many students were initially enrolled in this class? Males ____ 14-16
Females ____ 17-19

3. Approximately how many students completed this course and received grades? (Do not include withdrawals or incompletes.) Males ____ 20-22
Females ____ 23-25

4. **Check each of the items below that you believe properly describes this course:**

a. Parallel or equivalent to a lower division college level course at transfer institutions . . . . [ ] 1 26

b. Designed for transfer students majoring in one of the natural resources fields (e.g., agriculture, forestry) or an allied health field (e.g., nursing, dental hygiene, etc.) . . . . [ ] 2

c. Designed for transfer students majoring in one of the physical or biological sciences, engineering, mathematics, or the health sciences (e.g., pre-medicine, pre-dentistry) . . . . [ ] 3

d. Designed for transfer students majoring in a non-science area . . . . [ ] 4

e. Designed for occupational students in an allied health area . . . . . [ ] 5

f. Designed for occupational students in a science technology or engineering technology area . . . . [ ] 6

g. Designed as a high school make up or remedial course . . . . . . [ ] 7

h. Designed as a general education course for non-transfer and non-occupational students . . . . [ ] 8

i. Designed for further education or personal upgrading of adult students . . . . [ ] 9

j. Other *(please specify)*: ______________________ [ ] 0

5a. **Instructors may desire many qualities for their students. Please select the one quality in the following list of four that you most wanted your students to achieve in the specified course.**

1) Understand/appreciate interrelationships of science and technology with society . . . . [ ] 1 27

2) Be able to understand scientific research literature . . . . [ ] 2

3) Apply principles learned in course to solve qualitative and/or quantitative problems . . . . [ ] 3

4) Develop proficiency in laboratory methods and techniques of the discipline . . . . [ ] 4

b. **Of the four qualities listed below, which one did you most want your students to achieve?**

1) Relate knowledge acquired in class to real world systems and problems . . . . [ ] 1 28

2) Understand the principles, concepts, and terminology of the discipline [ ] 2

3) Develop appreciation/understanding of scientific method . . . . . [ ] 3

4) Gain "hands-on" or field experience in applied practice . . . . . . [ ] 4

c. **And from this list, which one did you most want your students to achieve in the specified class.**

1) Learn to use tools of research in the sciences . . . . [ ] 1 29

2) Gain qualities of mind useful in further education . . . . [ ] 2

3) Understand self . . . . [ ] 3

4) Develop the ability to think critically . . . . [ ] 4

6a. **Were there prerequisite requirements for this course?** Yes [ ] 1 No [ ] 2 30

b. **IF YES: Which of the following were required? (CHECK AS MANY AS APPLY)**

1) Prior course in the same discipline taken in high school [ ] 1 . . college [ ] 7 31

2) Prior course in any science taken in high school [ ] 2 . . college [ ] 8

3) Prior course in mathematics taken in high school [ ] 3 . . college [ ] 9

4) Declared science or technology major . . . . . [ ] 4

5) Achieved a specified score on entrance examination . [ ] 5

6) Other *(please specify)*: ______________________ [ ] 6

7. **Over the entire term, what percentage of class time is devoted to each of the following:**

a. Your own lectures	______ %	32/33
b. Guest lecturers	______ %	34/35
c. Student verbal presentations	______ %	36/37
d. Class discussion	______ %	38/39
e. Viewing and/or listening to film or taped media	______ %	40/41
f. Simulation/gaming	______ %	42/43
g. Quizzes/examinations	______ %	44/45
h. Field trips	______ %	46/47
i. Lecture/demonstration experiments	______ %	48/49
j. Laboratory experiments by students	______ %	50/51
k. Laboratory practical examinations and quizzes	______ %	52/53
l. Other *(please specify)*: ______	______ %	54/55

Please add percentages to make sure they agree with total TOTAL: 100 %

8. **How frequently were each of the following instructional media used in this class?**

Also check last box if you or any member of your faculty developed any of the designated media for this course.

	Frequently used	Occasionally used	Never used	Developed by self or other faculty member	
a. Films	☐ 1	☐ 2	☐ 3	☐ 4	56
b. Single concept film loops	☐ 1	☐ 2	☐ 3	☐ 4	57
c. Filmstrips	☐ 1	☐ 2	☐ 3	☐ 4	58
d. Slides	☐ 1	☐ 2	☐ 3	☐ 4	59
e. Audiotape/slide/film combinations	☐ 1	☐ 2	☐ 3	☐ 4	60
f. Overhead projected transparencies	☐ 1	☐ 2	☐ 3	☐ 4	61
g. Audiotapes, cassettes, records	☐ 1	☐ 2	☐ 3	☐ 4	62
h. Videotapes	☐ 1	☐ 2	☐ 3	☐ 4	63
i. Television (broadcast/closed circuit)	☐ 1	☐ 2	☐ 3	☐ 4	64
j. Maps, charts, illustrations, displays	☐ 1	☐ 2	☐ 3	☐ 4	65
k. Three dimensional models	☐ 1	☐ 2	☐ 3	☐ 4	66
l. Scientific instruments	☐ 1	☐ 2	☐ 3	☐ 4	67
m. Natural preserved or living specimens	☐ 1	☐ 2	☐ 3	☐ 4	68
n. Lecture or demonstration experiments involving chemical reagents or physical apparatus	☐ 1	☐ 2	☐ 3	☐ 4	69
o. Other *(please specify)*: ______	☐ 1	☐ 2	☐ 3	☐ 4	70

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9. **Which of the following materials were used in this class? CHECK EACH TYPE USED. THEN, FOR EACH TYPE USED, PLEASE ANSWER ITEMS A-D.**

	A.	**B.**			**C.**		**D.**			
		How satisfied were you with these materials?			**Did you prepare these materials?**		**How much say did you have in the selection of these materials?**			
Check Materials Used	**How many pages in total were students required to read?**	Well satisfied	Would like to change them	Definitely intend changing them	Yes	No	Total say	Selected them but had to verify with a chairperson or administrator	Was member of a group that selected them	Someone else selected them
☐ 1 Textbooks	___ 13 15	16 ☐ 1	☐ 2	☐ 3	17 ☐ 1	☐ 2	18 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 2 Laboratory materials and workbooks	___ 19 21	22 ☐ 1	☐ 2	☐ 3	23 ☐ 1	☐ 2	24 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 3 Collections of readings	___ 25 27	28 ☐ 1	☐ 2	☐ 3	29 ☐ 1	☐ 2	30 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 4 Reference books	___ 31 33	34 ☐ 1	☐ 2	☐ 3	35 ☐ 1	☐ 2	36 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 5 Journal and/or magazine articles	___ 37 39	40 ☐ 1	☐ 2	☐ 3	41 ☐ 1	☐ 2	42 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 6 Newspapers	___ 43 45	46 ☐ 1	☐ 2	☐ 3	47 ☐ 1	☐ 2	48 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 7 Syllabi and handout materials	___ 49 51	52 ☐ 1	☐ 2	☐ 3	53 ☐ 1	☐ 2	54 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 8 Problem books	___ 55 57	58 ☐ 1	☐ 2	☐ 3	59 ☐ 1	☐ 2	60 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 9 Other *(please specify)* ___	___ 61 63	64 ☐ 1	☐ 2	☐ 3	65 ☐ 1	☐ 2	66 ☐ 1	☐ 2	☐ 3	☐ 4

10. **Please indicate the emphasis given to each of the following student activities in this class.**

	Not included in determining student's grade	Included but counted less than 25% toward grade	Counted 25% or more toward grade	
a. Papers written outside of class	☐ 1	☐ 2	☐ 3	67
b. Papers written in class	☐ 1	☐ 2	☐ 3	68
c. Quick score/objective tests/exams	☐ 1	☐ 2	☐ 3	69
d. Essay tests/exams	☐ 1	☐ 2	☐ 3	70
e. Field reports	☐ 1	☐ 2	☐ 3	71
f. Oral recitations	☐ 1	☐ 2	☐ 3	72
g. Workbook completion	☐ 1	☐ 2	☐ 3	73
h. Regular class attendance	☐ 1	☐ 2	☐ 3	74
i. Participation in class discussions	☐ 1	☐ 2	☐ 3	75
j. Individual discussions with instructor	☐ 1	☐ 2	☐ 3	76
k. Research reports	☐ 1	☐ 2	☐ 3	77
l. Non written projects	☐ 1	☐ 2	☐ 3	78
m. Homework	☐ 1	☐ 2	☐ 3	79
n. Laboratory reports	☐ 1	☐ 2	☐ 3	80
o. Laboratory unknowns and/or practical exams (quantitative and qualitative)	☐ 1	☐ 2	☐ 3	12
p. Problem sets	☐ 1	☐ 2	☐ 3	13
q. Other *(please specify)*:	☐ 1	☐ 2	☐ 3	14

11. **Examinations or quizzes given to students may ask them to demonstrate various abilities. Please indicate the importance of each of these abilities in the tests you gave in this course. (CHECK ONE BOX FOR EACH ITEM)**

	Very important	Somewhat important	Not important	
a. Mastery of a skill	☐ 1	☐ 2	☐ 3	15
b. Acquaintance with concepts of the discipline	☐ 1	☐ 2	☐ 3	16
c. Recall of specific information	☐ 1	☐ 2	☐ 3	17
d. Understanding the significance of certain works, events, phenomena, and experiments	☐ 1	☐ 2	☐ 3	18
e. Ability to synthesize course content	☐ 1	☐ 2	☐ 3	19
f. Relationship of concepts to student's own values	☐ 1	☐ 2	☐ 3	20
g. Other *(please specify)*:	☐ 1	☐ 2	☐ 3	21

12. **What was the relative emphasis given to each type of question in written quizzes and examinations? (PLEASE RESPOND BY CHECKING ONE OF THE THREE BOXES FOR EACH ITEM.)**

	Frequently used	Seldom used	Never used	
a. Multiple response (including multiple choice and true/false)	☐ 1	☐ 2	☐ 3	22
b. Completion	☐ 1	☐ 2	☐ 3	23
c. Essay	☐ 1	☐ 2	☐ 3	24
d. Solution of mathematical type problems where the work must be shown	☐ 1	☐ 2	☐ 3	25
e. Construction of graphs, diagrams, chemical type equations, etc.	☐ 1	☐ 2	☐ 3	26
f. Derivation of a mathematical relationship	☐ 1	☐ 2	☐ 3	27
g. Other *(please specify)*:	☐ 1	☐ 2	☐ 3	28

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13. **What grading practice did you employ in this class?**

ABCDF	☐ 1	29
ABCD/No credit	☐ 2	
ABC/No credit	☐ 3	
Pass/Fail	☐ 4	
Pass/No credit	☐ 5	
No grades issued	☐ 6	
Other ________ *(please specify)*	☐ 7	

14. **For each of the following out-of-class activities, please indicate if attendance was required, recommended or neither.**

	Attendance required for course credit	Attendance recommended but not required	Neither required nor recommended	
a. On-campus educational type films	☐ 1	☐ 2	☐ 3	30
b. Other films	☐ 1	☐ 2	☐ 3	31
c. Field trips to industrial plants, research laboratories	☐ 1	☐ 2	☐ 3	32
d. Television programs	☐ 1	☐ 2	☐ 3	33
e. Museums/exhibits/zoos/arboretums	☐ 1	☐ 2	☐ 3	34
f. Volunteer service on an environmental project	☐ 1	☐ 2	☐ 3	35
g. Outside lectures	☐ 1	☐ 2	☐ 3	36
h. Field trips to natural formation or ecological area	☐ 1	☐ 2	☐ 3	37
i. Volunteer service on education/community project	☐ 1	☐ 2	☐ 3	38
j. Tutoring	☐ 1	☐ 2	☐ 3	39
k. Other *(please specify)*:	☐ 1	☐ 2	☐ 3	40

15a. **Was this class conducted as an interdisciplinary course?**

Yes	☐ 1	41
No	☐ 2	

b. **IF YES: Which other disciplines were involved?** ________ *(please specify)*

____ 42

____ 43

16. **Were instructors from other disciplines involved . . .**

	YES	NO	
. . . in course planning?	☐ 1	☐ 2	44
. . . in team teaching?	☐ 1	☐ 2	45
. . . in offering guest lectures?	☐ 1	☐ 2	46

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17a. Which of these types of assistance were available to you last term? CHECK AS MANY AS APPLY.

b. Which did you utilize? CHECK AS MANY AS APPLY.

	a. Assistance was available to me in the following areas	**b.** Utilized
a. Clerical help	47 ☐ 1	48 ☐ 1
b. Test-scoring facilities	☐ 2	☐ 2
c. Tutors	☐ 3	☐ 3
d. Readers	☐ 4	☐ 4
e. Paraprofessional aides/instructional assistants	☐ 5	☐ 5
f. Media production facilities/assistance	☐ 6	☐ 6
g. Library/bibliographical assistance	☐ 7	☐ 7
h. Laboratory assistants	☐ 8	☐ 8
i. Other *(please specify):*	☐ 9	☐ 9

18. Although this course may have been very effective, what would it take to have made it better? CHECK AS MANY AS APPLY.

- a. More freedom to choose materials ☐ 1 49
- b. More interaction with colleagues or administrators ☐ 2
- c. Less interference from colleagues or administrators ☐ 3
- d. Larger class (more students) ☐ 4
- e. Smaller class ☐ 5
- f. More reader/paraprofessional aides ☐ 6
- g. More clerical assistance ☐ 7
- h. Availability of more media or instructional materials ☐ 8
- i. Stricter prerequisites for admission to class ☐ 9
- j. Fewer or no prerequisites for admission to class ☐ 1 50
- k. Changed course description ☐ 2
- l. Instructor release time to develop course and/or material ☐ 3
- m. Different goals and objectives ☐ 4
- n. Professional development opportunities for instructors ☐ 5
- o. Better laboratory facilities ☐ 6
- p. Students better prepared to handle course requirements ☐ 7
- q. Other *(please specify):* ☐ 8

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Now, just a few questions about you . . .

19. **How many years have you taught in any two-year college?**

a. Less than one year . . . [ ] 1 — 51
b. 1-2 years . . . [ ] 2
c. 3-4 years . . . [ ] 3
d. 5-10 years . . . [ ] 4
e. 11-20 years . . . [ ] 5
f. Over 20 years . . . [ ] 6

20. **At this college are you considered to be a:**

a. Full-time faculty member . . . [ ] 1 — 52
b. Part-time faculty member . . . [ ] 2
c. Department or division chairperson . . . [ ] 3
d. Administrator . . . [ ] 4
e. Other *(please specify)*:
. . . [ ] 5

21a. **Are you currently employed in a research or industrial position directly related to the discipline of this course?**

Yes [ ] 1 — 53
No [ ] 2

b. **IF YES: For how many years?** — 54/55

c. **If previously you had been employed in a related industry or research organization, please indicate the number of years:** — 56/57

22. **What is the highest degree you presently hold?**

a. Bachelor's . . . [ ] 1 — 58
b. Master's . . . [ ] 2
c. Doctorate . . . [ ] 3

IMPORTANT INSTRUCTIONS

Thank you for taking the time to complete this survey. Please seal the completed questionnaire in the envelope which is addressed to the project facilitator on your campus and return it to that person. After collecting the forms from all participants, the facilitator will forward the sealed envelopes to the Center.

We appreciate your prompt attention and participation in this important survey for the National Science Foundation.

Arthur M. Cohen
Principal Investigator

Florence B. Brawer
Research Director

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