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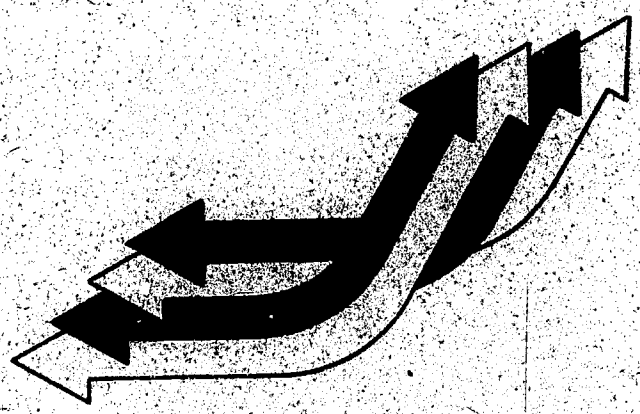
ABSTRACT

This report provides information on the current status of mathematics, science, vocational education, and computer science in the secondary schools in the United States. The introductory chapter briefly discusses the decline in mathematics and science education and possible solutions to stop the decline. An overview is also presented of course offerings and enrollments in these subjects. Chapter two presents definitions both at the conceptual and operational level of mathematics, science, vocational education, and computer science. Chapter three offers an overview of study findings pertaining to course offerings and course enrollments in mathematics, science, vocational education, and computer science. The fourth chapter describes offerings in these subject areas as related to school characteristics. Chapter five describes enrollments in these subjects as related to school characteristics. Technical appendices present brief descriptions of the sample designs, data sources, data adjustments, procedures for calculating standard errors, and a complete list of the courses which were encompassed under various mathematics, science, vocational education, and computer science instructional programs. (JD)

Contractor Report

An Analysis of Course Offerings and Enrollments As Related to School Characteristics



National Center for Education Statistics

An Analysis of Course Offerings and Enrollments As Related to School Characteristics

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EXECUTIVE SUMMARY

Over the last 20 years, the United States has witnessed a widespread decline in the quality of education. This situation was brought to the forefront of public attention by the National Commission on Excellence in Education's report, A Nation at Risk: The Imperative for Educational Reform. A central focus of the report is on the need to redress the decline in mathematics and science education and to prepare students to use emerging new technologies, such as the computer, so they may compete effectively in today's society.

Much of the public discussion and debate as to how to resolve the problems facing education in the United States has centered on how to impart basic skills to students and what should constitute a secondary school curriculum. Commissions and panels have set forth recommendations which would require a shift in emphasis to more traditional academic pursuits (i.e., mathematics, science, English, etc.). The role of non-academic curricula, such as vocational education, in responding to the problems in secondary education has yet to be determined.

At the most basic level, any changes in secondary school curricula must be grounded in reliable and up-to-date figures on what courses are available to students and their level of participation in these courses. However, the last available national statistics on course offerings and course enrollments were collected over a decade ago. Thus, more contemporary information of this type is needed to support any impetus to educational reform.

During the 1981-82 school year, a National Center for Education Statistics (NCES) survey collected data on public and private secondary schools and their students that can provide relatively recent information on course offerings and course enrollments at the national level. Moreover, for the first time, course enrollments can be estimated from student transcript data.

The analysis summarized in this report used the 1981-82 NCES data to determine the status of mathematics, science, vocational education, and computer science at the secondary level. The analysis:

- Identifies current mathematics, science, vocational education, and computer science course offerings and enrollments in U.S. secondary schools; and
- Identifies school characteristics that are associated with differential course offerings and enrollments in these subjects.

Some representative findings, based on the analysis of school-reported course offerings and student transcript data, follow.

Course Offerings

- Nearly all U.S. secondary schools offered at least one course in mathematics, science, and vocational education during the 1981-82 academic year. Over one-half of these schools offered at least a single course in computer science during this period.
- The number and percentage of schools that offered courses in the different instructional programs in these subject areas varied widely. The most commonly offered mathematics courses were general mathematics 1, algebra 1 and 2, and geometry. General biology, chemistry, and physics were the most commonly offered science courses, while business and consumer home economics were the most pervasive vocational education offerings. Courses offered least frequently included advanced placement calculus, statistics, applied mathematics, actuarial science, other physical sciences (e.g., astronomy, astrophysics, etc.), and technologies.
- Vocational education courses accounted for the largest percentage of all courses offered by U.S. secondary schools (31 percent). About eight percent of all courses offered were in mathematics and about seven percent were in science. Computer science courses represented one percent of total course offerings.

- On the average, schools offered about 32 courses in vocational education, nine in mathematics, seven in science, and one in computer science.

- As expected, public schools were, on average, three times more likely to offer courses in the vocational education instructional programs than were Catholic schools, while Catholic schools were more likely to offer advanced level mathematics courses. Public and Catholic schools were more likely to offer computer science languages and programming than were other private schools.

- Course offerings varied by school size, with the larger schools (those with 1,500 or more students) most likely to offer a greater number and variety of course-taking opportunities in most of the mathematics, science, vocational education, and computer science instructional programs.

- Regional differences were detected relative to certain course offerings. Schools in the North offered more of the advanced level mathematics and science courses than did schools in other regions. Schools in the South offered fewer courses in certain vocational education instructional programs (business, industrial arts, trade and industry, and consumer home economics) and in computer science.

- Rural schools offered fewer courses in geometry, advanced and pure mathematics, general biology, chemistry, physics, marketing, trade and industry, and business data processing applications than did schools in other settings.

- There was a strong relationship between the presence of a minimum competency test graduation requirement and the likelihood of offering courses in mathematics, science, vocational education, and computer science. Not surprisingly, schools with this requirement offered more courses in these subject areas.

- As expected, certain advanced level mathematics and science offerings were related to the percentage of students in an academic program. That is, as the percentage of students in an academic program decreased, so did course offerings in these areas. There were fewer vocational education courses in schools where more than three-quarters of the student body were in an academic program. Computer science languages and programming courses were more often available when over one-third of the student body participated in an academic program.

- Similarly, fewer college preparatory mathematics and science courses were offered in schools where students, in general, were not expected to attend college.

- The availability of a gifted-talented program was associated with a higher number and variety of advanced level mathematics and science courses and vocational education offerings.

- There was no consistent pattern in the relationship between student body composition characteristics (percent black, percent Hispanic, percent from non-English speaking homes, and percent disadvantaged) and course offerings.

- While schools with higher student dropout rates tended to offer a larger number of courses across all subject areas, this pattern was the most pronounced with respect to vocational education. These schools offered students more vocational training opportunities in agriculture, business, marketing, health, trade and industry, and consumer and occupational home economics.

Course Enrollments

- Over 95 percent of all U.S. secondary school students had taken at least one mathematics course during their high school careers and an equal percentage had taken at least one vocational education course. About 90 percent of all students had taken a science course. Only 13 percent had studied computer science.

- Instructional programs with one million or more students enrolled included: general mathematics 1, algebra 1, geometry, general biology, general physical sciences, chemistry, business, trade and industry, and consumer home economics. Less than five percent of all high school students had taken advanced placement calculus, statistics, applied mathematics, and actuarial science, other physical sciences, health, or technologies courses.

- Vocational education enrollments represented 18 percent of all high school course enrollments. Mathematics and science, on the other hand, represented 10 percent and seven percent, respectively. Computer science accounted for less than one percent of all course enrollments.

- Public schools had a significantly higher enrollment in general mathematics than did private schools and a lower enrollment in many of the college preparatory mathematics courses. Public school students were also less likely to have enrolled in such science courses as general biology and physics. Not surprisingly, vocational education enrollments were higher among public school students.

- School size was related to enrollments in a few mathematics and science instructional programs. General mathematics 1 and other life sciences enrollments were higher in larger schools while the reverse was true with respect to general biology and general physical sciences. While overall vocational education enrollments increased with school size, there was no consistent pattern between school size and the individual instructional program enrollments in this area. Both computer science languages and programming and business data processing applications enrollments were higher in larger schools.

- Enrollments in specific mathematics and science instructional programs differed across regions of the country. Schools in the South had the lowest percentage of students enrolled in algebra 3,

geometry, and advanced and pure mathematics courses and the highest percentage enrolled in algebra 2, general biology, and general physical sciences. Northern schools had generally higher enrollments in advanced level science programs.

- There were few significant differences in mathematics and science enrollments by school location; however, urban students were more likely to have enrolled in general mathematics 1, and suburban students were more likely to have enrolled in geometry, advanced and pure mathematics, and chemistry. Student enrollment in the individual vocational education instructional programs varied by school location.

- In general, there were few differences in instructional program enrollments between schools with and without a minimum competency test graduation requirement. However, schools with such a requirement had a higher percentage of their students enrolled in general mathematics courses and a lower percentage enrolled in algebra 1 and 2 and geometry.

- Schools with a higher percentage of their students in an academic program or schools in which three-quarters of the student population expected to attend college had higher overall science and computer science enrollments and lower vocational education enrollments. When at least two-thirds of their students were in an academic program, schools had a higher percentage of students enrolled in advanced level mathematics and science courses.

- While there was no relationship between overall enrollments in mathematics, science, and vocational education courses and the availability of a gifted-talented program, there was a pattern of slightly higher enrollments in computer science in schools with such a program.

- Overall, no consistent patterns emerged in mathematics, science, vocational education, and computer science enrollments with respect to the student body composition characteristics of schools.

- Schools with a dropout rate under two percent had a significantly higher percentage of their students enrolled in college preparatory mathematics and science courses and a lower percentage of students enrolled in general mathematics. Vocational education enrollments for marketing, industrial arts, trade and industry, and consumer and occupational home economics were higher when the dropout rate was two percent or more.

CHAPTER 1

INTRODUCTION

A well-documented problem facing education in the United States is the critical need to impart basic skills in mathematics and science to its students. Moreover, with the increasing role computers are playing in all facets of American life, another problem facing education is that of deciding how best to prepare students for using this technology. Panels, commissions, and policy-makers at the highest levels have put forth specific proposals for addressing these problems. The majority of these proposals shift curriculum emphasis and class hours away from such programs as vocational education to required courses in mathematics, science, and computer science. Advocates of vocational education have argued that such proposals have traditionally overlooked the role of their field in responding to these problems.

The analysis summarized in this report was undertaken to provide educators, policymakers, and the general public with information on the current status of mathematics, science, vocational education, and computer science in the secondary schools of the United States. Data collected by the National Center for Education Statistics were used to address questions concerning these secondary school programs. The answers provided to these questions may be used as input into policy decisions concerning future directions of mathematics, science, vocational education, and computer science in our nation's schools.

1.1 The Decline in Mathematics and Science Education

Mathematics and science education have experienced three essential problems: declining enrollments, declining achievement scores, and a diminishing teacher pool. Enrollments in traditional mathematics courses dropped sharply between 1964 and 1981. The percentage of high school students enrolled in algebra 1 declined from 76 to 64 percent, while enrollment in geometry

dropped from 51 to 44 percent, and algebra 2 from 35 to 31 percent. Enrollments in science courses such as biology (80 to 77 percent), chemistry (34 to 32 percent), and general science (61 to 37 percent) experienced similar declines over this period.[1]

Interrelated with declining enrollments in mathematics and science is the decline in student achievement scores in these areas. The National Science Board reported that between 1973 and 1982 the mean achievement scores of 17 year-olds declined 3.2 percent in mathematics. Similarly, between 1970 and 1983 mean science achievement scores declined 6.7 percent. Regarding the decline in the sciences, Stephen Graubard, editor of Daedalus, dismally concluded, "scientific knowledge and understanding, by any reasonable standard, is so uncommon among Americans of all ages and races today that it is no exaggeration to speak of mass illiteracy in the sciences."[2]

Compounding the problem of declining enrollments and achievement scores is a diminishing mathematics and science teacher pool. Max Sobel, past president of the National Council of Teachers of Mathematics, noted:

> Since 1972 there has been a 77 percent decline in the number of secondary level mathematics teachers prepared by schools of education nationwide. As a result, over 50 percent of the newly employed mathematics teachers in some states are considered to be unqualified to teach mathematics, but continue to be employed on an emergency basis because fully certified teachers are not available."[3]

The reduced science teacher pool is also critical. Between 1970 and 1980 the production of science teachers by schools of education dropped by 64 percent.[4]

1/ Clifford Adelman, "Devaluation, Diffusion and the College Connection: A Study of High School Transcripts, 1964-81," Washington, D.C. National Institute of Education, March 1983 in Educating Americans for the 21st Century by the National Science Board Commission on Precollege Education in Mathematics, Science and Technology, September, 1983, p. 1.

2/ Stephen Graubard, ed. "Nothing to Fear, Much to Do," Daedalus, Spring, 1983, p. 237.

3/ Max A. Sobel, "The Crisis in Mathematics Education," Educational Horizons, Winter.

4/ Susan Walton, "A Generation Lags Behind as Science Advanced," Education Week, July 27, 1983, p. 2.

1.2 Solutions to the Decline in, and Their Possible Impact on, Vocational Education

Many of the proposed solutions to the problems confronting mathematics and science education require a restructuring of curriculum emphasis. Students would be required to take more courses and devote more of their class hours to courses in mathematics and science. The Paideia Proposal would eliminate "all specialized training for particular jobs" from the secondary school curriculum in order to make time for the essentials of "basic schooling."[5] A plan of action prepared by the National Science Board for improving mathematics, science and technology education for all American elementary and secondary students recommends significant increases in the number of required mathematics and science courses. In the language of the report,

> All secondary school students should be required to take at least three years of high school mathematics including one year of algebra . . . (and) at least three years of science and technology, including one semester of computer science prior to high school graduation.[6]

The recommendations of the National Commission on Excellence in Education strongly emphasize a return to basics, or as the Commission phrases it, the "new basics." In the areas of mathematics and science, all students would be required to take, "at a minimum," three years of mathematics, three years of science, and one-half year of computer science.[7] The Commission also urges that high school curricula "also provide students with programs requiring rigorous effort in subjects that advance students' personal, educational, and occupational goals."[8]

5/ Mortimer J. Adler et al., The Paideia Proposal -- An Educational Manifesto (New York: Macmillan Publishing Co., 1982), p. 35.

6/ National Science Board Commission on Precollege Education in Mathematics, Science and Technology, Educating Americans for the 21st Century (Washington, D.C., 1983), p. 40.

7/ The National Commission on Excellence in Education, A Nation at Risk: The Imperative for Educational Reform (Washington, D.C., 1983), p. 24.

8/ A Nation at Risk: The Imperative for Educational Reform, p. 26.

Gene Bottoms, Executive Director of the American Vocational Association, takes exception to the proposal contained in the Commission on Excellence report and other similar reports. He notes:

> [They] focus narrowly on the academic curriculum in the high school. Both reports refer repeatedly to the goal of excellence for all programs and all students, but the recommendations fail to live up to this intention. In fact, four of the six specific charges to the Commission on Excellence dealt with preparation for college, college admissions, and success in college. No mention was made of preparation for work.[9]

Bottoms goes on to say, "The two prestigious panels did not even consider the potential of non-academic curriculums to contribute to the 'new basics' or to alleviate scientific and technological backwardness."[10]

The problems facing mathematics and science education must be resolved if our young people are going to compete effectively in an ever-changing technological world. However, there is much debate concerning the best way to accomplish this goal. Some argue that solving the problems of mathematics and science by undermining the success of vocational education in preparing students for entry into the labor force is not in the best interest of the nation or its young.

Before we adopt solutions to the problems confronting education in mathematics and science, we need to understand better the status of mathematics and science in the nation's secondary schools. Moreover, we need more information on these areas -- such as vocational education, the arts, and the humanities -- that would be affected by attempts to remedy the mathematics and science deficiencies of high school students. In particular, information is needed on: (1) the types of courses currently being taught in mathematics, science, and vocational education, (2) the current enrollments in these courses, (3) the characteristics of schools that offer different numbers and types of mathematics, science, and vocational education courses and have varying student participation rates in these courses, and (4) the characteristics of students who participate to varying degrees in these programs.

9/ Gene Bottoms, AVA Executive Director, "Voc Ed Belongs on the National Agenda for Excellence," VocEd, October 1983, p. 8.

10/ Bottoms, p. 8.

1.3 Computer Science Education

It is generally recognized that there is a shortage of computer science instruction in our nation's schools. It is equally recognized that, at a minimum, today's students need to become acquainted with the computer and its uses if they are to compete effectively in the job market and succeed in postsecondary education. Furthermore, schools are experiencing the value of the computer as a learning tool which permits students to explore subject areas and investigate concepts through simulations and games.

Traditionally, computer studies in education have been classified into two main groupings -- computer science and business data processing. Computer science was traditionally tied to mathematics while business data processing, as its name implies, was linked to the study of business. Recently, a third classification of computer studies has emerged which focuses on learning about computers. Computer literacy courses provide students with the opportunity to learn what a computer is, how it works, and what it can and cannot do.

As indicated earlier, many of the panels and commissions that have studied the status of contemporary education have recommended that computer science instruction be a part of all students' educational experience. There is, however, much discussion concerning the best way to achieve this goal. Often missing from this discussion is current information on the level of computer science instruction in schools, enrollments in these courses, and the characteristics of schools with differential offerings and students participation in this type of program.[11]

11/ Throughout this report, the term computer science is used to refer to the overall study of computers, including courses traditionally classified as computer science, business data processing, and computer literacy. An alternative term, which some might prefer, would be computer studies.

1.4 An Analysis of Course Offerings and Enrollments in Mathematics, Science, Vocational Education, and Computer Science

Recognizing the need for detailed information on the status of mathematics, science, vocational education, and computer science in secondary education, and the ability of certain data collected by the National Center for Education Statistics (NCES) to help meet this need, the NCES contracted with Evaluation Technologies Incorporated (ETI) to design and conduct an analysis of these subject areas. The general objectives of the analysis were to:

- Identify current mathematics, science, vocational education, and computer science course offerings and enrollments in the secondary schools in the United States;
- Identify those school characteristics that are associated with differential course offerings and enrollments in mathematics, science, vocational education, and computer science.

1.5 Data Sources

Data to investigate the course offerings and course enrollments of U.S. secondary schools in mathematics, science, vocational education, and computer science courses were available through several surveys sponsored by the U.S. Department of Education, National Center for Education Statistics. Particularly useful were the data collected by:

- The 1982 High School and Beyond (HS&B) Course Offerings and Course Enrollments Survey
- The 1982 High School and Beyond Transcripts Survey
- The 1980 High School and Beyond Base Year Survey
- The 1982 High School and Beyond First Follow-up Survey

Data from the HS&B Course Offerings and Course Enrollments survey were used to estimate the number and percentage of schools offering courses in mathematics, science, vocational education and computer science. The course

enrollment data obtained as part of this survey were not complete enough (i.e., the response rate was too low) to provide a basis for estimating national enrollments. Therefore, student transcript data were used for this purpose.

It should be noted that enrollment data based on student transcripts are not precisely comparable with "pure" enrollment data for a school year. Transcript data cover four years of study by each student. The two types of data are equivalent only to the extent that the freshmen, sophomores, and juniors of 1981-82 took the same courses that year that the HS&B seniors had taken when they were freshmen, sophomores, and juniors.

Data provided by school administrators in response to items on the HS&B Base Year and First Follow-up school questionnaires permitted the identification of school characteristics that were related to course offerings and course enrollments.

1.6 Report Organization

The remainder of this report is organized into four chapters and a technical appendix. Chapter 2, entitled Key Study Definitions, presents definitions both at the conceptual and operational level of mathematics, science, vocational education, and computer science. Chapter 3 presents an overview of study findings pertaining to course offerings and course enrollments in mathematics, science, vocational education, and computer science. Chapter 4 describes offerings in these subject areas as related to school characteristics, and Chapter 5 describes enrollments in these subjects as related to school characteristics. The technical appendix presents brief descriptions of the sample designs, data sources, data adjustments, procedures for calculating standard errors, and a complete list of the courses, by 6-digit codes, which were encompassed under various mathematics, science, vocational educaion, and computer science instructional programs.

CHAPTER 2

KEY STUDY DEFINITIONS

When designing the analysis of course offerings and enrollments in the curriculum areas of mathematics, science, vocational education, and computer science, it was necessary to establish conceptual and operational definitions of each area. These definitions were required for two reasons: (1) for the proposed analysis to produce meaningful and policy-relevant findings, all curriculum areas had to be uniquely described within the context of secondary education, and (2) the quantitative nature of the analysis required that key concepts be operationally defined in terms of the available survey data.

The NCES determined that subject-area specialists would be needed to identify the common and unique elements of mathematics, science, vocational education, and computer science secondary education and to advise in the operationalization of these elements in terms of instructional programs and courses. Specialists were selected from among national, state, and local leaders in secondary and postsecondary education and in educational policy development.

The subject-area specialists and ETI project staff convened to: (1) develop abstract definitions of mathematics, science, vocational education, and computer science; (2) identify high school courses which should be flagged as mathematics, science, vocational education, or computer science offerings; and (3) develop a set of research questions framed in the HS&B survey data. Two sessions were held, one to consider mathematics, science, and computer science and one to consider vocational education.

The subject-matter specialists provided either a conceptual definition of the relevant subject area, accompanied by a list of course codes from the Classification of Secondary School Courses (CSSC) organized to represent this definition, or the codes which implied a clear definition.[12] These

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12/ Evaluation Technologies Incorporated, A Classification of Secondary School Courses, Washington, D.C.: National Center for Education Statistics, 1982.

definitions are presented in the following sections. The CSSC codes which were used to define secondary school study in each area are included as part of the technical appendix to this report.

2.1 Mathematics

Mathematics is the group of subjects that deals with quantities, magnitudes, forms, and their relationships by the use and manipulation of numbers and symbols. The study of mathematics in secondary schools includes coursework in the following instructional programs:[13]

- General Mathematics (1, 2, and other)
- Algebra (1, 2, and 3)
- Geometry
- Advanced and Pure Mathematics (e.g., calculus, trigonometry, and analytic geometry)
- Advanced Placement Calculus
- Statistics, Applied Mathematics, and Actuarial Science

2.2 Science

Science was defined as the organized knowledge that is gained through systematic empirical methods. The sciences listed in the CSSC were divided into two general categories: (1) life sciences and (2) physical sciences. Within these two categories, courses were grouped according to the general structure of the CSSC 4-digit subject areas codes as follows:[14].

- General Biology
- College Preparatory Biology
- Other Life Sciences (e.g., botany, biochemistry, and microbiology)

13/ On the advice of the panel members, certain mathematics offerings were not included in the analyses. They included vocational (i.e., business mathematics, agricultural mathematics) and computer mathematics courses. These offerings are instead included under the vocational education and computer science subject areas.

14/ The panel decided to exclude general science offerings. The reasons for this decision were threefold: (1) the interdisciplinary nature of courses of this type; (2) the differences in content and format of such courses across schools, and (3) the fact that general science is offered as an eighth grade course in many schools.

- General Physical Sciences
- Other Physical Sciences (e.g., astronomy and atmospheric science)
- Chemistry
- Geological Sciences
- Physics

2.3 Vocational Education

"Vocational Education means organized educational programs which are directly related to the preparation of individuals for paid or unpaid employment in occupations . . . . requiring other than a baccalaurate or advanced degree."[15]

In the secondary school setting, vocational education includes coursework in the following nine areas:

- Agriculture
- Business[16]
- Marketing
- Health
- Industrial Arts
- Technologies
- Trade and Industry
- Consumer Home Economics
- Occupational Home Economics

15/ 34 Combined Federal Regulations, Part 400.

16/ Due to the critical importance of computer studies, certain business and technology offerings (e.g., business data processing and computer applications) were considered under the heading of computer studies rather than vocational education.

2.4 Computer Science

Out of an appreciation that computer science is becoming increasingly separated into its own curriculum area, it was decided to treat it separately from mathematics, science, and vocational education in the analysis. A program development specialist from a nearby public school suggested guidelines for the analysis of offerings and enrollments in computer science.

The study of computers has been tied to two different disciplines: computer science has become associated with the discipline of mathematics, whereas data processing has allied itself with business. A new third curriculum area is computer literacy. Current literature tends to include computer literacy under the subject heading of computer science.

The study of computers in U.S. secondary schools includes coursework in the following areas:

- Computer Science Languages and Programming
- Business Data Processing Applications.

CHAPTER 3

OFFERINGS AND ENROLLMENTS IN MATHEMATICS, SCIENCE, VOCATIONAL EDUCATION, AND COMPUTER SCIENCE: OVERVIEW

This chapter presents a general overview of our research findings. The findings are structured to address the following questions:

- What mathematics, science, vocational education, and computer science courses are offered in U.S. secondary schools? Which courses are offered most and least frequently?
- What percentage of total high school course offerings are mathematics, science, vocational education, and computer science course offerings?
- What is the enrollment in mathematics, science, vocational education, and computer science? Which courses have the highest and lowest enrollments?
- What percentage of total high school course enrollments are mathematics, science, vocational education, and computer science course enrollments?

3.1 Course Offerings

The vast majority of secondary schools in the United States offered one or more courses in mathematics, science, and vocational education during the 1981-82 school year (see Table 1). In addition, over one-half of these schools offered at least one course in computer science during this period. A total of 19,700 schools (99.8 percent of the U.S. total) offered course-work in mathematics. The corresponding numbers for science, vocational education, and computer science were 19,500 (98.9 percent), 19,500 (98.8 percent), and 10,900 (55.3 percent), respectively.

Table 1: Number of U.S. Secondary Schools Offering Courses in Mathematics, Science, Vocational Education and Computer Science Instructional Programs, Total Enrollment in Each Program, and their Percent of U.S. Totals: 1981-82

(U.S. Total Secondary Schools = 19,725; U.S. Total Grade 12 Enrollment = 3,268,000)

Instructional Program	Secondary Schools Offering Courses in this Program		Program Enrollment	
	N[a]	As Percent of U.S. Total	N[b] (Thousands)	As Percent of U.S. Total
Mathematics	19,700	99.8	3,198	98.0
General Mathematics 1	16,700	84.8	1,347	41.3
General Mathematics 2	13,200	67.1	848	26.0
General Mathematics, Other	2,500	12.6	123	3.8
Algebra 1	18,200	92.1	1,929	59.1
Algebra 2	16,500	83.4	989	30.3
Algebra 3	9,500	48.4	392	12.0
Geometry	18,100	91.5	1,558	47.7
Advanced and Pure Mathematics	13,700	69.3	546	16.7
Calculus, Advanced Placement	2,400	12.0	53	1.6
Statistics, Applied Mathematics and Actuarial Science	2,400	12.3	43	1.3
Science	19,500	98.9	2,967	90.9
Biology, General	19,200	97.5	2,425	74.3
Biology, College Preparatory	10,500	53.2	420	12.9
Life Sciences, Other	4,500	22.9	188	5.8
Physical Sciences, General	11,400	57.8	1,033	31.6
Physical Sciences, Other	2,400	12.2	96	2.9
Chemistry	17,600	89.2	1,057	32.4
Geological Sciences	6,700	33.9	464	14.2
Physics	16,200	82.4	498	15.3
Vocational Education	19,500	98.8	3,144	96.3
Agriculture	10,200	51.9	318	9.7
Business	19,100	96.8	2,537	77.7
Marketing	8,700	44.0	304	9.3
Health	5,600	28.2	115	3.5
Industrial Arts	14,800	75.1	904	27.7
Technologies	2,100	10.5	75	2.3
Trade and Industry	15,600	79.2	1,370	42.0
Consumer Home Economics	17,600	89.3	1,672	51.2
Occupational Home Economics	11,500	58.2	680	20.8
Computer Science	10,900	55.3	435	13.3
Computer Science Languages and Programming	9,300	47.0	323	9.9
Business Data Processing Applications	4,500	23.0	131	4.0

a/ Schools rounded to the nearest hundred.

b/ Estimated number of students who took one or more courses in the specified instructional program over high school career.

The extent to which courses in the different instructional programs in mathematics, science, vocational education, and computer science were offered varied a great deal. The course classification system is described in Appendix E. The most commonly offered instructional programs, as evidenced by their presence in over 80 percent of the secondary schools across the nation, were:

Mathematics

- General Mathematics 1
- Algebra 1
- Algebra 2
- Geometry

Science

- General Biology
- Chemistry
- Physics

Vocational Education

- Business
- Consumer Home Economics.

Computer science courses were less widely available in U.S. secondary schools during the 1981-82 school year. Computer science languages and programming courses were offered at 47 percent of the schools and business data processing applications at 23 percent.

Instructional programs offered least frequently (i.e., by less than 15 percent of the nation's schools) included:

Mathematics

- Other General Mathematics
- Advanced Placement Calculus
- Statistics, Applied Mathematics, and Actuarial Science

Science

- Other Physical Sciences

Vocational Education

- Technologies.

3.2 Course Enrollments

In addition to providing information on the number and percent of schools offering courses in each of the mathematics, science, vocational education, and computer science instructional programs, Table 1 presents information on the number and percent of students who enrolled in courses in each of these programs over the course of their high school careers. This enrollment information applies only to secondary school students who were still enrolled in school in Spring 1982 or who had already graduated. Students who had left school between the HS&B Base Year Survey in 1980 and the First Follow-up Survey in 1982 were not included.

Overall, mathematics and vocational education courses had higher enrollments than did science and computer science courses. Over 95 percent of the secondary school students had enrolled in at least one mathematics course and at least one vocational education course at some point in their high school careers. Approximately 90 percent of the students had taken at least a single science course. In contrast, only about 13 percent had studied computer science.

As expected, there was a strong relationship between the availability of courses in the various instructional programs and program enrollments. Only two of the instructional programs, general biology and business, had student enrollments in excess of two million. Instructional programs with enrollments of one million or more included:

Mathematics

- General Mathematics 1
- Algebra 1
- Geometry

Science

- General Physical Sciences
- Chemistry

Vocational Education

- Trade and Industry
- Consumer Home Economics

Courses least frequently taken (i.e., those taken by less than five percent of the students) included other general mathematics; advanced placement calculus; statistics, applied mathematics, and actuarial science; other physical sciences; health; and technologies.

Student enrollments in the two computer science programs were relatively low. About 10 percent of the students had enrolled in computer science languages and programming, and another four percent had enrolled in business data processing applications. In conjunction with the findings pertaining to computer science offerings, these data indicate that as late as 1981-82, relatively few students had the opportunity to take computer science instruction and had actually been exposed to such instruction in a secondary school setting.

3.3 Cooperative Education Course Offerings and Enrollments

A central component of vocational education in U.S. secondary schools is cooperative education. Through participation in a cooperative education program, students gain paid on-the-job training which augments their classroom experiences.

Cooperative education courses were grouped under the vocational education instructional programs to which they are most closely aligned thoughout the analyses reported in this and subsequent chapters. However, given the importance of these courses, a separate analysis was performed to determine the number and percentage of schools that offered cooperative education courses and enrollments in these courses. A list of the cooperative education courses used for this analysis is found in Section E of the Technical Appendix.

By far, the most prevalent form of cooperative education was related to training in trade and industry. About 44 percent of secondary schools offered this form of cooperative work experience, and about 12 percent of secondary school students had enrolled. Business and marketing were the next most common areas of cooperative education. Nearly one-quarter of all schools offered cooperative education courses of these types and about three percent of all students had enrolled in each. Agriculture and occupational home economics cooperative education were offered by a smaller percentage of schools (7 percent and 4.5 percent, respectively) and enrolled significantly fewer students (.4 percent and .3 percent, respectively). Finally, cooperative education was not typically associated with vocational training in health; less than two percent of the schools offered this type of course and only about one student in every thousand was enrolled.

3.4 Total and Average Number of Courses Offered in U.S. Secondary Schools

Table 2 presents findings pertaining to the number of courses offered in 19,725 secondary schools throughout the U.S. during the 1981-82 school year.[17]

Vocational education courses were, by far, more pervasive than were courses in the other areas. Approximately 32 courses of this type were offered per school as compared with about nine in mathematics, nearly seven in science, and one in computer science. The larger number of vocational education

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17/ Because the length of high school courses varies by subject area and school, caution should be exercised when interpreting these findings and those reported in Table 3

Table 2: Total and Average Number of Course Offerings in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs in U.S. Secondary Schools: 1981-82

Instructional Program	Course Offerings	
	Total Courses Offered (Thousands)	Average Per School
Mathematics	169	8.5
General Mathematics 1	30	1.5
General Mathematics 2	23	1.2
General Mathematics, Other	3	.2
Algebra 1	21	1.1
Algebra 2	19	1.0
Algebra 3	13	.7
Geometry	23	1.2
Advanced and Pure Mathematics	29	1.5
Calculus, Advanced Placement	3	.1
Statistics, Applied Mathematics and Actuarial Science	3	.1
Science	133	6.7
Biology, General	33	1.7
Biology, College Preparatory	15	.8
Life Sciences, Other	7	.3
Physical Sciences, General	15	.7
Physical Sciences, Other	4	.2
Chemistry	29	1.5
Geological Sciences	9	.4
Physics	22	1.1
Vocational Education	625	31.7
Agriculture	43	2.2
Business	179	9.1
Marketing	22	1.1
Health	11	.6
Industrial Arts	45	2.3
Technologies	4	.2
Trade and Industry	172	8.7
Consumer Home Economics	118	6.0
Occupational Home Economics	32	1.6
Computer Science	21	1.0
Computer Science Languages and Programming	15	.7
Business Data Processing Applications	6	.3

offerings reflects the broader scope of secondary school training in this area. That is, agriculture and business encompass a wider range of topics than chemistry or algebra 1, for example.

Among the various instructional programs, the most extensive offerings (i.e., those that averaged 1.5 or above per school) were in general mathematics 1; advanced and pure mathematics; general biology; chemistry; agriculture; business; industrial arts; trade and industry; and consumer and occupational home economics.

Courses in the following instructional programs were not commonly offered: other general mathematics; advanced placement calculus; statistics, applied mathematics, and actuarial science; other life sciences; other physical sciences; geological sciences; technologies; and business data processing applications.

3.5 Mathematics, Science, Vocational Education, and Computer Science Course Offerings and Enrollments as a Percentage of Total High School Course Offerings and Enrollments

Table 3 presents the course offerings in mathematics, science, vocational education, and computer science as percentages of all courses offered by U.S. secondary schools during the 1981-82 school year. Table 4 presents the results of a similar analysis of course enrollments as percentages of all U.S. course enrollments.

Mathematics courses offered during the 1981-82 school year represented approximately eight percent of all the high school courses offered during that period, while science courses accounted for about seven percent and computer science courses accounted for one percent. Vocational education courses, on the other hand, represented nearly one-third of all high school offerings. This finding and those presented in Tables 1 and 2 highlight vocational education's position as a major component of secondary school education.

Table 3: Course Offerings in Mathematics, Science, Vocational Education, and Computer Science as a Percentage of Total High School Offerings: 1981-82

Program Category	Percentage of Total High School Offerings
Mathematics	8.3
Science	6.6
Vocational Education	30.9
Computer Science	1.0

Table 4: Student Enrollment In Mathematics, Science, Vocational Education, and Computer Science as a Percentage of the Total High School Course Enrollment: 1981-82

Program Category	Percentage of Total High School Course Enrollment
Mathematics	9.9
Science	7.3
Vocational Education	18.0
Computer Science	.5

Among the four subject areas under study, student enrollments in vocational education courses accounted for the largest share of the total high school course enrollment; 18 percent of the total enrollment in all high school courses was in vocational education. In contrast, about 10 percent of high school course enrollments were in mathematics and about seven percent in science. Computer science enrollments accounted for about one-half of one percent of the total course enrollment.

CHAPTER 4

OFFERINGS IN MATHEMATICS, SCIENCE, VOCATIONAL EDUCATION, AND COMPUTER SCIENCE AS RELATED TO SCHOOL CHARACTERISTICS

In order to understand the secondary school mathematics, science, vocational education, and computer science curricula, course offerings in the instructional programs of each subject area were further analyzed. The focus of this analysis was on identifying the characteristics of schools that offered more than the average number of courses in the various mathematics, science, vocational education, and computer science instructional programs. The characteristics of schools that offered greater than the national average number of courses in each instructional program were compared with characteristics of those schools that offered the national average number or fewer courses in that program.[18]

When the national average number of courses offered by schools is less than one, the classification of schools in the sample with respect to course offerings is simplified. In these cases, schools are classified as either offering one or more courses in an instructional program or as offering no courses of this type.[19]

All estimates presented in the tables that follow were derived from samples of schools and students. Consequently, they differ somewhat from the values that would have been obtained had a complete census of the populations of

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18/ The national average number of courses offered for any particular instructional program actually translates to the average number of distinct course titles offered by the schools. It does not represent the number of sections of a particular type of course since schools only reported offering a course; no data on the number of sections of a course were collected.

19/ When classifying schools prior to the analysis of course offerings by school characteristics, the actual weighted mean number of courses was used rather than the rounded mean reported in Table 2. Thus, in a few cases, schools that offered the number of courses reported as the mean in Table 2 are included in the classification of "greater than the national average number" of course offerings. This occurs with respect to algebra 2 and consumer home economics.

schools and students been conducted. Procedures for measuring the variability of the estimates reported in the tables are outlined in the Technical Appendix.

All of the differences described in this report, unless otherwise indicated, are at least two times the standard error of the difference and therefore are statistically significant.[20] It is recommended that the reader who is interested in other differences displayed in the tables calculate their standard error to reduce the likelihood of misinterpreting the findings.

4.1 School Type: Public, Catholic, and Other Private

It is generally assumed that the education provided by public and private schools is quite different in terms of the numbers and types of courses they provide. In order to examine these differences, HS&B schools were grouped into three categories: public, Catholic, and other private. The percentage of schools in each of these categories that offered greater than the national average number of courses in mathematics, science, vocational education, and computer science were then compared with one another (see Table 5).

Other private schools were, in general, less likely to offer mathematics, science, and vocational education courses than were public and Catholic schools.[21] As expected, the largest difference in course offerings as related to school type was for vocational education. Over one-half of the public schools as compared with nearly 17 percent of Catholic schools and 1.5 percent of other private schools offered at least 32 vocational education course titles.

20/ The method for approximating the standard errors of course offerings which is presented in the Technical Appendix was used to determine the significance of the estimates reported in Tables 5 through 16. The significance of the estimates reported in Tables 17 through 28 was based on the calculation of exact standard errors using the method of Balanced Repeated Replicates.

21/ Estimates for other private schools may be less accurate than those for other school types because of the small sample size and a low response rate.

Table 5: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Type of School: 1981-82

Instructional Program	Type of School		
	Public	Catholic	Other Private
N=	15,900[a]	1,500	2,400
Mathematics	42.2	51.6	17.8
General Mathematics 1	44.5	27.6	13.0
General Mathematics 2	32.0	32.0	6.7
General Mathematics, Other	14.0	8.4	5.7
Algebra 1	14.2	12.8	8.7
Algebra 2	85.1	83.0	72.8
Algebra 3	48.1	60.8	42.0
Geometry	19.7	37.9	9.4
Advanced and Pure Mathematics	41.4	57.5	27.8
Calculus, Advanced Placement	10.5	13.9	20.8
Statistics, Applied Mathematics and Actuarial Science	12.4	13.5	10.7
Science	41.3	48.5	27.3
Biology, General	47.5	51.2	30.2
Biology, College Preparatory	55.3	61.3	34.4
Life Sciences, Other	23.2	31.8	15.1
Physical Sciences, General	55.6	54.7	74.7
Physical Sciences, Other	11.9	10.4	16.8
Chemistry	39.5	46.2	22.5
Geological Sciences	34.3	37.0	28.7
Physics	20.0	19.9	16.6
Vocational Education	51.3	16.9	1.5
Agriculture	44.5	0.0	1.5
Business	49.3	36.5	2.1
Marketing	34.5	20.4	3.0
Health	33.1	19.1	1.5
Industrial Arts	52.0	1.1	1.5
Technologies	10.7	8.0	10.5
Trade and Industry	45.8	14.1	1.5
Consumer Home Economics	60.4	23.1	7.9
Occupational Home Economics	40.3	16.7	17.0
Computer Science	29.5	22.5	17.9
Computer Science Languages and Programming	48.9	55.7	28.5
Business Data Processing Applications	26.5	15.4	3.9

a/ Schools rounded to the nearest hundred.

With respect to mathematics instructional program offerings, Catholic schools were more likely to offer advanced level mathematics courses (algebra 3, geometry, and advanced and pure mathematics) and other private schools were more than twice as likely to offer advanced placement calculus. Public schools, on the other hand, were, on average, three times more likely to offer courses in the vocational education instructional programs than were Catholic schools. While few schools offered more than a single course in computer science, Catholic and public schools were more likely to offer computer science languages and programming; public schools were more prone to offer business data processing applications.

4.2 School Size, Region, and Urbanicity

School size, region, and urbanicity were examined to determine whether or not they had any bearing on the types and number of mathematics, science, vocational education, and computer science courses offered to students. Schools were grouped into one of three size categories based on their total enrollment: (1) less than 500 students, (2) between 500 and 1,499 students, and (3) 1,500 or more students. Schools were also classified into four regions--North, South, North Central, and West--and according to whether they were located in an urban, suburban, or rural setting.

As can be seen in Table 6, there is a strong association between school size and course offerings: as student enrollment increased, there was a corresponding increase in the number (and variety) of courses offered in mathematics, science, vocational education, and computer science.

In general, differences in course offerings were the most pronounced between the smallest schools (those with enrollments of less than 500 students) and mid-sized schools (those having between 500 and 1,499 students) than between mid-sized schools and larger schools (those with 1,500 students or more). Larger schools were most likely to offer a greater number and variety of course-taking opportunities in most instructional programs of interest. Exceptions to this pattern included algebra 1 and 2, statistics, applied mathematics, and actuarial science, other life sciences, general physical sciences, and agriculture.

Table 6: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by School Size: 1981-82

Instructional Program	School Size		
	Less than 500 Students	500 to 1,499 Students	1,500 or More Students
N =	9,000[a]	7,100	2,700
Mathematics	14.0	59.7	84.2
General Mathematics 1	20.5	52.7	74.7
General Mathematics 2	14.4	40.1	53.5
General Mathematics, Other	4.1	17.8	30.2
Algebra 1	5.3	20.3	25.6
Algebra 2	79.5	88.4	85.1
Algebra 3	39.9	54.7	62.8
Geometry	7.6	27.3	45.4
Advanced and Pure Mathematics	22.4	56.5	69.0
Calculus, Advanced Placement	4.8	16.8	25.9
Statistics, Applied Mathematics and Actuarial Science	5.1	18.3	25.2
Science	15.8	58.1	83.1
Biology, General	30.5	55.4	77.1
Biology, College Preparatory	34.2	68.6	83.3
Life Sciences, Other	12.2	31.3	39.9
Physical Sciences, General	37.7	56.8	60.9
Physical Sciences, Other	6.8	13.2	25.8
Chemistry	14.6	56.8	74.8
Geological Sciences	26.6	37.1	52.3
Physics	7.7	25.8	47.1
Vocational Education	14.7	63.9	90.2
Agriculture	33.6	39.7	34.3
Business	15.2	63.8	88.5
Marketing	10.7	40.1	71.6
Health	11.8	38.7	61.2
Industrial Arts	25.9	53.1	72.7
Technologies	4.1	11.7	30.9
Trade and Industry	11.2	57.2	86.7
Consumer Home Economics	32.8	66.3	79.4
Occupational Home Economics	18.1	45.9	73.5
Computer Science	12.8	54.7	83.4
Computer Science Languages and Programming	34.1	55.3	72.7
Business Data Processing Applications	9.0	30.0	55.9

a/ Schools rounded to the nearest hundred.

Interestingly, many of the findings pertaining to school size are similar to those relating course offerings to region (see Table 7). The course offerings of southern schools resemble those of smaller schools while the course offerings of northern schools are, in many cases, comparable to those of the larger schools.

Northern schools offered more of the advanced level mathematics and science courses than did schools in other regions. These schools also offered more general biology courses. Schools in the South offered the fewest courses in many of the vocational education instructional programs (business, industrial arts, trade and industry, and consumer home economics) and in computer science.

Since rural schools are, in general, smaller than those in an urban or suburban location, it is not surprising that the course offerings of these schools approximate those reported for the smaller schools. For example, rural schools offered fewer geometry, advanced and pure mathematics, general biology, chemistry, physics, marketing, trade and industry, and business data processing applications courses than did schools in other settings (see Table 8). As one would expect, rural schools offered more agriculture courses.

Suburban schools offered more statistics, applied mathematics, and actuarial science courses than either urban or rural schools. They also offered more geological sciences, business, occupational home economics, and computer science languages and programming courses.

4.3 Minimum Competency Test Graduation Requirement

Schools were classified according to whether or not they had a requirement that students pass a minimum competency test as a prerequisite for graduation. In Table 9, schools with and without this requirement are compared with respect to their mathematics, science, vocational education, and computer science offerings.

Table 7: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Region: 1981-82

Instructional Program	Region			
	North	South	North Central	West
N =	3,400[a]	6,900	6,100	3,200
Mathematics	68.3	30.3	37.1	36.6
General Mathematics 1	45.1	42.9	33.2	38.0
General Mathematics 2	44.2	29.6	22.3	24.3
General Mathematics, Other	20.3	8.8	9.9	17.7
Algebra 1	22.7	10.0	14.3	9.3
Algebra 2	85.9	87.2	79.1	81.0
Algebra 3	63.5	36.7	54.2	46.4
Geometry	34.4	7.4	24.6	22.1
Advanced and Pure Mathematics	64.6	34.0	33.5	45.6
Calculus, Advanced Placement	28.5	9.5	7.3	8.8
Statistics, Applied Mathematics and Actuarial Science	27.3	4.8	14.6	8.3
Science	68.9	26.8	35.5	47.5
Biology, General	63.5	32.1	53.7	41.0
Biology, College Preparatory	68.7	43.8	54.1	55.5
Life Sciences, Other	33.9	18.1	17.7	31.2
Physical Sciences, General	57.3	69.5	49.0	50.0
Physical Sciences, Other	23.3	6.7	8.2	20.3
Chemistry	65.1	26.0	38.3	34.5
Geological Sciences	66.9	27.3	23.1	33.5
Physics	39.9	9.3	18.3	22.5
Vocational Education	56.4	30.3	46.7	47.4
Agriculture	18.9	44.3	39.7	28.5
Business	66.2	30.4	42.5	44.6
Marketing	35.3	28.3	28.0	29.6
Health	39.8	24.1	28.8	24.0
Industrial Arts	57.5	24.1	55.0	39.6
Technologies	16.9	5.4	8.9	17.4
Trade and Industry	51.1	26.7	41.0	42.9
Consumer Home Economics	50.9	35.0	68.3	54.0
Occupational Home Economics	34.7	29.2	32.6	56.7
Computer Science	45.5	15.0	28.1	34.7
Computer Science Languages and Programming	70.6	23.3	56.1	55.5
Business Data Processing Applications	37.2	16.0	24.8	19.4

a/ Schools rounded to the nearest hundred.

Table 8: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Urbanicity of School: 1981-82

Instructional Program	Urbanicity		
	Urban	Suburban	Rural
N =	3,000[a]	7,000	9,700
Mathematics	51.8	56.9	24.2
General Mathematics 1	39.2	49.2	32.5
General Mathematics 2	32.3	30.9	26.5
General Mathematics, Other	18.7	15.3	8.7
Algebra 1	20.0	17.9	8.2
Algebra 2	77.8	84.0	84.8
Algebra 3	57.4	55.5	41.9
Geometry	21.8	32.9	9.9
Advanced and Pure Mathematics	41.6	59.8	27.4
Calculus, Advanced Placement	20.6	16.4	6.1
Statistics, Applied Mathematics and Actuarial Science	8.8	20.1	7.8
Science	46.8	58.3	25.1
Biology, General	53.7	59.4	33.4
Biology, College Preparatory	53.6	60.0	48.3
Life Sciences, Other	19.5	32.8	16.8
Physical Sciences, General	59.0	61.0	55.1
Physical Sciences, Other	10.4	21.6	6.1
Chemistry	43.4	52.7	25.8
Geological Sciences	31.1	43.6	27.7
Physics	27.1	28.6	10.8
Vocational Education	46.7	51.4	35.3
Agriculture	9.2	30.3	48.2
Business	45.5	52.9	34.5
Marketing	40.7	36.7	21.1
Health	30.3	34.6	23.0
Industrial Arts	33.4	48.3	40.3
Technologies	12.4	17.8	4.6
Trade and Industry	42.0	48.3	29.5
Consumer Home Economics	41.5	57.8	49.6
Occupational Home Economics	31.6	43.8	31.1
Computer Science	34.2	39.6	16.9
Computer Science Languages and Programming	44.0	63.0	36.4
Business Data Processing Applications	27.0	32.3	15.7

[a] Schools rounded to the nearest hundred.

Table 9: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by the Existence of a Graduation Requirement of Passing a Minimum Competency Test: 1981-82

Instructional Program	Minimum Competency Test Graduation Requirement	
	Not Required	Required
N =	15,200[a]	4,400
Mathematics	36.2	54.1
General Mathematics 1	35.9	52.7
General Mathematics 2	26.7	36.6
General Mathematics, Other	9.8	22.1
Algebra 1	12.4	16.9
Algebra 2	84.3	80.3
Algebra 3	44.6	61.3
Geometry	18.7	24.3
Advanced and Pure Mathematics	37.7	53.1
Calculus, Advanced Placement	10.3	18.3
Statistics, Applied Mathematics and Actuarial Science	12.8	10.9
Science	34.8	59.3
Biology, General	43.6	54.1
Biology, College Preparatory	50.5	62.5
Life Sciences, Other	20.1	32.6
Physical Sciences, General	59.9	50.9
Physical Sciences, Other	10.9	17.3
Chemistry	34.6	48.6
Geological Sciences	29.6	48.0
Physics	18.3	24.4
Vocational Education	36.7	64.5
Agriculture	37.4	30.9
Business	37.9	60.5
Marketing	25.4	43.9
Health	23.9	43.2
Industrial Arts	38.1	55.9
Technologies	8.6	16.5
Trade and Industry	31.0	62.7
Consumer Home Economics	49.6	56.8
Occupational Home Economics	29.4	58.1
Computer Science	23.4	42.4
Computer Science Languages and Programming	45.0	54.4
Business Data Processing Applications	18.9	37.2

[a] Schools rounded to the nearest hundred.

As the data indicate, there is a strong association between the presence of a minimum competency test graduation requirement and increased mathematics, science, vocational education, and computer science course offerings. That is, schools that required students to pass a minimum competency test as a prerequisite for graduation offered more courses in these subject areas.

Not surprisingly, schools that had such a requirement in effect offered more general mathematics (1, 2, and other) than did schools without this requirement. At the same time, these schools offered more advanced level courses such as algebra 3, advanced and pure mathematics, college preparatory biology, other life sciences, chemistry, and geological sciences. Likewise, vocational education offerings tended to increase in schools that had this requirement in place as is evidenced by the business, marketing, health, industrial arts, trade and industry, and occupational home economics offerings. Finally, business data processing applications programs were more available in schools that had this requirement in place. Thus, schools which required that students demonstrate certain competencies appear to have afforded students more opportunities to develop skills that will prepare them for postsecondary academic and non-academic pursuits.

4.4 Percent of Students in an Academic High School Program

Schools were categorized on the basis of the percentage of their students who were enrolled in an academic (i.e., college preparatory) high school program to determine whether or not participation in such a program had any influence on offerings in mathematics, science, vocational education, and computer science. Course offerings relative to this school characteristic are presented in Table 10.

Certain mathematics and science offerings tended to decrease when the percentage of students in an academic program fell below one-third of the student body. Fewer geometry, advanced and pure mathematics, chemistry, geological sciences, and physics courses were available when less than one-third of the students in a school were engaged in academic study. Offerings in general mathematics 1, on the other hand, experienced a decrease when more than two-thirds of the students were in an academic program while advanced placement calculus offerings were most extensive in these schools.

Table 10: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Students in an Academic High School Program: 1981-82

Instructional Program	Percent of Students in an Academic High School Program		
	0 - 33	34 - 66	67 or Greater
N=	8,600[a]	5,800	4,200
Mathematics	31.7	49.5	43.4
General Mathematics 1	39.2	46.5	26.0
General Mathematics 2	28.9	33.7	22.3
General Mathematics, Other	9.0	14.9	11.9
Algebra 1	10.7	18.5	9.1
Algebra 2	81.8	86.2	85.4
Algebra 3	42.3	53.3	52.3
Geometry	10.6	28.7	24.9
Advanced and Pure Mathematics	31.4	50.2	44.2
Calculus, Advanced Placement	6.2	11.9	24.2
Statistics, Applied Mathematics and Actuarial Science	9.1	14.9	15.3
Science	29.8	47.9	48.7
Biology, General	40.7	51.9	46.0
Biology, College Preparatory	44.8	62.0	56.2
Life Sciences, Other	16.3	27.7	28.6
Physical Sciences, General	55.7	58.5	67.8
Physical Sciences, Other	8.2	10.1	21.8
Chemistry	28.5	46.4	42.9
Geological Sciences	26.7	37.5	45.1
Physics	12.4	22.8	26.4
Vocational Education	41.5	58.4	22.8
Agriculture	46.5	40.0	11.1
Business	39.5	56.1	29.1
Marketing	27.9	35.9	23.9
Health	29.5	36.3	15.6
Industrial Arts	42.7	54.5	21.0
Technologies	6.3	13.2	15.2
Trade and Industry	37.0	50.9	19.7
Consumer Home Economics	51.3	67.3	27.8
Occupational Home Economics	32.3	41.7	27.8
Computer Science	23.3	32.9	20.7
Computer Science Languages and Programming	38.3	54.9	52.9
Business Data Processing Applications	25.3	26.7	14.0

a/ Schools rounded to the nearest hundred.

There was a decrease in the overall vocational education offerings when the percentage of students in an academic program increased above two-thirds. Not surprisingly, course offerings in virtually every vocational education instructional program decreased significantly when over two-thirds of the students were engaged in academic study (i.e., one third or fewer students in a school participated in a vocational or general education program). The exceptions to this pattern were marketing and technologies programs.

Computer science languages and programming offerings increased when the percentage of students enrolled in an academic program exceeded one-third of the student body. This pattern did not hold for course offerings in business data processing applications.

4.5 Percent of Graduates Expected to Enter College

Schools were also classified in terms of the percent of their graduates that were expected to enter college[22] to determine whether or not this characteristic was related to differential course offerings (see Table 11). It was expected that course offerings in the upper level mathematics, science, and computer science languages and programming courses would increase along with the percent of students who were expected to enter college. Moreover, it was anticipated that the course offerings patterns in schools with high and low percentages of students who were expected to enter college would resemble the patterns reported on the percent of students in an academic program.

In general, these expectations were borne out. Fewer algebra 1, geometry, advanced and pure mathematics, statistics, applied mathematics, and actuarial science, general and college preparatory biology, other life sciences, other physical sciences, chemistry, and computer science languages and programming courses were offered in schools where less than 26 percent of their students intended to continue on to college. However, contrary to expectations, course offerings in these programs were highest in those schools

22/ These percentages were actually estimates, made by the school administrator, of the percentage of the previous year's graduates who had gone on to college.

Table 11: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Graduates Expected to Enter College: 1981-82

Instructional Program	Percent of Graduates Expected to Enter College			
	0 - 25	26 - 50	51 - 75	76 - 100
N =	3,600[a]	8,200	4,400	3,300
Mathematics	23.3	40.8	55.0	36.7
General Mathematics 1	40.0	41.8	51.2	19.1
General Mathematics 2	27.2	30.0	38.4	15.8
General Mathematics, Other	14.4	11.8	14.8	9.5
Algebra 1	7.2	12.9	21.8	10.6
Algebra 2	79.3	82.6	84.8	87.8
Algebra 3	36.2	48.1	55.1	52.8
Geometry	7.2	19.0	29.1	24.1
Advanced and Pure Mathematics	33.2	38.7	53.7	38.4
Calculus, Advanced Placement	6.4	6.0	17.4	26.1
Statistics, Applied Mathematics and Actuarial Science	11.1	9.4	17.9	14.0
Science	18.9	39.7	57.2	41.4
Biology, General	26.0	46.6	61.4	45.8
Biology, College Preparatory	40.3	55.8	59.8	51.5
Life Sciences, Other	13.0	24.8	27.1	22.5
Physical Sciences, General	47.6	57.4	60.1	67.9
Physical Sciences, Other	4.4	9.6	19.0	18.5
Chemistry	22.2	37.0	50.3	39.0
Geological Sciences	25.8	33.5	35.3	40.0
Physics	13.1	17.6	25.0	25.2
Vocational Education	31.2	50.5	60.6	13.7
Agriculture	37.0	47.8	34.9	7.3
Business	31.5	48.3	59.6	20.0
Marketing	24.4	34.0	37.7	13.1
Health	22.4	33.0	37.3	10.7
Industrial Arts	34.8	55.4	50.0	7.1
Technologies	4.6	7.7	16.7	14.8
Trade and Industry	21.4	47.5	53.8	12.4
Consumer Home Economics	40.7	63.4	65.8	13.6
Occupational Home Economics	34.0	36.2	46.4	22.6
Computer Science	21.1	26.6	38.1	25.6
Computer Science Languages and Programming	28.0	51.0	58.0	44.5
Business Data Processing Applications	16.6	25.7	32.5	11.0

a/ Schools rounded to the nearest hundred

where between 51 and 75 percent of the graduating class were expected to enter college than in those schools where a higher percentage of students were college-bound. There is no apparent explanation for this pattern.

Not surprisingly, there were fewer vocational education courses offered in schools where the expected college-going rate exceeded 75 percent. Other than the technologies and occupational home economics instructional programs, these schools offered fewer vocational education courses than did schools where between 26 and 75 of their graduates were expected to enter college.

4.6 Availability of a Gifted-Talented Program

Schools that operated a gifted-talented program were compared with those that did not to determine whether or not they differed on offerings in mathematics, science, vocational education, and computer science.

As shown in Table 12, schools that had a gifted-talented program offered more courses in science, vocational education, and computer science than schools without a gifted-talented program. These schools offered more advanced level mathematics and science courses such as geometry, advanced and pure mathematics, advanced placement calculus, college preparatory biology, other physical sciences, chemistry, geological sciences, and physics. These schools also offered a greater number and variety of business, marketing, technologies, trade and industry, computer science languages and programming, and business data processing applications courses.

4.7 Student Body Characteristics

Several student body characteristics were examined as part of this analysis: percent black and percent Hispanic, percent from non-English speaking homes, and percent classified as disadvantaged. The impact, if any, of these student characteristics on course offerings in the subject areas of interest is presented in Tables 13 through 15.

Table 12: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by the Availability of a Gifted-Talented Program: 1981-82

Instructional Program	Gifted-Talented Program Availability	
	Not Available	Available
N =	8,600[a]	10,200
Mathematics	33.9	45.3
General Mathematics 1	38.2	42.3
General Mathematics 2	24.5	33.7
General Mathematics, Other	10.6	14.3
Algebra 1	11.8	15.2
Algebra 2	84.5	83.3
Algebra 3	45.2	51.0
Geometry	14.7	25.2
Advanced and Pure Mathematics	33.3	49.2
Calculus, Advanced Placement	7.0	15.3
Statistics, Applied Mathematics and Actuarial Science	12.4	13.0
Science	30.5	48.7
Biology, General	42.1	49.2
Biology, College Preparatory	47.3	59.0
Life Sciences, Other	18.6	27.7
Physical Sciences, General	59.4	57.3
Physical Sciences, Other	7.1	17.4
Chemistry	28.7	45.2
Geological Sciences	25.5	40.8
Physics	11.4	25.6
Vocational Education	37.5	48.9
Agriculture	42.0	30.9
Business	33.7	51.7
Marketing	21.4	36.9
Health	24.1	32.4
Industrial Arts	38.1	46.8
Technologies	6.1	14.4
Trade and Industry	27.6	47.8
Consumer Home Economics	47.9	56.2
Occupational Home Economics	31.0	41.5
Computer Science	18.3	35.0
Computer Science Languages and Programming	37.6	54.5
Business Data Processing Applications	16.2	29.6

a/ Schools rounded to the nearest hundred.

In general, there is no consistent pattern in the relationship between student body minority composition and schools' course offerings in mathematics, science, vocational education, and computer science (see Table 13). Nevertheless, for certain subject areas and instructional programs, students had a greater opportunity to avail themselves of a larger number and variety of courses when the percentage of minority students in attendence was between one and nine.

Course offerings in general mathematics (1, 2, and other) were higher when the percentage of black students in a school exceeded nine than when schools had no black students. Offerings in advanced level courses (i.e., geometry, advanced and pure mathematics, advanced placement calculus, and statistics, applied mathematics, and actuarial science) were higher when the percentage of black students was between one and nine than when the percentage of black students in a school was zero. When examining Hispanic student enrollment, a similar pattern was found with respect to the upper level mathematics course offerings.

While the percentage of schools with above the national average number of courses in science was lowest when schools had no black students, few relationships existed between the course offerings for specific science instructional programs and the percent of black students enrolled. Exceptions to this finding were chemistry and geological sciences. Fewer chemistry courses were offered by schools with no black students, and more geological sciences courses were offered when the percent of black students was between one and nine. For four of the eight science instructional programs (college preparatory biology, chemistry, geological sciences and physics), increased offerings were associated with schools having between one and nine percent Hispanic students.

In the area of vocational education, business, marketing, health, trade and industry, and occupational home economics course offerings were higher in those schools with a larger percentage of black students. Overall course offerings in vocational education were highest when the percentage of Hispanic students in a school was between one and nine. The same pattern was true with respect to business and trade and industry courses.

Table 13: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent Black and Percent Hispanic in the Student Body: 1981-82

Instructional Program	Percent Black			Percent Hispanic		
	0	1 - 9	10 or Greater	0	1 - 9	10 or Greater
N =	8,400[a]	6,100	4,300	11,200	5,300	2,400
Mathematics	27.2	48.6	53.0	32.4	56.5	38.7
General Mathematics 1	27.5	44.8	54.9	35.4	47.1	41.5
General Mathematics 2	19.9	32.7	51.5	27.0	32.9	28.4
General Mathematics, Other	8.8	10.1	19.5	9.5	17.7	11.3
Algebra 1	12.3	11.8	17.5	11.0	16.4	17.0
Algebra 2	81.6	84.7	86.2	83.3	87.0	78.6
Algebra 3	45.8	49.2	53.0	48.6	55.5	32.4
Geometry	10.9	31.1	20.7	15.0	31.0	16.0
Advanced and Pure Mathematics	31.6	40.9	47.9	33.3	56.6	45.4
Calculus, Advanced Placement	6.5	17.4	15.0	7.8	22.3	9.1
Statistics, Applied Mathematics and Actuarial Science	8.2	16.2	13.4	8.8	20.3	8.1
Science	36.8	53.8	47.4	31.6	50.5	38.4
Biology, General	42.1	52.8	43.6	37.1	60.5	55.6
Biology, College Preparatory	47.7	55.5	56.4	47.2	68.8	39.5
Life Sciences, Other	15.8	34.2	22.9	19.7	30.2	25.8
Physical Sciences, General	55.5	59.4	65.7	50.1	58.7	66.2
Physical Sciences, Other	7.2	18.8	11.7	7.8	18.8	16.9
Chemistry	25.1	48.8	46.5	31.1	53.8	30.7
Geological Sciences	25.8	45.4	35.8	32.9	45.2	21.1
Physics	13.4	26.1	21.2	14.6	29.3	18.4
Vocational Education	53.9	48.8	56.5	57.3	55.3	40.6
Agriculture	37.4	29.7	42.5	38.0	31.7	36.8
Business	55.3	47.3	52.2	50.6	54.7	39.5
Marketing	16.7	32.2	44.0	24.5	37.0	30.4
Health	21.7	29.6	38.2	26.2	33.1	27.9
Industrial Arts	42.7	48.2	48.3	41.6	47.3	27.3
Technologies	5.8	16.5	12.6	8.4	14.8	12.7
Trade and Industry	28.1	48.3	47.8	32.7	48.4	38.6
Consumer Home Economics	51.7	51.9	50.1	52.2	53.7	40.3
Occupational Home Economics	37.4	48.8	48.4	31.2	45.4	39.5
Computer Science	21.1	38.8	31.8	23.8	38.7	23.0
Computer Science Languages and Programming	40.7	59.8	48.6	40.7	66.4	38.5
Business Data Processing Applications	16.6	26.4	30.7	21.8	28.9	16.1

[a] Schools rounded to the nearest hundred.

Computer science languages and programming offerings were more likely to be found in schools where black student enrollment was between one and nine percent, while business data processing applications programs were more likely to be offered in schools with at least 10 percent of black students enrolled than in schools with no black students. Overall computer science course offerings were highest when the percent of Hispanics was between one and nine, as were computer science languages and programming course offerings.

As the data in Table 14 indicate, more mathematics, vocational education, and computer science courses were offered by schools with students from non-English speaking homes than by schools with no non-English speaking students. General mathematics 1, geometry, advanced and pure mathematics, advanced placement calculus, business, technologies, trade and industry, occupational home economics, and computer science languages and programming were all offered by a higher percentage of schools where there were students from non-English speaking homes. Finally, each of the science instructional programs was more likely to be offered in schools with students from non-English speaking homes, with the exceptions of general physical sciences and college preparatory biology.

As indicated in Table 15, mathematics, science, vocational education, and computer science instruction were more generally available when between one and 24 percent of students in a school were classified as disadvantaged than when schools had no disadvantaged students. Schools with one to nine percent disadvantaged students offered more algebra 1, advanced and pure mathematics, and statistics, applied mathematics, and actuarial science courses than did schools with no disadvantaged students. The advanced and pure mathematics and statistics, applied mathematics and actuarial science offerings of these former schools were also significantly higher than those of schools with 25 percent or greater disadvantaged students.

Four science instructional programs--general and college preparatory biology, chemistry, and physics--were offered less in schools with no disadvantaged students than they were in schools with one to 24 percent disadvantaged students. Schools with a disadvantaged population equal to or

Table 14: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Students from Non-English Speaking Homes: 1981-82

Instructional Program	Percent of Students from Non-English Speaking Homes	
	0	Greater Than 0
N =	10,300[a]	8,700
Mathematics	28.3	53.6
General Mathematics 1	34.6	45.5
General Mathematics 2	24.6	34.3
General Mathematics, Other	8.0	16.9
Algebra 1	10.7	15.8
Algebra 2	82.9	83.6
Algebra 3	44.9	52.6
Geometry	12.0	28.0
Advanced and Pure Mathematics	30.2	53.2
Calculus, Advanced Placement	6.7	18.1
Statistics, Applied Mathematics and Actuarial Science	9.0	16.1
Science	27.3	54.7
Biology, General	35.0	58.6
Biology, College Preparatory	48.5	58.9
Life Sciences, Other	14.3	33.6
Physical Sciences, General	54.1	64.1
Physical Sciences, Other	6.0	19.4
Chemistry	27.5	49.1
Geological Sciences	28.3	41.0
Physics	11.5	28.5
Vocational Education	36.1	50.7
Agriculture	38.9	32.1
Business	37.3	49.1
Marketing	26.2	34.0
Health	24.5	33.3
Industrial Arts	41.2	43.1
Technologies	5.9	16.0
Trade and Industry	31.2	46.0
Consumer Home Economics	49.3	53.5
Occupational Home Economics	27.4	43.9
Computer Science	21.0	35.7
Computer Science Languages and Programming	35.7	59.7
Business Data Processing Applications	19.4	27.7

[a] Schools rounded to the nearest hundred.

Table 15: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Students Disadvantaged: 1981-82

Instructional Program	Percent of Students Disadvantaged			
	0	1 - 9	10 - 24	25 or Greater
N =	5,000[a]	5,300	4,300	3,300
Mathematics	22.6	50.7	49.1	38.1
General Mathematics 1	28.7	42.0	44.8	44.4
General Mathematics 2	13.5	25.8	30.9	36.4
General Mathematics, Other	7.7	11.6	15.8	15.4
Algebra 1	5.0	20.9	13.7	11.4
Algebra 2	75.5	87.8	83.3	86.8
Algebra 3	42.0	49.8	53.8	50.6
Geometry	12.5	20.5	24.9	11.8
Advanced and Pure Mathematics	31.6	51.5	44.3	27.0
Calculus, Advanced Placement	10.7	15.3	14.4	6.7
Statistics, Applied Mathematics and Actuarial Science	13.4	14.3	14.1	7.1
Science	27.6	48.5	49.5	33.7
Biology, General	33.4	62.5	52.7	35.3
Biology, College Preparatory	41.9	63.5	64.5	38.6
Life Sciences, Other	18.6	24.0	31.8	19.9
Physical Sciences, General	59.2	62.8	52.7	56.6
Physical Sciences, Other	15.0	13.0	12.8	7.0
Chemistry	25.6	45.8	46.1	39.3
Geological Sciences	32.2	31.3	38.7	30.4
Physics	11.9	24.7	23.5	13.9
Vocational Education	17.1	53.9	50.3	40.2
Agriculture	11.1	41.0	48.3	44.8
Business	22.7	53.6	54.0	44.2
Marketing	17.9	33.4	37.0	31.1
Health	10.1	35.6	39.1	31.1
Industrial Arts	16.6	46.8	63.9	39.4
Technologies	0.5	12.6	13.9	7.2
Trade and Industry	15.8	49.3	50.6	39.4
Consumer Home Economics	27.0	69.2	69.6	36.8
Occupational Home Economics	29.2	42.8	39.1	35.6
Computer Science	10.9	39.6	30.5	19.8
Computer Science Languages and Programming	36.9	62.0	40.6	30.2
Business Data Processing Applications	12.8	38.2	28.3	19.3

[a] Schools rounded to the nearest hundred.

greater than 25 percent were less likely to offer more than the national average number of courses in general and college preparatory biology than were schools with no disadvantaged students.

For seven of the nine vocational education instructional programs, schools with no disadvantaged students offered fewer courses than did schools with some disadvantaged population. The exceptions were technologies and consumer home economics courses.

Computer science languages and programming courses were less likely to be found in schools with no disadvantaged students and in schools that reported having at least a 25 percent disadvantaged student population than in schools with one to nine percent disadvantaged students. Business data processing applications programs were more often available when the percent disadvantaged was in the one to 24 range than when schools had no disadvantaged students.

Percent of Students Who Dropped Out of School

Table 16 presents course offerings with respect to the student dropout rate. In general, it appears that schools with higher dropout rates offered a larger number of courses across all subject areas of interest. While this pattern held true for many of the mathematics, science, and computer science instructional program offerings, it was the most pronounced for vocational education.

Agriculture, business, marketing, health, industrial arts, trade and industry, and consumer and occupational home economics offerings were most generally available in schools that experienced a dropout rate of at least two percent. Schools with this dropout rate also offered more business data processing applications courses.

These findings suggest that schools confronted with higher rates of student attrition sought to curb this phenomenon by offering more opportunities to study subjects other than those associated with a college preparatory program. These schools offered more vocational training opportunities to prepare students for entry into the labor market.

Table 16: Percentage of Schools Offering Greater than the National Average Number of Courses in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Students Who Dropped Out of School: 1981-82

Instructional Program	Percent of Students Who Dropped Out of School		
	0-1	2-9	10 or More
N =	5,700[a]	7,600	5,700
Mathematics			
General Mathematics 1	26.9	45.7	44.5
General Mathematics 2	20.3	47.3	47.4
General Mathematics, Other	18.6	30.8	37.1
Algebra 1	5.6	11.5	18.6
Algebra 2	9.6	12.9	16.6
Algebra 3	77.5	84.7	89.2
Geometry	48.3	50.8	45.9
Advanced and Pure Mathematics	16.9	20.6	20.0
Calculus, Advanced Placement	36.8	42.4	42.2
Statistics, Applied Mathematics and Actuarial Science	15.6	10.4	10.5
	13.5	11.0	11.0
Science			
Biology, General	32.0	42.8	43.8
Biology, College Preparatory	36.2	48.8	52.6
Life Sciences, Other	41.9	59.4	56.4
Physical Sciences, General	23.6	23.3	22.5
Physical Sciences, Other	62.8	59.9	58.9
Chemistry	12.0	11.8	12.4
Geological Sciences	27.5	40.8	43.3
Physics	27.1	38.2	36.7
	16.8	21.3	10.8
Vocational Education			
Agriculture	16.9	31.8	36.7
Business	16.6	44.8	44.7
Marketing	20.8	49.2	55.8
Health	14.2	33.6	39.8
Industrial Arts	14.1	20.2	31.1
Technologies	16.8	54.6	50.1
Trade and Industry	10.8	12.1	9.3
Consumer Home Economics	14.8	45.3	51.5
Occupational Home Economics	24.5	66.7	57.2
	16.8	37.8	50.8
Computer Science	29.4	39.8	51.5
Computer Science Languages and Programming	25.6	36.8	42.4
Business Data Processing Applications	11.6	24.8	31.6

[a] Includes schools reporting no dropout numbers.

CHAPTER 5

ENROLLMENTS IN MATHEMATICS, SCIENCE, VOCATIONAL EDUCATION, AND COMPUTER SCIENCE AS RELATED TO SCHOOL CHARACTERISTICS

This chapter presents information on enrollments in mathematics, science, vocational education, and computer science as related to a number of school characteristics. Because information on school characteristics was available only for those students who had already graduated or who were still in their HS&B Base-Year school at the time of the First Follow-Up Survey, transfer students were excluded from the analyses reported in this chapter. In addition, dropouts were excluded. The enrollment data reported here are based on the HS&B transcript file and have been expanded to represent population values.

As was suggested in Chapter 1, the enrollment data presented in the following tables come from student transcripts and are not precisely comparable to "pure" enrollment data for a school year. Transcript data cover four years of study by each student. The two types of data (i.e., "pure" enrollment and transcript) are equivalent to the extent that the freshmen, sophomores, and juniors of 1981-82 took the same courses that year that the HS&B seniors had taken when they were freshmen, sophomores, and juniors.

Because course enrollments are necessarily tied to course offerings, many of the patterns described in this chapter are similar to those presented in Chapter 4.

5.1 School Type: Public, Catholic, and Other Private

Table 17 presents information on students attending public, Catholic, and other private schools who were enrolled in mathematics, science, vocational education, and computer science courses over the course of their high school careers.

Table 17: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Type of School: 1981-82

Instructional Program	Type of School		
	Public	Catholic	Other Private[a]
N =	2,604[b]	195	83
Mathematics	97.7	99.5	99.5
General Mathematics 1	42.9	21.6	21.7
General Mathematics 2	26.9	16.1	8.3
General Mathematics, Other	3.7	2.3	1.1
Algebra 1	56.5	77.8	76.7
Algebra 2	29.0	46.0	44.3
Algebra 3	11.4	25.2	19.6
Geometry	45.0	79.9	73.6
Advanced and Pure Mathematics	15.2	33.2	37.7
Calculus, Advanced Placement	1.6	1.4	8.7
Statistics, Applied Mathematics and Actuarial Science	1.2	2.8	3.3
Science	90.5	96.9	96.5
Biology, General	72.3	87.6	92.4
Biology, College Preparatory	13.2	14.0	15.5
Life Sciences, Other	5.4	8.3	6.0
Physical Sciences, General	30.3	35.6	44.6
Physical Sciences, Other	3.1	.6	3.6
Chemistry	31.1	53.8	47.3
Geological Sciences	14.9	8.5	14.9
Physics	15.0	23.3	26.2
Vocational Education	97.5	91.2	74.5
Agriculture	10.6	1.8	6.4
Business	78.6	83.1	57.9
Marketing	9.9	3.9	3.4
Health	3.8	2.4	.6
Industrial Arts	29.4	2.7	13.8
Technologies	2.4	1.7	5.1
Trade and Industry	44.3	20.4	19.1
Consumer Home Economics	52.7	39.1	24.7
Occupational Home Economics	22.0	5.9	20.3
Computer Science	13.6	15.7	8.4
Computer Science Languages and Programming	9.9	14.5	7.2
Business Data Processing Applications	4.3	1.2	1.3

a/ Estimates for other private schools may be less accurate than those for public or Catholic schools because of small sample sizes and a low response rate.

b/ Students in thousands.

There were significant differences in the enrollments of public, Catholic, and other private school students in eight of the 10 mathematics instructional programs. Public schools had a significantly higher enrollment in general mathematics 1 and 2 than did Catholic or other private schools. On the other hand, public schools enrolled substantially fewer students in many of the college preparatory courses (e.g., algebra 1, 2, and 3, geometry, and advanced and pure mathematics).

There were also significant differences in the overall percentage of public and private school students enrolled in science courses. Students in public schools were less likely to have enrolled in science courses such as general biology and physics. Catholic schools had a significantly higher enrollment in chemistry and general physical sciences than did public schools.

As reported in Chapter 4, private school students had fewer vocational education opportunities. Thus, as expected, students in these schools were less likely to have enrolled in one or more vocational education courses during their high school careers than were public school students. This pattern held true for marketing, industrial arts, trade and industry, and consumer home economics courses. In addition, Catholic schools had a lower enrollment in agriculture and occupational home economics courses in comparison with public schools, while other private schools had the lowest enrollment in business.

Although there were no significant differences in the overall computer science enrollments of public, Catholic, and other private school students, public schools had a higher enrollment in those courses with a vocational orientation. That is, these schools had higher enrollments in business data processing applications courses than did their private school counterparts.

5.2 School Size, Region, and Urbanicity

Information on enrollments by school size is presented in Table 18. Overall, there was no significant relationship between school size and the percentage of students taking mathematics or science courses. Nevertheless, school size was related to enrollments in a few mathematics and science

Table 18: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by School Size: 1981-82

Instructional Program	School Size		
	Less Than 500 Students	500 to 1,499 Students	1,500 or More Students
N =	449[a]	1,370	1,065
Mathematics	98.1	97.9	97.8
General Mathematics 1	36.2	39.6	44.3
General Mathematics 2	22.6	25.0	27.6
General Mathematics, Other	.7	3.1	5.2
Algebra 1	67.8	58.5	54.7
Algebra 2	34.2	31.3	28.1
Algebra 3	12.4	13.3	11.7
Geometry	45.3	48.9	48.5
Advanced and Pure Mathematics	16.1	17.6	16.8
Calculus, Advanced Placement	1.4	1.9	1.8
Statistics, Applied Mathematics and Actuarial Science	.3	1.5	1.7
Science	89.9	90.8	91.9
Biology, General	78.8	73.5	72.5
Biology, College Preparatory	10.5	13.9	14.3
Life Sciences, Other	3.5	5.9	6.2
Physical Sciences, General	38.3	31.5	27.4
Physical Sciences, Other	1.2	2.5	4.2
Chemistry	32.9	34.4	31.5
Geological Sciences	13.5	15.6	13.3
Physics	10.3	15.8	16.1
Vocational Education	96.4	97.0	96.9
Agriculture	17.3	9.9	6.8
Business	82.4	80.1	74.2
Marketing	4.5	10.0	10.4
Health	1.8	3.7	4.3
Industrial Arts	26.0	26.4	28.5
Technologies	1.7	2.1	3.0
Trade and Industry	27.3	42.1	47.8
Consumer Home Economics	59.7	91.2	48.7
Occupational Home Economics	19.6	17.5	25.8
Computer Science	8.3	13.3	16.1
Computer Science Languages and Programming	3.5	10.3	11.9
Business Data Processing Applications	.9	3.5	6.0

[a] Students in thousands.

programs. Increased school size was associated with a higher percentage of students taking courses in general mathematics 1 and other life sciences (i.e., a higher percentage of students in the largest schools took courses of these types as compared with students in the smallest schools). In contrast, algebra 1, general biology, and general physical sciences enrollments decreased as school size increased.

Overall vocational education enrollments increased with school size. There was, however, no consistent pattern in the individual vocational education instructional program enrollments as related to school size. Larger schools had higher enrollments in marketing, trade and industry, and occupational home economics courses while smaller schools had higher enrollments in agriculture, business, and consumer home economics.

With respect to computer science, school size was associated with the percentage of students taking both computer science languages and programming and business data processing applications courses. In both instances, enrollments were higher in larger schools.

Overall enrollments in science, vocational education, and computer science differed slightly by region of the country, but there were no significant differences with respect to the overall mathematics course enrollments (see Table 19). Schools in the North Central region had slightly lower science enrollments than did schools in the North and South. Vocational education enrollments were slightly lower in the North than in other parts of the country, and computer science enrollments were lower in the South and West.

Regional differences were evident with respect to specific mathematics and science instructional programs. Schools in the South had the lowest enrollments in algebra 3, geometry, and advanced and pure mathematics and the highest enrollments in algebra 2, general biology, and general physical sciences courses. Northern schools had relatively higher enrollments in advanced level science programs (i.e., college preparatory biology, chemistry, geological sciences, and physics).

Table 19: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Region: 1981-82

Mathematics, Science, Vocational Program	Region			
	North	South	North Central	West
N [1]	683[1]	899	859	463
Mathematics	96.1	98.9	97.2	97.3
General Mathematics 1	40.3	46.4	38.1	41.4
General Mathematics 2	29.3	30.8	28.3	28.9
General Mathematics, Other	6.2	2.6	3.7	3.8
Algebra 1	94.7	96.4	94.2	97.5
Algebra 2	54.9	54.6	51.1	53.5
Algebra 3	16.3	7.9	10.1	11.1
Geometry	50.6	42.1	42.5	48.4
Advanced and Pure Mathematics	24.5	12.1	16.6	16.5
Calculus, Advanced Placement	4.1	.9	.9	1.5
Statistics, Applied Mathematics and Actuarial Science	2.4	.8	1.1	.7
Science	91.3	92.5	91.3	89.6
Biology, General	71.4	70.6	70.3	73.8
Biology, College Preparatory	17.5	11.7	13.2	11.1
Life Sciences, Other	5.8	5.8	6.1	4.2
Physical Sciences, General	27.6	41.9	30.2	24.9
Physical Sciences, Other	3.5	3.6	2.2	2.4
Chemistry	45.1	52.1	41.1	44.4
Geological Sciences	14.7	18.8	15.6	12.4
Physics	13.4	16.3	14.0	14.1
Vocational Education	91.2	93.4	93.3	86.5
Agriculture	8.7	12.7	7.4	9.5
Business	72.4	77.8	74.5	76.7
Marketing	8.9	9.2	10.7	8.8
Health	5.6	5.3	2.8	3.6
Industrial Arts	29.0	19.2	31.8	31.6
Technologies	3.1	.7	3.3	2.8
Trade and Industry	30.1	34.2	28.5	34.2
Consumer Home Economics	50.8	51.8	49.1	57.4
Occupational Home Economics	6.9	10.2	10.8	47.9
Computer Science	11.3	9.8	10.3	11.9
Computer Science Languages and Programming	13.2	4.7	12.9	9.2
Business Data Processing Applications	4.7	4.4	3.5	3.9

[1] Numbers in thousands.

Schools in the South had low enrollments in industrial arts, technologies, and trade and industry courses compared with schools in other regions. Schools in the South, along with those in the West, had lower enrollments in computer science languages and programming courses. For business data processing applications courses, enrollments were lower in the West than in other regions of the country.

On the whole, there was little variation in student enrollments in mathematics, science, and vocational education among schools in urban, suburban, and rural areas (see Table [illegible]). Rural schools did, however, have lower computer science enrollments than did their urban and suburban counterparts.

Urban students were more likely to have enrolled in a general mathematics course. Students in suburban schools were more likely to have taken geometry, advanced and pure mathematics, and chemistry.

[illegible] enrollments in the individual vocational education instructional programs varied by school location. Not surprisingly, rural students were [illegible] twice as likely as nonrural students to have enrolled in an agriculture course. Furthermore, a higher percentage of rural students were enrolled in [illegible] consumer and homemaking courses. [illegible]

[illegible] single computer science [illegible] likely to have enrolled [illegible] more suburban [illegible] opportunities [illegible] enrolled in [illegible]

Table 30: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Urbanicity of School: 1981-82

Instructional Program	Urbanicity		
	Urban	Suburban	Rural
	1,000	1,405	882
Mathematics	93.9	93.0	97.0
General Mathematics 1	45.4	38.1	41.6
General Mathematics 2	27.4	25.3	24.8
General Mathematics, Other	5.6	4.9	1.7
Algebra 1	56.0	58.4	60.4
Algebra 2	28.5	31.9	30.0
Algebra 3	11.6	14.2	10.5
Geometry	44.9	53.5	42.3
Advanced and Pure Mathematics	14.3	21.1	12.6
Calculus, Advanced Placement	1.4	2.5	.9
Statistics, Applied Mathematics and Actuarial Science	1.4	1.8	.8
Science	91.6	91.7	89.9
Biology, General	75.4	75.4	73.8
Biology, College Preparatory	11.1	14.4	13.1
Life Sciences, Other	6.5	5.8	4.9
Physical Sciences, General	32.8	28.7	34.1
Physical Sciences, Other	4.8	3.8	2.1
Chemistry	29.2	36.2	30.7
Geological Sciences	13.6	15.8	14.2
Physics	16.6	17.7	13.8
Vocational Education	93.8	93.6	97.9
Agriculture	4.8	7.3	17.3
Business	73.6	77.4	82.7
Marketing	11.5	9.1	8.1
Health	4.1	3.4	3.7
Industrial Arts	27.4	29.5	29.5
Technologies	5.3	2.6	1.6
Trade and Industry	48.9	42.1	40.4
Consumer Home Economics	47.7	48.6	56.8
Occupational Home Economics	10.6	22.3	20.3
Computer Science	14.3	16.4	8.8
Computer Science Languages and Programming	3.3	12.6	7.8
Business Data Processing Applications	1.1	6.3	2.8

a/ Students in thousands.

Table [illegible] Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by the Existence of a Graduation Requirement of Passing a Minimum Competency Test: 1981-82

Instructional Program	Minimum Competency Test Graduation Requirement	
	Not Required	Required
	1982[a]	920
Mathematics	97.9	93.0
General Mathematics 1	57.6	47.2
General Mathematics 2	23.9	28.8
General Mathematics, Other	2.7	9.2
Algebra 1	91.6	92.4
Algebra 2	92.9	20.0
Algebra 3	11.9	13.7
Geometry	50.1	44.3
Advanced and Pure Mathematics	17.9	16.1
Calculus, Advanced Placement	1.6	2.1
Statistics, Applied Mathematics and Actuarial Science	1.3	1.9
Science	91.2	98.9
Biology, General	74.6	72.6
Biology, College Preparatory	14.1	11.9
Life Sciences, Other	5.7	5.7
Physical Sciences, General	33.5	35.1
Physical Sciences, Other	2.6	3.6
Chemistry	32.8	33.4
Geological Sciences	13.0	17.3
Physics	15.2	16.2
Vocational Education	99.2	95.0
Agriculture	11.6	7.7
Business	79.0	75.4
Marketing	0.6	10.6
Health	3.1	4.6
Industrial Arts	35.9	27.7
Technologies	2.4	2.4
Trade and Industry	39.6	43.0
Consumer Home Economics	58.0	45.9
Occupational Home Economics	10.6	25.6
Computer Science	15.5	14.1
Computer Science Languages and Programming	9.4	11.6
Business Data Processing	7.6	4.8

[a] Includes 11 States.

Table 22: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Students in an Academic High School Program: 1981-82

Instructional Program	Percent of Students in an Academic High School Program		
	0 - 33	34 - 66	67 or Greater
N =	1,061[a]	1,111	939
Mathematics	97.8	97.6	98.8
General Mathematics 1	46.8	39.3	32.8
General Mathematics 2	29.6	29.7	19.9
General Mathematics, Other	3.4	3.5	4.0
Algebra 1	56.5	58.0	61.7
Algebra 2	27.8	26.6	39.4
Algebra 3	8.3	12.9	19.4
Geometry	38.6	49.9	62.9
Advanced and Pure Mathematics	11.8	16.8	29.4
Calculus, Advanced Placement	.6	1.6	4.6
Statistics, Applied Mathematics and Actuarial Science	.7	1.3	2.7
Science	89.2	90.8	95.7
Biology, General	72.5	72.0	80.5
Biology, College Preparatory	11.0	14.5	16.2
Life Sciences, Other	5.0	6.3	7.0
Physical Sciences, General	21.7	20.7	32.4
Physical Sciences, Other	2.8	2.4	4.0
Chemistry	25.7	33.0	47.2
Geological Sciences	13.3	15.5	14.9
Physics	11.3	16.3	23.7
Vocational Education	97.0	97.6	1.2
Agriculture	13.2	9.4	4.9
Business	77.7	80.2	75.1
Marketing	9.3	10.5	7.5
Health	5.4	4.2	2.9
Industrial Arts	20.2	20.9	17.4
Technologies	1.3	3.1	3.1
Trade and Industry	35.3	42.3	32.0
Engineering and Science	30.1	35.5	37.5
Occupational Home Economics	21.7	18.0	16.4
Computer Science	11.8	15.6	17.6
Computer Science Languages			
Data Processing	4.0	5.9	15.4
Computer Data Processing Applications	1.1	3.5	2.8

[a] Weighted frequencies

courses. While overall mathematics enrollments were not related to academic program participation, enrollments in the various mathematics instructional programs were tied to this characteristic.

Schools with at least two-thirds of their students in an academic program had a higher percentage of students enrolled in upper level mathematics courses. On the other hand, schools with one-third or fewer of their students in an academic program had higher enrollments in lower level courses (general mathematics I and II).

Similarly, science enrollments were significantly higher in schools with at least two-thirds of their students in an academic curriculum. This pattern holds true for general biology, other life sciences, chemistry, and physics. Not surprisingly, college preparatory biology enrollments were significantly lower in schools with one-third or fewer students in an academic program.

In vocational education programs, there was a negative correlation between agriculture enrollments and the percentage of students participating in an academic program. Moreover, enrollments were lower in industrial arts, trade and industry, and consumer home economics courses when the percentage of students in an academic program exceeded two-thirds of the student body. Business enrollments were significantly higher in schools with between 34 and 66 percent of their students in an academic program as compared with schools characterized by higher academic program participation. These results seem to reflect the dual role that business plays in the secondary school curriculum of college preparatory and non-college preparatory students. Enrollments in occupational home economics courses were highest in those schools with one-third or fewer academic students.

Enrollments in computer science in general and in computer [illegible] and programming in particular were higher in schools where at least two-thirds of the students were enrolled in an academic program. There were no significant differences in the enrollments in business data processing [illegible] courses for schools with varying degrees of student participation in an academic program.

5.5 Percent of Graduates Expected to Enter College

The percentage of a school's students that were expected to enter college was related to the percentage of students who took at least a certain number of courses in mathematics, science, vocational education, and computer science and to a number of individual instructional programs in those subject areas (see Table 23).

As expected, when one-fourth or fewer students in a school were expected to attend college, enrollments were higher in lower level mathematics courses (general mathematics 1 and 2). Conversely, in schools where the college-going rate exceeded three-fourths of the student population, a significantly higher percentage of students studied college preparatory mathematics and science courses. Higher enrollments were found in algebra 1, 2, and 3, geometry, advanced and pure mathematics, statistics, applied mathematics and actuarial science, advanced placement calculus, general physics, chemistry, and physics when over 75 percent of the student body was expected to continue on to college.

Because a primary function of vocational education is to prepare the college bound student for the world of work, it was anticipated that student participation in this area would be lower in schools where the percentage of college bound students was high. The findings reported in Table 23 support this notion. Enrollments in a number of courses declined as the percentage of students who were expected to enter college increased to 76 percent and above. This pattern was evident for business, industrial arts, trade and industry, and consumer and occupational home economics course enrollments.

Enrollments in computer science languages and programming were significantly higher when more than 75 percent of the student body was college-bound. The percentage of students enrolled in one or more business data processing applications courses did not vary by the percentage of the student body that was college bound.

Table 23: Percentage of Students Who Had Enrolled in Courses in the Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Graduates Expected to Enter College: 1981-82

Instructional Program	Percent of Graduates Expected to Enter College[a]			
	0 - 25	26 - 50	51 - 75	76 - 100
N =	360[b]	1,368	915	321
Mathematics	97.8	97.4	98.1	99.6
General Mathematics 1	59.6	45.6	36.8	30.4
General Mathematics 2	35.6	25.2	25.1	19.9
General Mathematics, Other	3.7	2.8	3.8	5.3
Algebra 1	58.0	57.2	59.6	66.1
Algebra 2	23.5	27.5	33.3	42.5
Algebra 3	6.8	11.5	12.6	25.8
Geometry	39.2	44.1	52.3	60.8
Advanced and Pure Mathematics	11.2	15.8	19.1	30.7
Calculus, Advanced Placement	.6	.4	2.6	9.9
Statistics, Applied Mathematics and Actuarial Science	.4	1.0	1.9	3.8
Science	88.3	89.4	92.3	96.6
Biology, General	75.9	71.8	73.2	82.0
Biology, College Preparatory	8.8	12.9	14.4	16.4
Life Sciences, Other	5.2	5.4	5.8	8.3
Physical Sciences, General	30.8	31.6	30.2	29.8
Physical Sciences, Other	2.4	2.3	3.3	4.8
Chemistry	21.8	29.5	35.8	55.1
Geological Sciences	13.5	15.3	16.2	14.5
Physics	11.1	13.7	16.4	20.1
Vocational Education	97.3	97.8	98.6	98.3
Agriculture	13.5	12.2	6.9	3.6
Business	79.4	79.3	86.9	75.3
Marketing	3.3	10.1	9.7	6.5
Health	4.3	5.1	6.3	5.3
Industrial Arts	37.5	35.7	25.9	12.7
Technologies	2.1	2.8	3.5	4.5
Trade and Industry	47.2	47.3	38.5	32.2
Consumer Home Economics	92.2	94.5	89.3	85.4
Occupational Home Economics	21.5	21.7	18.6	14.4
Computer Science	8.3	11.9	19.8	19.8
Computer Science Languages and Programming	2.7	8.2	11.5	14.3
Business Data Processing Applications	1.4	3.1	6.7	5.5

[a] These percentages were estimates made by a school with respect to the 1981-82 graduating class.

[b] Students in thousands.

5.6 Availability of a Gifted-Talented Program

As can be seen in Table 24, there was not a strong relationship between the overall enrollments in mathematics, science, and vocational education and the availability of a gifted-talented program; there was, however, a pattern of slightly higher enrollments in computer science courses in schools with such a program. No difference between these two classifications of schools were evident with respect to individual mathematics and science courses. In regard to vocational education, on the other hand, small differences were detected in agriculture, business, and consumer home economics course enrollments, all of which were higher in schools that did not have a gifted-talented program. While courses in each of the computer science instructional programs were more likely to be available in schools with a gifted-talented program, enrollments were higher only in business data processing applications courses.

5.7 Student Body Characteristics

In general, no consistent pattern emerged in mathematics, science, vocational education, and computer science enrollments with respect to the student body minority composition of schools. Enrollments in the various instructional programs of these subjects by the percent of black and Hispanic students in a school are presented in Table 25.

Schools with 10 percent or more black students had higher enrollments in general mathematics 1 and 2. These same schools had a lower percentage of students enrolled in algebra 1, geometry, advanced and pure mathematics, and algebra 3.

Few significant differences were detected with respect to science course enrollments as they pertain to the percentage of black students in attendance. The exceptions were chemistry and physics; enrollments in these instructional programs were lower in schools with the highest percentage of black students enrolled.

Schools with no black students had the highest enrollments in business, industrial arts, and consumer home economics courses.

Table 24: Percentage of Students Who Had Enrolled In Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by the Availability of a Gifted-Talented Program: 1981-82

Instructional Program	Gifted-Talented Program Availability	
	Not Available	Available
N =	959[a]	1,838
Mathematics	97.7	98.0
General Mathematics 1	39.2	41.7
General Mathematics 2	24.3	26.4
General Mathematics, Other	2.9	3.8
Algebra 1	60.2	57.6
Algebra 2	31.4	30.2
Algebra 3	12.0	12.6
Geometry	47.9	48.5
Advanced and Pure Mathematics	15.7	17.6
Calculus, Advanced Placement	1.3	2.0
Statistics, Applied Mathematics and Actuarial Science	1.1	1.6
Science	91.0	91.2
Biology, General	74.9	73.3
Biology, College Preparatory	13.8	13.3
Life Sciences, Other	4.7	6.1
Physical Sciences, General	33.2	30.2
Physical Sciences, Other	2.0	3.5
Chemistry	32.4	33.7
Geological Sciences	14.1	14.8
Physics	14.2	16.9
Vocational Education	97.0	96.3
Agriculture	12.7	8.4
Business	81.3	77.2
Marketing	8.3	9.6
Health	3.0	4.0
Industrial Arts	28.8	26.6
Technologies	2.8	2.2
Trade and Industry	41.5	42.3
Consumer Home Economics	54.3	49.6
Occupational Home Economics	20.8	20.9
Computer Science	11.0	15.1
Computer Science Languages and Programming	9.0	10.9
Business Data Processing Applications	2.3	4.9

a/ Students in thousands.

Table 25: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent Black and Percent Hispanic in the Student Body: 1981-82

Instructional Program	Percent Black			Percent Hispanic		
	0	1 - 9	10 or Greater	0	1 - 9	10 or Greater
N =	814[a]	1,033	910	1,308	1,069	384
Mathematics	97.2	98.2	98.3	98.0	98.0	97.9
General Mathematics 1	36.4	36.5	49.9	42.1	37.8	45.2
General Mathematics 2	21.9	23.3	31.5	26.0	24.6	26.3
General Mathematics, Other	2.1	3.3	4.8	2.3	4.6	4.1
Algebra 1	61.2	59.8	54.8	58.3	58.7	59.6
Algebra 2	29.2	33.0	29.2	31.7	31.4	25.5
Algebra 3	12.2	14.6	10.7	11.2	15.2	10.0
Geometry	48.3	53.6	42.8	46.1	53.0	44.7
Advanced and Pure Mathematics	16.1	21.7	13.1	15.6	20.2	15.1
Calculus, Advanced Placement	1.7	2.1	1.5	1.4	2.5	1.2
Statistics, Applied Mathematics and Actuarial Science	1.1	1.8	1.2	.8	2.2	1.2
Science	90.3	90.9	92.2	90.7	92.1	91.2
Biology, General	73.1	72.8	75.4	73.8	73.3	75.8
Biology, College Preparatory	13.8	14.0	12.0	13.6	14.4	9.8
Life Sciences, Other	4.4	6.9	5.6	5.5	5.9	6.3
Physical Sciences, General	29.6	29.9	33.9	31.8	29.0	35.4
Physical Sciences, Other	1.5	3.7	3.1	1.7	4.2	3.5
Chemistry	33.2	35.4	29.7	33.7	34.5	27.2
Geological Sciences	15.3	16.3	12.3	15.5	16.7	7.6
Physics	17.4	17.3	12.6	15.4	17.3	13.2
Vocational Education	97.4	95.2	97.0	96.8	96.0	96.3
Agriculture	12.3	8.9	9.1	11.5	8.7	7.4
Business	83.9	76.9	75.4	80.9	76.7	74.7
Marketing	8.8	9.0	10.6	9.2	9.9	8.9
Health	4.1	2.9	4.0	3.8	3.1	4.0
Industrial Arts	31.9	26.9	23.5	27.9	26.5	28.1
Technologies	2.7	2.5	2.0	2.1	2.5	3.5
Trade and Industry	42.5	42.9	40.1	39.2	43.6	45.8
Consumer Home Economics	56.1	49.3	48.2	52.6	49.2	50.0
Occupational Home Economics	23.1	20.8	19.2	15.9	23.8	29.4
Computer Science	12.5	15.5	12.7	12.2	16.2	11.8
Computer Science Languages and Programming	10.1	12.4	7.8	9.1	12.0	8.8
Business Data Processing Applications	2.6	3.8	5.5	3.5	4.8	3.7

a/ Students in thousands.

Table 26: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Students from Non-English Speaking Homes: 1981-82

Instructional Program	Percent of Students from Non-English Speaking Homes	
	0	Greater Than 0
N =	1,181[a]	1,596
Mathematics	97.9	98.0
General Mathematics 1	41.6	40.7
General Mathematics 2	25.4	26.0
General Mathematics, Other	2.3	4.5
Algebra 1	57.8	58.7
Algebra 2	30.7	30.5
Algebra 3	11.5	13.3
Geometry	45.3	49.8
Advanced and Pure Mathematics	14.2	19.1
Calculus, Advanced Placement	1.3	2.1
Statistics, Applied Mathematics and Actuarial Science	1.0	1.6
Science	89.7	92.2
Biology, General	74.0	74.3
Biology, College Preparatory	14.0	12.7
Life Sciences, Other	4.2	6.8
Physical Sciences, General	30.9	31.3
Physical Sciences, Other	1.7	3.8
Chemistry	31.1	34.3
Geological Sciences	14.9	14.1
Physics	13.4	17.6
Vocational Education	97.8	95.4
Agriculture	12.1	8.3
Business	81.9	75.7
Marketing	9.1	9.7
Health	3.1	4.1
Industrial Arts	28.1	26.3
Technologies	1.6	2.8
Trade and Industry	39.9	43.4
Consumer Home Economics	54.5	48.0
Occupational Home Economics	16.9	23.4
Computer Science	11.8	14.6
Computer Science Languages and Programming	8.8	10.9
Business Data Processing Applications	3.4	4.4

a/ Students in thousands.

Overall, computer science enrollments were higher when the percent of black students was in the one to nine range. The same held true for computer science languages and programming courses. Enrollments in business data processing applications courses were higher in schools with 10 percent or more black students in attendance than in schools with no black students. These findings are consistent with those reported in Table 13, linking this student body characteristic to course offerings.

Schools with between one and nine percent Hispanic students had lower enrollments in general mathematics 1. These same schools had higher enrollments in algebra 3, geometry, and advanced and pure mathematics. Algebra 2 enrollments decreased when the percent of Hispanic students exceeded nine.

When the percent Hispanic students was 10 or greater, science enrollments were lower in college preparatory biology, chemistry, geological sciences, and physics.

Schools with no Hispanic students had a higher percentage of students enrolled in agriculture and business courses but a lower percentage enrolled in trade and industry and occupational home economics courses.

Overall computer science enrollments were slightly higher in schools with one to nine percent Hispanic students than in other schools. The same pattern held true for computer science languages and programming courses. No significant differences were detected with respect to enrollment in business data processing applications programs.

By and large, enrollments were not related to the percentage of students from non-English speaking homes (see Table 26). However, enrollments in advanced and pure mathematics, statistics, applied mathematics, and actuarial science, physics, occupational home economics, and overall computer science were higher when there were at least some students from non-English speaking homes in attendance. The reverse pattern held for agriculture, business, and consumer home economics.

Table 27: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Students Disadvantaged: 1981-82

Instructional Program	Percent of Students Disadvantaged			
	0	1 - 9	10 - 24	25 or Greater
N =	384[a]	969	776	521
Mathematics	98.5	98.0	98.1	97.9
General Mathematics 1	32.1	39.2	37.9	55.4
General Mathematics 2	19.9	25.0	24.9	31.3
General Mathematics, Other	2.5	3.3	4.0	4.3
Algebra 1	65.1	56.7	59.8	53.8
Algebra 2	34.1	32.0	30.1	26.8
Algebra 3	18.8	14.3	11.0	7.9
Geometry	60.0	53.4	47.7	34.4
Advanced and Pure Mathematics	23.2	19.7	16.4	9.7
Calculus, Advanced Placement	3.8	2.0	1.5	.2
Statistics, Applied Mathematics and Actuarial Science	2.0	1.3	1.4	1.2
Science	92.9	90.8	91.9	90.3
Biology, General	78.4	75.9	70.7	74.1
Biology, College Preparatory	14.7	11.6	16.2	10.3
Life Sciences, Other	5.2	6.1	6.1	5.3
Physical Sciences, General	37.4	30.2	29.0	32.8
Physical Sciences, Other	2.8	3.1	3.0	3.0
Chemistry	39.1	35.9	31.1	26.8
Geological Sciences	12.6	14.5	17.1	14.7
Physics	20.3	16.7	15.4	11.3
Vocational Education	94.1	96.0	97.0	97.8
Agriculture	6.0	10.0	10.3	10.9
Business	79.7	78.8	78.3	77.2
Marketing	8.4	9.3	9.9	9.6
Health	1.8	3.1	4.8	3.8
Industrial Arts	20.5	27.6	30.5	27.0
Technologies	2.8	2.1	2.9	1.8
Trade and Industry	33.9	44.0	42.7	43.0
Consumer Home Economics	49.4	51.9	50.5	52.1
Occupational Home Economics	21.1	22.0	19.3	20.6
Computer Science	13.9	16.2	12.2	10.6
Computer Science Languages and Programming	11.5	12.5	8.7	6.5
Business Data Processing Applications	2.7	4.4	3.9	4.8

a/ Students in thousands.

On the whole, there were no consistent patterns in enrollments in mathematics, science, vocational education, and computer science with respect to the percentage of the student body classified as disadvantaged (see Table 27).

There was, however, a tendency for enrollments in general mathematics 1 to be higher when the percentage of disadvantaged students in a school exceeded 25 percent. Enrollments in certain college preparatory courses (i.e., algebra 1, 2, and 3, geometry, and advanced and pure mathematics), on the other hand, were higher in schools with no disadvantaged students as compared with schools with a disadvantaged population of 25 percent or greater.

A similar pattern held for college preparatory science courses. Enrollments in general biology, chemistry, and physics tended to be highest in schools with no disadvantaged students. It is interesting that these same schools offered fewer courses of these types. General biology enrollments were lowest in schools with 10 to 24 percent of the students classified as disadvantaged whereas chemistry and physics enrollments were lowest when 25 percent or more of the student body was disadvantaged. College preparatory biology and geological sciences enrollments were highest in schools having between 10 and 24 percent of their students classified as disadvantaged.

In vocational education, enrollments in agriculture, industrial arts, and trade and industry were lowest when no students in a school were disadvantaged. Enrollments in health courses were lower in schools with no disadvantaged students as compared with schools with 10 to 24 percent disadvantaged.

A higher percentage of students attending schools where one to nine percent of the student body was classified as disadvantaged took one or more courses in computer sciences as compared with students in schools where 10 percent or more were disadvantaged. This pattern held for computer science languages and programming enrollments.

Table 28: Percentage of Students Who Had Enrolled in Mathematics, Science, Vocational Education, and Computer Science Instructional Programs, by Percent of Students Who Dropped Out of School: 1981-82

Instructional Program	Percent of Students Who Dropped Out of School		
	0 - 1	2 - 9	10 or More
N =	457[a]	1,286	1,044
Mathematics	99.2	97.4	98.1
General Mathematics 1	29.6	39.0	47.6
General Mathematics 2	19.2	26.1	27.7
General Mathematics, Other	2.5	3.3	3.9
Algebra 1	68.1	58.3	55.2
Algebra 2	42.5	29.2	27.2
Algebra 3	18.9	12.8	9.4
Geometry	64.9	48.5	41.0
Advanced and Pure Mathematics	27.8	16.5	13.4
Calculus, Advanced Placement	4.1	1.3	1.2
Statistics, Applied Mathematics and Actuarial Science	2.4	1.1	1.3
Science	95.5	91.2	89.4
Biology, General	81.8	72.4	72.7
Biology, College Preparatory	14.4	14.4	11.7
Life Sciences, Other	7.9	5.1	5.6
Physical Sciences, General	37.0	28.7	31.5
Physical Sciences, Other	2.8	2.7	3.3
Chemistry	46.8	34.4	25.7
Geological Sciences	13.1	16.4	12.6
Physics	21.2	17.5	11.3
Vocational Education	91.1	97.6	97.2
Agriculture	7.2	10.3	10.8
Business	78.2	80.6	75.8
Marketing	6.5	9.2	10.6
Health	2.7	3.2	4.5
Industrial Arts	15.1	29.3	30.0
Technologies	2.7	3.3	1.3
Trade and Industry	28.2	43.5	45.2
Consumer Home Economics	45.3	53.7	50.3
Occupational Home Economics	15.0	21.2	22.5
Computer Science	14.1	14.3	12.4
Computer Science Languages and Programming	12.3	10.6	8.3
Business Data Processing Applications	2.3	4.2	4.7

a/ Students in thousands.

5.8 Percent of Students Who Dropped Out of School

Table 28 presents findings pertaining to the student dropout rate and enrollments in each of the subject areas under investigation. The percentage of students that dropped out of school was not linked to the percentage of students who took at least one course in mathematics. However, it was tied to enrollments in a number of mathematics instructional programs. In schools where the dropout rate was under two percent, a significantly higher percentage of students were enrolled in algebra 1, 2, and 3, geometry, advanced and pure mathematics, and advanced placement calculus courses. On the other hand, enrollments were lower in general mathematics 1 and 2 in these schools.

With respect to science enrollments, a significantly higher percentage of students studied general biology, chemistry, and physics in schools where the dropout rate was under two percent.

Because schools with a higher dropout rate offered more vocational education courses, it was expected that there would a positive association between the dropout rate and vocational education enrollments. This expectation was met with respect to several instructional programs in this area. A substantially higher percentage of students who attended schools where the dropout rate was two percent or more enrolled in marketing, industrial arts, trade and industry, and consumer and occupational home economics courses.

There was no relationship between the dropout rate and overall computer science course enrollments; however, a higher percentage of students attending schools with a dropout rate under two percent enrolled in computer science languages and programming courses than did students in schools with the highest dropout rates. The reverse was true for business data processing applications courses.

A. SOURCES OF THE DATA

Data for the analysis of secondary school course offerings and enrollments in mathematics, science, vocational education, and computer science came from the High School and Beyond (HS&B) Study sponsored by NCES. Two components of the First Follow-up Survey provided data on 1981-82 course offerings and enrollments. The offerings and enrollments component provided data on secondary school mathematics, science, vocational education, and computer science offerings, while the 1982 HS&B transcripts collection provided data which were used to estimate enrollments in these subject areas. The data on the characteristics of secondary schools used in the analyses represented the responses to the school questionnaires administered during the HS&B Base Year and First Follow-up surveys.

All of the HS&B samples were designed to provide national estimates. The sample designs of these surveys are described in the following sections.[1]

1/ More detailed information on the sample designs of the HS&B surveys as well as information on their data collection procedures and other survey features is provided in:

C. Jones, S. Knight, H. McWilliams, M. Butz, I. Crawford, and B. Stephenson, High School and Beyond Course Offerings and Course Enrollments Survey (1982): Data File User's Manual. Chicago, Illinois: National Opinion Research Center, 1983.

C. Jones, S. Knight, M. Butz, I. Crawford, and B. Stephenson, High School and Beyond Transcripts Survey (1982): Data File User's Manual. Chicago, Illinois: National Opinion Research Center, 1983.

C. Jones, M. Clarke, H. McWilliams, I. Crawford, B. Stephenson, and R. Tourangeau, High School and Beyond 1980 Sophomore Cohort First Follow-Up (1982): Data File User's Manual. National Center for Education Statistics (NCES 83-214), 1983.

C. Jones, M. Frankel, R. Tourangeau, H. McWilliams, F. O'Brien, High School and Beyond First Follow-up Sample Design Report, Chicago, Illinois: National Opinion Research Center, 1983.

A.1 High School and Beyond Sample Designs

A.1.1 Base Year Survey Sample Design

Base year data for the HS&B study were collected in 1980. A highly stratified, two-stage probability sample was used to select over 58,000 high school students (over 28,000 seniors and over 30,000 sophomores) from over 1,000 public and private secondary schools. Over 1,000 schools were selected during the first stage of the design with a probability proportional to the estimated enrollment in their 10th and 12th grades.[2] During the second stage of sampling, 36 seniors and 36 sophomores were selected in each school, except in those schools with fewer than 36 seniors or 36 sophomores. In the latter schools, all eligible students were drawn in the sample. This report utilizes only data from the sophomore cohort members.

A.1.2 First Follow-up Survey Sample Design

The HS&B First Follow-up Survey sample design retained the essential features of the 1980 Base Year design. That is, it was a multi-stage, stratified, probability sample with schools selected during the first stage of sampling and students selected during stage two. Listed below are the important features of the 1982 First Follow-up sample design:

- All schools selected as part of the Base Year Survey were contacted for participation in the First Follow-Up Survey unless they had no 1980 sophomores, had closed, or had merged with other schools in the Base Year sample.

- 1980 sophomores still enrolled in their 1980 schools were retained with certainty, resulting in approximately 30,000 1980 sophomores being included in the sample.

2/ This selection criterion was not used uniformly across all strata in the sample design. In certain sample strata (e.g., schools with large minority enrollments), study requirements resulted in an oversampling of schools. For more information on the Base Year Survey sample design, see M. Frankel, L. Luane, D. Buonanno, and R. Tourangeau, Sample Design Report, Chicago, Illinois: National Opinion Research Center, 1981.

- 1980 sophomore cohort students who were no longer attending their Base Year schools (e.g., dropouts, early graduates, and those who had transferred as individuals to a new school) were subsampled.

A.1.3 Course Offerings and Course Enrollments Survey Sample Design

Secondary school course offerings and enrollments data were collected from those schools selected as the first-stage sampling units in the Base Year Survey in which 1980 sophomores were still enrolled during the 1981-82 academic year. Of the more than 1,000 schools included in the Base Year Survey, 975 schools had a 10th and/or 12th grade in 1980 and were in continuous existence through the 1981-82 academic year (i.e., they had not closed or merged with other schools since the 1980 survey). School administrators at the 975 schools were asked to provide information on the courses offered at their schools during the academic year and the enrollments in these courses.

A.1.4 Transcripts Survey Sample Design

The sample for the HS&B Transcripts Survey was selected from among the 1980 sophomores who were eligible for the First Follow-Up Survey. Prior to selecting the sample, 1980 sophomores were stratified according to a number of student and school-level characteristics. The strata were partitioned into one of two major groups with different student selection probabilities: one contained policy-relevant subgroups (e.g., students from private schools, base year nonrespondents, high achievement blacks, and high achievement Hispanics), and the other contained all of the remaining sophomore subgroupings (e.g., other blacks, other Hispanics, and all other students).

All students in the policy-relevant subgroups were selected with certainty, resulting in 12,987 students being included in the survey sample. An additional 5,440 sophomores were selected from the remaining subgroups, with a selection probability equal to approximately .32. A total of 18,427 members of the 1980 sophomore cohort were selected for participation in the HS&B Transcripts Survey.

B. OFFERINGS AND ENROLLMENTS SURVEY NONRESPONSE AND NONRESPONSE ADJUSTMENTS

Lists of courses offered in the 1981-82 school year were supplied by 941 (97 percent) of the schools selected for participation in the HS&B Offerings and Enrollments Survey.

Data on course enrollments were received from only 762 (78 percent) of the eligible schools. In addition, 97 percent of these schools reported incomplete enrollment values for the courses they offered during the school year. Roughly one-third of the schools reported enrollment data for 80 to 90 percent of the courses they reported offering, and another one-third of the schools reported enrollment data for between 0 and 59 percent of their courses. Only 63 (4 percent) of the 1,516 unique course titles that were reported as being offered by one or more schools provided complete enrollment data. Approximately 72 percent of the courses identified by schools had between 40 and 100 percent missing enrollment data.

An adjustment for nonresponse to the request for course offerings data was incorporated into the 1981-82 estimates of course offerings. This was accomplished by adjusting the case weights for the responding schools. Case weights were multiplied by the ratio of the sum of the weights for all sampled schools to the sum of the weights for the responding schools.[3]

The nonresponse rate associated with the school-reported enrollments data undoubtedly would lead to biased estimates if these data were used in the analysis. To prevent this, it was decided to use student transcript data to estimate course enrollments. The approaches to using these data and their impact on the study are elaborated upon in Section C of this appendix.

The level of nonresponse to the HS&B Transcripts Survey closely resembled the level of nonresponse to the Offerings and Enrollments Survey's request for course offerings data. Ninety-one percent of the schools responded to the request for student transcripts. Schools provided 15,941 (88 percent) of the 18,152 transcripts requested.

3/ This adjustment was equal to 19,725.6/18,806.2. Thus, all estimates of the number of schools offering courses were inflated by a factor of 1.04889.

The case weights for the transcripts data were adjusted to take into account differential rates of response for a number of school types and student statuses. The average nonresponse adjustment factor was 1.13.[4]

C. ESTIMATION PROCEDURES

The goals of the analysis were to identify: (1) the mathematics, science, vocational education, and computer science courses offered in U.S. secondary schools, (2) the enrollment levels in these courses, and (3) the characteristics of schools that relate to mathematics, science, vocational education, and computer science course offerings and course enrollments.

Since the goals of the study were directed toward understanding course offerings and course enrollments in U.S. secondary schools, estimates were expanded to represent all or some portion of the national population of schools and students. The procedures used to produce the estimates found in the study tables are described below.

C.1 Estimates of Course Offerings

All estimates of the number of courses offered by secondary schools, the average number of courses offered, and the number and percentage of schools that offered courses were based on data supplied by the schools responding to the HS&B Course Offerings and Course Enrollments Survey. These estimates represent the entire population of 19,726 secondary schools. To account for the absence of offerings data from 34 of the 975 schools surveyed, all estimates of course offerings were adjusted by a factor of 1.04889. This factor represented the ratio of the sum of the sampling weights of the 975 sampled schools to the sum of the sampling weights of the 941 responding schools.

The number of schools that offered instruction in a mathematics, science, vocational education, or computer science program area was computed by taking the weighted sum of the schools reporting that a course (or courses)

4/ For more information on this adjustment see High School and Beyond Transcripts Survey (1982): Data File User's Manual, pp. 12-17.

listed in the program area was offered during the 1981-82 school year. Since instructional programs represented aggregations of individual courses, each school was counted only once for each instructional program listed in the tables. Thus, the number and percentage of schools that offered instruction in a specific program, unless otherwise noted, translates into the number and percentage of schools that offered one or more of the courses represented by the program area.

The analysis of secondary school course offerings as related to selected school characteristics compares the characteristics of schools offering greater than the national average number of courses in an instructional program with the characteristics of schools with other levels of course offerings. The national average for each instructional program was calculated by enumerating the total number of courses offered by each school in the sample and computing a weighted average for all schools. Schools were then divided into one of two groups depending upon whether the number of courses they offered was above the weighted average value or equal to or below the weighted average value.

C.2 Estimates of Course Enrollments

As noted in Section B above, 1981-82 course enrollment data were missing for a large percentage of the course titles reported by the sampled schools. Therefore, the decision was made to estimate course enrollments from data collected by the HS&B Transcripts Survey.

The decision to use HS&B Transcript Survey data in place of the school-reported enrollments altered the meaning of the course enrollment figures. Rather than indicating the number and percentage of secondary school students enrolled in the courses grouped to form the mathematics, science, vocational education, and computer science instructional programs during the 1981-82 school year, the estimates contained in the tables represent the number and percentage of 1982 seniors who enrolled in one or more courses in the instructional programs over their secondary school careers.

The use of the transcript data was restricted in certain ways for the different analyses that were performed. The overall estimates of instructional program enrollments (see Table 1) were based on the number of courses in the program areas that appeared on a student's transcript. All courses appearing on the transcript were counted toward measuring instructional program enrollments. Students who had taken courses in an instructional program were summed to estimate the enrollment for a program. Students who dropped out of school subsequent to the 1980 HS&B Base Year survey were deleted from this analysis. Thus, the estimates apply only to the subpopulation of students who had attended high school for four years.

The analysis of mathematics, science, vocational education, and computer science course enrollments as related to school characteristics (see Tables 17 through 28) required the elimination of transfer student data from the analysis. The decision not to use transfer student transcript data was a function of the information that was available on transfer students' schools and the assumptions that would need to be made if transfer student data were used. Since the estimates of instructional program enrollments were related to school characteristics, individual school attribute data were required. These data were not available from the transfer schools; thus, the only school data available for analysis were those reported by the original 975 HS&B schools. Therefore, if transfer student data were used it would have to be assumed that the characteristics (e.g., total student enrollment) of the schools that students transferred to were the same as the characteristics of the schools that they originally attended. It would also have to be assumed that transfer students had the same opportunity to take the same types of courses in each school. The validity of these assumptions was problematic for the analysis of the instructional program enrollments in specific types of schools.

D. STANDARD ERRORS

Each of the 1982 HS&B samples represent only one of many that could have been selected using the same sample design specifications. Estimates derived from these different samples would vary. Standard errors of the estimated totals and percentages measure the precision of these estimates,

i.e., the variation of all the estimates around the theoretical, complete-coverage values. The standard errors, together with the sample estimates, may be used to define confidence intervals, i.e., ranges that would include the comparable complete-coverage value for a specified percentage of all possible samples. For example, the complete-coverage value would be included in the range from two standard errors above to two standard errors below the estimate for about 95 percent of all possible samples.

No standard errors were reported for the estimates presented in the tables in Chapter 3 and 4. Methods for approximating the standard errors of the estimated totals and percentages presented in the tables are described in the following sections.

D.1 Standard Errors for 1981-82 Course Offerings Estimates

All of the estimates of the number and percentage of schools offering courses in the different instructional programs used school-reported data. The standard error (SE) of a percentage (p) estimated from a simple random sample (SRS) of n schools from the total population of secondary schools (N) is approximately:

$$SE_{(p)} = DEFT\sqrt{(1 - n/N)\ (p)\ (1-p)/n}$$

DEFT is a correction factor used to compensate for the effect of the school sample design. Since the schools in the 1982 HS&B study were selected using a disproportionate stratified sample design, simple random sampling formulas will underestimate the variance and standard errors of simple statistics such as percentages. For the school-based estimates reported in the tables, the DEFT correction factor is 1.75.

For example, with 941 schools supplying course offerings data, the standard error of the weighted percentage of schools offering algebra I courses in 1981-82 is:

$$SE_{(p)} = 1.75\ \sqrt{(1 - 941/19{,}726)(92.1)(7.9/941)} = 1.50 \text{ percent}$$

The standard error of the estimated number of schools offering a course is computed by multiplying the standard error of the estimated proportion (SE_p/100) by the number of schools in the population of U.S. secondary schools. There were 19,726 secondary schools in 1981-82.

Using the same example, the standard error of the number of schools offering one or more courses in algebra I in 1981-82 is 19,726 x 1.50/100 = 296 schools.

Equation 1 may also be used to approximate the standard errors of the estimated percentages or totals for the different subclasses of schools (e.g., public versus private schools or schools with different percentages of minority representation). The appropriate subclass n to use in these calculations are found in Table A.1. The population of the subclass (N) can be found in the findings tables in Chapters 4 and 5 of the report.

D.2 Standard Errors for Estimates Based on Student Data

Standard errors of the estimated number and percentage of 1982 seniors who enrolled in one or more courses in the mathematics, science, vocational education, and computer science instructional programs may be approximated using Equation 1.[5] Because different tables in the report are based on different subsamples of students, it is important that the appropriate sample sizes (n) be used in calculating these approximations of the standard errors.

Table 1 estimates of the number and percentage of 1982 seniors who took one or more courses in the instructional programs during their high school careers were based on the responses of 13,972 students who participated in the transcript survey and who had not dropped out of school since the HS&B Base Year Survey. Table 4 estimates were based on the responses of this same student subsample.

5/ Exact standard errors using the method of balanced repeat replications are available through NCES.

Estimates reported in Tables 17 through 28 were based on the responses of those students participating in the transcript survey who were still attending their original base year sampled school (or had graduated early). Thus, eliminated from these estimates are students who had dropped out of school or had transferred to another school. The subclass sample sizes (n) on which these estimates were based are reported in Table A.2.

As was the case with the standard errors of the school-based estimates, simple random formulas will underestimate the error associated with totals and percentages. To compensate for the effects of the sample design, all standard errors of estimates derived from the student data should be multiplied by a factor of 2.

Table A.1: Numbers of Schools in the Sample, for the Major Subclasses Used in the Course Offerings Tables

	n
Total Schools	941
Type of School	
Public	835
Private Catholic	75
Private Non-Catholic	31
Region	
North	199
South	293
North Central	263
West	186
Urbanization	
Urban	236
Suburban	446
Rural	259
Race/Ethnicity of Student Body Composition	
Black	
0 Percent Black	240
1-9 Percent Black	328
10 Percent Black or Greater	323
Hispanic	
0 Percent Hispanic	363
1-9 Percent Hispanic	317
10 Percent Hispanic or Greater	212
Percentage of Students from Non-English Speaking Homes	
0 Percent from Non-English Speaking Homes	337
1-100 Percent from Non-English Speaking Homes	562
Percentage of Graduating Class Going to College	
0-25 Percentage of Graduating Class Going to College	133
26-50 Percentage of Graduating Class Going to College	396
51-75 Percentage of Graduating Class Going to College	277
76-100 Percentage of Graduating Class Going to College	125

Schools (Continued)

Percentage of Spring 1980 Seniors in an Academic Program

0-33 Percent	353
34-66 Percent	324
67 Percent or Greater	187

Gifted - Talented Program

Not offered	293
Offered	609

Percentage of Disadvantaged Students

0 Percent	133
1-9 Percent	274
10-24 Percent	228
25 Percent or Greater	218

Total High School Membership

Less than 500 Students	154
500 to 1499 Students	413
1500 or More Students	374

Minimum Competency Test Required for Graduation

Not Required	580
Required	353

Percent of Students Who Drop Out of School

0-1 Percent	156
2-9 Percent	368
10 Percent of More	370

Table A.2: Numbers of Students in the Sample, for the Major Subclasses Used in the Course Enrollments Tables

	n
Total Students	13,972
Type of School	
Public	10,143
Private Catholic	2,154
Private Non-Catholic	734
Region	
North	3,106
South	3,892
North Central	3,592
West	2,441
Urbanization	
Urban	3,043
Suburban	6,624
Rural	3,364
Race/Ethnicity of Student Body Composition	
Black	
0 Percent Black	3,329
1-9 Percent Black	4,846
10 Percent Black or Greater	4,206
Hispanic	
0 Percent Hispanic	4,786
1-9 Percent Hispanic	4,545
10 Percent Hispanic or Greater	3,079
Percentage of Students from Non-English Speaking Homes	
0 Percent from Non-English Speaking Homes	4,404
1-100 Percent from Non-English Speaking Homes	8,049
Percentage of Graduating Class Going to College	
0-25 Percentage of Graduating Class Going to College	1,503
26-50 Percentage of Graduating Class Going to College	5,110
51-75 Percentage of Graduating Class Going to College	3,830
76-100 Percentage of Graduating Class Going to College	2,466

Schools (Continued)

Percentage of Spring 1980 Seniors In an Academic Program	
0-33 Percent	4,317
34-66 Percent	4,231
67 Percent or Greater	3,551
Gifted-Talented Program	
Not offered	4,232
Offered	8,299
Percentage of Disadvantaged Students	
0 Percent	2,342
1-9 Percent	3,881
10-24 Percent	2,954
25 Percent or Greater	2,761
Total High School Membership	
Less than 500 Students	2,382
500 to 1499 Students	6,061
1500 or More Students	4,588
Minimum Competency Test Required for Graduation	
Not Required	8,414
Required	4,536
Percent of Students Who Drop Out of School	
0-1 Percent	3,175
2-9 Percent	4,870
10 Percent or More	4,460

E. Classification of Courses

The subject areas -- mathematics, science, vocational education, and computer science -- were subdivided into instructional programs. The secondary school courses which constitued the the instructional programs were classified according to the codes for the Classification of Secondary School Courses (CSSC). The CSSC was originally developed for use in coding transcripts of students participating in the National Center for Education Statistics' longitudinal High School and Beyond study. This nationwide inventory of high school courses identifies each course with a six-digit numerical code. Each subject area and its subdivisions are listed. The appropriate CSSC codes and their titles follow.*

MATHEMATICS

General Mathematics 1

27.0105	Mathematics, Basic
27.0106	Mathematics 1, General
27.0402	Algebra 1, Part 1

General Mathematics 2

27.0107	Mathematics 2, General
27.0108	Science Mathematics
27.0109	Mathematics in the Arts
27.0110	Mathematics, Vocational
27.0111	Technical Mathematics
27.0114	Consumer Mathematics
27.0403	Algebra 1, Part 2

General Mathematics, Other

27.0100	Mathematics, Other General
27.0112	Mathematics Review
27.0113	Mathematics Tutoring

Algebra 1

27.0404	Algebra 1
27.0421	Mathematics 1, Unified

Algebra 2

27.0405	Algebra 2

*Each course is identified with a six-digit numerical code. Instructional programs are identified with a four-digit code or by the first four digits of a six-digit code.

Algebra 3

27.0410	Algebra 3
27.0414	Algebra and Trigonometry
27.0415	Algebra and Analytic Geometry
27.0423	Mathematics 3, Unified

Geometry

27.0406	Geometry, Plane
27.0408	Geometry
27.0409	Geometry, Informal
27.0422	Mathematics 2, Unified

Advanced and Pure Mathematics

27.0400	Pure Mathematics, Other
27.0407	Geometry, Solid
27.0411	Trigonometry
27.0412	Analytic Geometry
27.0413	Trigonometry and Solid Geometry
27.0416	Analysis, Introductory
27.0417	Linear Algebra
27.0418	Calculus and Analytic Geometry
27.0419	Calculus
27.0424	Mathematics, Independent Study

Statistics, Applied Mathematics and Actuarial Science

27.02	Actuarial Sciences
27.03	Applied Mathematics
27.05	Statistics

Calculus, Advanced Placement

27.0420	Calculus, Advanced Placement

SCIENCE

Biology, General

26.0121	Biology, Basic
26.0131	Biology, General
26.0151	Field Biology
26.0751	Physiology, Human
26.0752	Physiology, Advanced

Biology, College Preparatory

26.0141	Biology, College Preparatory
26.0142	Biology, Advanced
26.0161	Genetics
26.0171	Biopsychology
26.0181	Biology Seminar
26.0100	Biology, Other General

26.0711 Zoology
26.0721 Zoology, Vertebrate
26.0731 Zoology, Invertebrate
26.0741 Animal Behavior
26.0761 Pathology
26.0700 Zoology, Other

Life Sciences, Other

26.02 Biochemistry and Biophysics
26.03 Botany
26.04 Cell and Molecular Biology
26.05 Microbiology
26.06 Miscellaneous Specialized Areas, Life Sciences
26.99 Life Sciences, Other

Physical Sciences, General

40.01 Physical Sciences, General

Physical Sciences, Other

40.02 Astronomy
40.03 Astrophysics
40.04 Atmospheric Science and Meterology
40.07 Miscellaneous Physical Sciences
40.99 Physical Sciences, Other

Chemistry

40.0511 Chemistry, Introductory
40.0521 Chemistry 1
40.0522 Chemistry 2
40.0531 Organic Chemistry
40.0541 Physical Chemistry
40.0551 Consumer Chemistry
40.0561 Chemistry, Independent Study
40.0500 Chemistry, Other

Geological Sciences

40.06 Geological Sciences

Physics

40.0811 Physics, General
40.0821 Physics 1
40.0822 Physics 2
40.0831 Physics 2 Without Calculus
40.0841 Electricity and Electronics Science
40.0851 Acoustics
40.0800 Physics, Other
40.0911 Rocketry and Space Science
40.0900 Planetary Science, Other

VOCATIONAL EDUCATION

Agriculture

01.01	Agricultural Business and Management
01.02	Agricultural Mechanics
01.03	Agricultural Production (plus 01.0681)
01.04	Agricultural Products and Processing
01.05	Agricultural Services and Supplies
01.06	Horticulture (All except 01.0681) (plus 02.0421 - 02.0423)
01.07	International Agriculture
01.99	Agribusiness and Agriculture Production, Other
02.01	Agricultural Sciences, General
02.02	Animal Sciences
02.03	Food Sciences
02.04	Plant Sciences (All except 02.0421 - 02.0423)
02.05	Soil Sciences
03.01	Renewable Natural Resources, General
03.02	Conservation and Regulation
03.03	Fishing and Fisheries
03.04	Forestry Production and Processing
03.05	Forestry and Related Sciences
03.06	Wildlife Management
03.99	Renewable Natural Resources, Other

Business

06.01	Business and Management, General
06.02	Accounting
06.04	Business Administration and Management
06.05	Business Economics
06.06	Human Resources Development
06.09	International Business Management
06.11	Labor Industrial Relations
06.12	Management Information Systems
06.13	Management Science
06.15	Organizational Behavior
06.16	Personnel Management
06.18	Small Business Management and Ownership
06.19	Taxation
06.99	Business and Management, Other
07.01	Accounting, Bookkeeping, and Related Programs (All except 07.0161 and 07.0162)
07.02	Banking and Related Financial Programs (plus 06.03)
07.03	Business Data Processing and Related Programs (All except 07.0311, 07.0321, 07.0322, 07.0331, 07.0332)
07.04	Office Supervision and Management (All except 07.0411 and 07.0412)
07.05	Personnel and Training Programs
07.06	Secretarial and Related Programs (plus 07.0411 and 07.0412)
07.07	Typing, General Office, and Related Programs (plus 07.0161 and 07.0162)
07.99	Business and Office, Other

Marketing

06.07	Institutional Management
06.08	Insurance and Risk Management
06.14	Marketing Management and Research
06.17	Real Estate
08.01	Apparel and Accessories Marketing
08.02	Business and Personal Services Marketing
08.03	Entrepreneurship
08.04	Financial Services Marketing
08.05	Floristry, Farm and Garden Supplies Marketing
08.06	Food Marketing
08.07	General Marketing
08.08	Home and Office Products Marketing
08.09	Hospitality and Recreation Marketing
08.10	Insurance Marketing
08.11	Transportation and Travel Marketing
08.12	Vehicles and Petroleum Marketing
08.99	Marketing and Distribution, Other
09.02	Advertising

Health

17.01	Dental Services
17.02	Diagnostic and Treatment Services (All except 17.0211)
17.03	Medical Laboratory Technologies
17.04	Mental Health/Human Services
17.05	Miscellaneous Allied Health Services (All except 17.0561)
17.06	Nurse-Related Services (All except 17.0611)
17.07	Ophthalmic Services
17.08	Rehabilitation Services
17.99	Allied Health, Other

Industrial Arts

21.01	Industrial Arts (All except 21.0110, 21.0111, 21.0112, 21.0114, 21.0116 - 21.0118, 21.0120 - 21.0124)
47.0651	Consumer Auto
48.0511	Metal 1
48.0711	Woodworking 1

Technologies

10.01	Communication Technologies (All except 10.0111 - 10.0132)
11.0300	Data Processing, Other
11.04	Information Sciences and Systems
11.05	Systems Analysis
15.0400	Electromechanical Instrumentation and Maintenance Technologies, Other
15.0500	Environmental Control Technologies, Other
15.06	Industrial Production Technologies (All except 15.0611 and 16.0631)
15.0700	Quality Control and Safety Technologies, Other
15.0800	Mechanical and Related Technologies, Other
15.0900	Mining and Petroleum Technologies, Other

Trade and Industry

06.20	Trade and Industrial Supervision and Management
12.01	Drycleaning and Laundering Services
12.04	Personal Services
12.99	Consumer, Personal, and Miscellaneous Services, Other
43.01	Criminal Justice
43.02	Fire Protection
43.99	Protective Services, Other
46.01	Brickmasonry, Stonemasonry, and Tile Setting
46.02	Carpentry
46.03	Electrical and Power Transmission Installation (plus 47.0521)
46.04	Miscellaneous Construction Trades (All except 46.0441)
46.05	Plumbing, Pipefitting, and Steamfitting
46.99	Construction Trades, Other
47.01	Electrical and Electronics Equipment Repair (plus 15.03, 21.0114, 21.0116 - 21.0118, 21.0120)
47.02	Heating, Air Conditioning, and Refrigeration Mechanics (plus 15.0511)
47.03	Industrial Equipment Maintenance and Repair (All except 47.0321) (Plus 15.0911 and 15.0921)
47.04	Miscellaneous Mechanics and Repair (Plus 15.0411 and 15.0441)
47.06	Vehicle and Mobile Equipment Mechanics and Repair (All except 47.0651) (Plus 47.0321, 47.0511 - 47.0514)
47.99	Mechanics and Repairers, Other
48.01	Drafting (Plus 15.0211)
48.02	Graphic and Printing Communications (plus 10.0131 and 10.0132)
48.03	Leatherworking and Upholstering (All except 48.0311 and 48.0312)
48.04	Precision Food Production
48.05	Precision Metal Work (All except 48.0511) (plus 15.0611, 15.0711, 21.0121 - 21.0124)
48.06	Precision Work, Assorted Materials (plus 15.0631)
48.07	Woodworking (All except 48.0711)
48.99	Precision Production, Other
49.01	Air Transportation
49.02	Vehicle and Equipment Operation
49.03	Water Transportation
49.99	Transportation and Material Moving, Other
21.0110	Trade and Industry Cooperative
21.0111	Industrial Cooperative Work Experience
21.0112	Industrial Cooperative Work Experience, Advanced
32.0104	Work Experience
32.0105	Work Experience, Advanced
32.0106	Cooperative Education 1
32.0107	Cooperative Education 2

Consumer Home Economics

20.0113	Home Economics 1
20.0114	Home Economics 2
20.0115	Home Economics 3

20.0116	Home Economics 4
20.0118	Comprehensive Consumer and Homemaking Home Economics, Independent Study
20.0122	Child Development 1
20.0123	Child Development 2
20.0124	Child Development 3
20.0125	Child Development 4
20.0133	Clothing 1
20.0134	Clothing 2
20.0135	Clothing 3
20.0136	Clothing 4
20.0137	Tailoring
20.0141	Consumer Education 1
20.0142	Consumer Education 2
12.9900	Consumer, Personal, and Miscellaneous Services, Other
20.0151	Home Economics Occupations 1, Exploratory
20.0152	Home Economics Occupations 2, Exploratory
20.0161	Family Health 1
20.0162	Family Health 2
20.0117	Adults Roles and Functions
17.0211	First Aid
20.0171	Family Relations
20.0172	Marriage Society and Change
20.0173	Parenthood
20.0154	Home Economics Leadership
35.0111	Interpersonal Relationships
35.0121	Building Human Relationships
35.0100	Interpersonal Skills, Other
37.0111	Personal Development Techniques
37.0121	Coping with Personal Problems
37.0131	Self Perception
37.0100	Personal Awareness, Other
20.0183	Foods 1
20.0184	Foods 2
20.0185	Foods 3
20.0186	Foods 4
20.0187	International Foods
20.0188	Nutrition
19.0500	Food Sciences and Human Nutrition, Other
20.0191	Home Management 1
20.0192	Home Management 2
19.0400	Family/Consumer Resource Management, Other
46.0441	Home Maintenance and Repair
19.06	Human Environment and Housing
04.0511	Interior Design
04.0500	Interior Design, Other
20.0100	Consumer and Home Economics

Occupational Home Economics

20.0211	Child Care Services
20.0221	Child Care Aide
42.0711	Child Psychology

20.0231	Child Care Management
20.0241	Foster Care and Family Care
20.0251	Teacher Aide
20.0153	Home Economics Laboratory Assistant
33.0111	Student Assistant
20.0321	Clothing Maintenance Aide
12.0100	Dry Cleaning and Laundering Services, Other
12.0111	Dry Cleaning
20.0311	Clothing Occupations 1
20.0312	Clothing Occupations 2
20.0313	Clothing Occupations 3
20.0331	Commercial Garment and Apparel Construction
20.0391	Clothing Production Management
20.0341	Customer Apparel Construction
20.0351	Customer Tailoring and Alteration
20.0361	Wedding and Specialty Consulting
20.0371	Fashion and Fabric Coordination
20.0381	Textiles Testing
20.0300	Clothing, Apparel, and Textiles, Management, Production, and Services, Other
20.0411	Food Service Training 1
20.0412	Food Service Training 2
20.0421	Food Service Cooperative Training
20.0431	Baking
20.0441	Chef
20.0461	Dietetic Aide
20.0451	Catering
20.0471	Food Testing
20.0481	School Food Service
20.0511	Housing and Interior Design 1
20.0512	Housing and Interior Design 2
20.0513	Interior Design Occupations
20.0521	Floral Design
20.0541	Home Furnishings Aide
20.0551	Custom Drapery and Window Treatment Design
20.0561	Custom Slipcovering and Upholstering
20.0571	Home-Service Assisting
20.0611	Custodial Services
20.0621	Executive Housekeeping
20.0631	Homemaker's Aide
20.0661	Therapeutic Recreation Aide
20.0651	Consumer Aide
20.0641	Companion to the Aged

COOPERATIVE EDUCATION

The CSSC codes and course titles that were grouped to support the analysis of cooperative education summarized in Chapter 3 are listed below.

Agriculture

01.0171 Agriculture Cooperatives

Business

06.0141	Business Education, Cooperative
07.0741	Office Education 1, Cooperative
07.0742	Office Education 2, Cooperative

Marketing

08.0712	Distributive Education 2
08.0713	Distributive Education 3
08.0721	Distributive Education 1, Cooperative
08.0722	Distributive Education 2, Cooperative

Health

17.0121	Dental Assistant 2
17.0641	Nurse Aide, Cooperative

Trade and Industry

21.0109	Industrial Occupations 1
21.0110	Industrial Occupations 2
21.0111	Industrial Cooperative Work Experience
21.0112	Industrial Cooperative Work Experience, Advanced
32.0104	Work Experience
32.0105	Work Experience, Advanced
32.0106	Cooperative Education 1
32.0107	Cooperative Education 2
48.0151	Drafting 1, Cooperative
48.0152	Drafting 2, Cooperative
48.0213	Commercial Art, Cooperative
48.0223	Graphic Arts 3

Occupational Home Economics

20.0421	Food Service Cooperative Training

COMPUTER SCIENCE

Computer Science Languages and Programming

11.0111	Computer Appreciation
11.9900	Computer and Information Sciences, Other
11.0121	Computer Mathematics 1
11.0211	Computer Programming 1
11.0100	Computer and Information Sciences, Other General
11.0241	BASIC Introduction
11.0122	Computer Mathematics 2
11.0212	Computer Programming 2
11.0131	Computer Applications
11.0132	Computer Applications, Independent Study
11.0141	Computer Science, A.P.
11.0221	FORTRAN
11.0231	PASCAL
11.0200	Computer Programming, Other
11.0251	COBOL

Business Data Processing Applications

11.0311	Data Processing 1
07.0311	Computers in Business
07.0321	Business Data Processing 1
07.0331	Business Computer Programming 1
11.0312	Data Processing 2
11.0313	Data Processing Advanced
07.0322	Business Data Processing 2
07.0332	Business Computer Programming 2

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