OFFERINGS and ENROLLMENTS in SCIENCE and MATHEMATICS *in Public High Schools*

1958

by

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Foreword

THE SCIENTIST AND MATHEMATICIAN of tomorrow will come from the high school students of today. It is important to appraise this source of our future scientific manpower from time to time, both to note the trends and to judge the effectiveness of the efforts being made to bolster the defense, security and future welfare of the Nation through the improvement of science and mathematics courses in our public high schools.

Biennially, since 1954, the U.S. Office of Education has obtained information on the offerings and enrollments in science and mathematics in the public high schools of the United States. The first study was published as Pamphlet 118, and the second as Pamphlet 120. These studies were widely distributed. That they served to meet a definite need was attested by letters received from many users. It is hoped that the present study, which summarizes the offerings and enrollment data obtained for the school year 1958–59, will be a significant addition to the series.

The authors wish to give special acknowledgment to the excellent work of Mrs. Mary W. Dinota and Mrs. Edith McGuinn, Research Aides, in the preparation of this report.

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Offerings and Enrollments in Science and Mathematics in Public High Schools: 1958

Introduction

The last U.S. Office of Education publication on public high schools offerings and enrollments in science and mathematics reported data for 1956.[1] The 1958 data, used for the present report, show that during the intervening years the total enrollment in grades 9–12 of these schools increased from 7.3 million to around 7.8 million.

With the science frontier expanding at the accelerated pace by which new knowledge is being discovered, the demand for an increasing number of competent scientists and mathematicians creates a crucial problem of deep consequence to the national security. The degree to which this critical need can be met in the future is partially reflected in the extent to which present public high school pupils are studying the courses offered in science and mathematics.

On still another front, the impact of science and technology has a constantly increasing influence on the lives of average citizens who will not become scientists or mathematicians. They will, however, need to understand increasingly complex concepts in order to read intelligently the daily press and the periodicals, which constantly allude to new discoveries and applications of science. For another thing, automation is affecting labor in most industries. Thus, it seems almost imperative that more and more young people should be studying science and mathematics in order to provide the level of scientific literacy to be demanded of an informed citizenry.

The critical nature of these problems and their implications for the future well-being of the Nation have been recognized in many quarters. Professional organizations have prepared reports, the Congress has appropriated many millions of dollars, and industry and other sources have contributed liberally for the purposes of strengthening the offerings in high school science and mathematics and attracting young people to study in these areas, both for special and general education.

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[1] Brown, Kenneth E. and Ellsworth S. Obourn. *Offerings and Enrollments in Science and Mathematics in Public High Schools, 1956* (Pamphlet No. 120). U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1957. 44 pages.

New Programs

The financial support from the Congress and from industry and numerous foundations has made possible many new programs designed to alleviate the problems mentioned above. This Nation's future security may well be determened by the success of these programs in producing the scientists and the informed public needed in the years immediately ahead. Among the programs the following should be mentioned.

To improve teacher competence.—The Federal Government through grants to the National Science Foundation has been providing funds annually since 1957 to support a variety of programs intended to improve the competence of high school and college science and mathematics teachers. These programs are conducted as summer and academic-year institutes by colleges and universities scattered over the Nation. During the summer of 1959 there were 350 such institutes enrolling more than 18,000 teachers. In the school year 1959–60, there were 32 academic-year institutes. The National Science Foundation also supports a Fellowship Program for science and mathematics teachers as well as a variety of other inservice training programs.

To improve facilities, equipment, and teaching aids.—Title III of the National Defense Education Act[2] provides funds to local school systems through State departments of education for remodeling facilities on a minor scale and for purchasing equipment and modern teaching aids for both science and mathematics. This endeavor will tend to decrease one of the most troublesome blocks to effective teaching, especially in science.

To strengthen consultant and supervisory programs.—Before 1958, when the Congress passed the National Defense Education Act, fewer than five State departments of education had consultant personnel for science and/or mathematics. This new legislation makes money available to States for employing supervisors in each of these fields. As a result, more than 40 of the States currently have such personnel. These supervisors should aid substantially in the long-range improvement of science and mathematics teaching.

To strengthen science clubs and science fairs.—No single force with a potential for improving the future manpower situation in science and mathematics has grown so rapidly in recent years as that of science youth activities—clubs, fairs, and the like. These have developed in every State as well as in the territories. The National Science Foundation has supported the movements for several years through grants to Science Service, Inc., which manages the Science

[2] Public Law 85 864. 85th Cong., H.R. 13247, Sept. 2, 1958, "To strengthen the national defense and to encourage and assist in the expansion and improvement of educational programs to meet critical national needs; and for other purposes." 72 Stat. 1580.

Clubs of America and the National Science Fair International. The National Science Foundation also makes grants to selected colleges for summer science and mathematics institutes for able young people.

The 85th Congress passed the Wright bill [3] which made moneys available to the U.S. Office of Education to further strengthen the science youth activity movement over the country.

To strengthen the curriculum.—State and local programs undertaken to strengthen the curriculum are far too numerous to mention in detail here. Other programs on a countrywide basis have national implications. These include the following:

The Physical Science Study Committee has prepared a unique course in physics; the Biological Sciences Curriculum Study is revising high school courses in the biological sciences at all levels; and the Chemical Bond Approach Study is working on a new approach to the study of high school chemistry. These programs are supported in part by the National Science Foundation.

In mathematics the National Science Foundation also supports the School Mathematics Study Group, which has developed textbooks for grades 7–12 containing completely new experimental materials. In a similar fashion, the Carnegie Foundation has supported experimental work on the mathematics curriculum at the Universities of Illinois and Maryland.

Each of the programs mentioned above provides resources which give much promise for the future manpower needs of the Nation and also lays a foundation from which a scientifically literate citizenry for the future may be forthcoming. If these programs are effective, the results should soon be reflected both in increased enrollments in science and mathematics and improved offerings in these subjects.

This bulletin seeks to throw light on these and other aspects of offerings and enrollments in high school science and mathematics.

Nature of the Data

The data found in the tables of this publication are based on information received in 1958 from a randomly selected sample of public high schools. The 4,228 usable returns in science and the 4,254 in mathematics came from about 20 percent of the total number of public high schools in the United States. Although the sample is fairly representative of the United States (see section, *Characteristics of the Sample*), it is subject to sampling variability, which may be large when the number of schools in a particular category is small. In these cases, therefore, generalizations to a national level should be made with caution (see section, *National Generalizations*).

[3] Public Law 85-875. 85th Cong., H.R. 13191, Sept. 2, 1958, "To require the Commissioner of Education to encourage, foster, and assist in the establishment of clubs for boys and girls especially interested in science." 72 Stat. 1700.

Offerings and Enrollments in Science

Offerings

The Changing Pattern

The pattern of science offerings in the public high schools of the United States has changed many times since the earliest high schools were established.

The years since the turn of the century have seen the emergence of new offerings, the disappearance of older ones, and in some cases the consolidation of early offerings to provide new ones.

To a considerable degree the changes and shifts are reflections of changes in social modes and therefore may be regarded as an important index of trends and developments in the purposes and plans for education of youth.

In this section of the study, the offerings in public high school science will be examined.

Schools Offering Science

The study of offerings and enrollments reported in 1954 [1] included only the science offerings in the last 3 years of the public high school. The study done in 1956,[2] as well as the present one, reports science offerings in the 9th grade along with those in the 10th, 11th, and 12th grades.

The 1956 study showed that 85.3 percent of the schools having students enrolled in the 9th grade offered general science. The present study (table 1) reveals that for the school year 1958, 87.7 percent of the schools enrolling 9th-grade pupils offered general science. Between 1954 and 1956, of the public high schools enrolling 10th-grade pupils, the percent offering biology increased slightly from 89 percent in 1954 to 90.3 percent in 1956. The present study shows that between 1956 and 1958 there was a somewhat greater increase to 92 percent.

For schools enrolling 11th-grade pupils and offering chemistry, there was an increase from 57 percent in 1954 to 63.8 percent in 1956, and a further increase to 72.3 percent in 1958. For schools enrolling

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[1] Brown, Kenneth E. *Offerings and Enrollments in Science and Mathematics in Public High Schools, 1954* (Pamphlet No. 118). U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office. 1956. 24 pages.

[2] ———and Ellsworth S. Obourn. *Offerings and Enrollments in Science and Mathematics in Public High Schools 1956* (Pamphlet No. 120). U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1957. 44 pages.

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12th-grade pupils and offering physics, there was an increase from 52 percent in 1954 to 56.8 percent in 1956, and a continued increase to 63.9 percent in 1958.

Thus it would appear from these data that there is an increasing number of public high schools over the Nation in which each of the four traditional science courses is being offered. Further, that general science is available in more than 8 of every 10 public high schools, biology in more than 9 of every 10, chemistry in more than 7 of every 10, and physics in more than 6 of every 10.

Table 1 shows, by size of school, the number and percent of schools in the sample offering certain science courses. These data tend in general to indicate that size of school is a factor influencing the percent

Table 1.—Number and Percent [1] of Public High Schools Offering Certain Science Courses, by Size of School: Fall 1958

Course	Size of school (enrollment)								Total	
	1–99		100–199		200–499		500 or more			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
General science	869	81.9	896	87.9	1,133	91.8	631	89.1	3,529	87.7
Biology	749	78.0	845	95.1	990	98.3	800	97.3	3,384	92.0
Chemistry	392	42.5	545	61.6	873	87.8	808	98.1	2,618	72.3
Physics	306	33.4	442	50.4	761	76.8	794	96.9	2,303	63.9
Advanced general science	49	5.3	58	6.6	128	12.9	196	23.9	431	11.9
Advanced biology	13	1.4	6	.6	18	1.8	110	13.4	147	4.0
Advanced chemistry	7	.7	4	.4	8	.8	63	7.6	82	2.2
Advanced physics	4	.4	4	.4	9	.9	41	5.0	58	1.6
Science research seminar	4	.4	4	.4	14	1.4	31	3.7	53	1.4
All other sciences	40	3.7	46	4.5	99	7.8	268	31.3	453	10.7

[1] In computing the percentage, only those schools are included that have pupils in the grade where the course is usually offered. For example, if a school did not have pupils in the 10th grade, that school was not included in the data on biology, regardless of whether or not it offered biology. For the total number of pupils enrolled in each grade, see tables 52 and 53.

The data in the tables in this study are based on information received in 1958 from a randomly selected sample of public secondary schools. The 4,254 usable returns in mathematics and the 4,228 usable returns in science represented about 20 percent of the total number of public secondary schools in the United States. Although the sample is fairly representative of the United States (see section, Characteristics of the Sample) the data are subject to sampling variability, which may be large when the number in a particular category is small. In these cases, therefore, generalizations to a national level should be made with caution. (See section, National Generalizations.)

which offer the various science courses. Every science course is offered by higher percentages of schools with enrollments above 200. As was the case in 1954 and 1956, biology continues to be the science most commonly offered in the public high schools, and general science is second. Between 1956 and 1958, however, general science increased 2.4 percent in the frequency of its offering, while biology increased 1.7 percent. In the smallest high schools (1 to 99 pupils) the percent of schools offering general science exceeds by a small amount the percent offering biology.

In the smallest category (1 to 99), biology is offered in 78 percent and general science in 81.9 percent of the schools. Although it may

seem that these subjects are denied to many rural youth who attend small schools, some caution must be used in making such an interpretation, since the small schools commonly offer biology and general science in alternate years. It is significant to note that at least 95 of every 100 schools having enrollments of 100 or more do offer biology.

Chemistry and physics, the usual science offerings in the last 2 years of high school, appear to be influenced more by school size than do the subjects offered in the first 2 years. Once more in making interpretations of the lower percentages of the small schools offering physics and chemistry some caution should be used. Again, the small schools commonly offer these subjects in alternate years as they do in the case of general science and biology.

Over the past 4 years the percentage increase in the schools offering science has been much greater for chemistry and physics than for general science and biology.

Table 1 indicates another significant pattern in the offerings of high school science. To a slight but perceptible degree, schools in every size category reveal offerings in advanced biology, advanced chemistry, and advanced physics. In schools of 500 or more, the percentages which are offering these advanced courses are quite substantial. This is a new pattern and is perhaps a reflection of the idea that science courses in the public high schools may be concerned more with basic science principles than with technological applications. The tendency to make more advanced materials in science available at the high school level is further reflected in the fact that a discernible percentage of schools in all size categories report some sort of science research seminars. This has perhaps been influenced by the rapid growth of science fairs throughout the Nation. Table 2 shows, by grades in school, the number and percent of schools in the sample that offered certain science courses. The present study uses the following categories as the types of schools: Grades 9–12; 9 only; 10, 11, and 12th; and other. This was slightly different from the categories used in the earlier studies of 1954 and 1956. The categories used for these studies were as follows: regular 4-year high school; senior high school; junior-senior high school; and undivided high school. It should be noted that in the 1958 study the great preponderance of schools reporting were organized on the 4-year plan (grades 9–12) and the 6-year plan (grades 7–12). There were 3,386 schools of the sample in this category and only 189 organized on the senior high school pattern (grades 10–12). The organization pattern of a high school appears to have some effect on the percent offering various science courses. In the case of every science listed, a higher percent of schools with 10th, 11th, and 12th grades only, offered that science than did schools organized on the 4- or 6-year pattern. These percentage differences were most pronounced in

Table 2.—Number and Percent [1] of Public High Schools Offering Certain Science Courses, by Grades in School: Fall 1958

Course	Grades in school								Total	
	9-12 [2]		9 only [3]		10, 11, and 12 [4]		Other			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
General science	2,931	85.5	509	94.9	0	0.0	89	88.1	3,529	87.7
Biology	3,119	92.1	0	0.0	181	95.7	84	82.3	3,384	92.0
Chemistry	2,408	71.1	0	0.0	182	96.2	28	60.8	2,618	72.3
Physics	2,124	62.7	0	0.0	172	91.0	7	26.9	2,303	63.9
Advanced general science	365	10.7	0	0.0	57	30.1	9	34.6	431	11.9
Advanced biology	113	3.3	0	0.0	32	16.9	2	7.7	147	4.0
Advanced chemistry	64	1.9	0	0.0	16	8.4	2	7.7	82	2.2
Advanced physics	46	1.3	0	0.0	11	5.8	1	3.8	58	1.6
Science research seminar	45	1.3	0	0.0	8	4.2	0	0.0	53	1.4
All other sciences	366	10.8	14	2.6	66	34.9	7	8.9	453	12.7

[1] In computing the percentage, only those schools are included that have pupils in the grade where the course is usually offered. For example, if a school did not have pupils in the 10th grade, that school was not included in the data on biology regardless of whether or not it offered biology.
[2] Includes regular 4-year high schools and 6-year junior-senior high schools.
[3] Junior high school.
[4] Senior high school.

advanced general science, chemistry, and physics. Likewise, the newer and more advanced courses in the specialized sciences were more frequently offered by the former group of schools than by the latter.

Comparative data over the 4-year period 1954–58 indicate some significant tendencies. The percent of senior high schools offering biology, chemistry, and physics, for example, has changed very little:

Subject	Percent		
	1954	1956	1958
Biology	96.0	97.1	95.7
Chemistry	95.0	92.5	96.2
Physics	91.0	91.9	91.0

On the other hand, the percent of 4-year and 6-year high schools offering these sciences has increased significantly:

Subject	Percent		
	1954	1956	1958
Biology	85.0	87.7	92.1
Chemistry	51.0	56.8	71.1
Physics	44.0	47.9	62.7

Table 3 gives the same data by geographic region. The range from one region to another is interesting to note. In general science it was 26.7 percent: from 99.2 percent in the Middle Atlantic region to 72.5 percent in the East North Central region. There was a range of 11.9 percent in the schools offering biology: from 97.3 percent in the South Atlantic to 85.4 percent in the West North Central region. For chemistry there was a range of 37 percent: from 91.8 percent in the Middle

Table 3.—Number and Percent[1] of Public High Schools Offering Certain Science Courses, by Geographic Region: Fall 1958

Course	Geographic region[2]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
General science	158	91.3	397	99.2	532	72.5	647	90.6	531	93.3	329	89.9	564	91.3	175	81.0	194	83.9	3,529	87.7
Biology	132	89.8	329	94.0	650	96.5	585	85.4	506	97.3	302	92.0	520	88.7	175	90.6	185	94.8	3,384	92.0
Chemistry	108	74.4	315	91.8	513	76.1	376	55.2	424	82.9	220	68.7	348	61.3	144	77.4	170	87.1	2,618	72.3
Physics	124	86.1	299	87.4	521	77.5	390	57.5	321	63.8	148	46.3	219	38.2	118	62.7	163	83.6	2,303	63.9
Advanced general science	37	25.7	88	25.7	72	10.7	48	7.0	52	10.3	47	14.7	30	5.3	22	11.7	35	17.9	431	11.9
Advanced biology	14	9.7	22	6.4	24	3.6	13	1.9	19	3.7	4	1.2	11	1.9	8	4.2	32	16.4	147	4.0
Advanced chemistry	7	4.8	21	6.1	16	2.3	6	.9	9	1.8	4	1.2	2	.3	6	3.1	11	5.6	82	2.2
Advanced physics	10	6.9	18	5.2	3	.4	5	.7	6	1.1	1	.3	4	.7	4	2.1	7	3.6	58	1.6
Science research seminar	1	.6	14	4.0	8	1.1	3	.4	3	.6	1	.3	3	.5	P 7	3.7	13	6.6	53	1.4
All other sciences	36	19.3	117	27.3	78	10.3	46	6.3	46	7.8	17	4.5	20	3.0	26	11.4	67	25.6	453	10.7

[1] In computing the percentage, only those schools are included that have pupils in the grade where the course is usually offered. For example, if a school did not have pupils in the 10th grade, that school was not included in the data on biology, regardless of whether or not it offered biology.

[2] For names of States comprising each region, see table 50.

Atlantic region to 55.2 percent in the West North Central. Physics showed the widest range: from 87.4 percent in the Middle Atlantic region to 39.2 in the West South Central.

It is very difficult to account for the wide variations and the apparent inconsistencies in them. For example, the East North Central region has one of the highest percentages of schools in the Nation offering biology and also has the lowest percent of schools offering general science. This might indicate that in this region biology is offered in place of general science. This same region also shows percentages of its schools offering physics and chemistry that are above the average for the Nation. The data show the following regions generally to be consistently near or above the average in the percent of schools offering the various science courses: New England, Middle Atlantic, East North Central, and South Atlantic.

The percent of schools from all regions offering chemistry exceeded those offering physics by 8.4 percent. However, in three of the geographic regions (New England, East North Central, and West North Central) the percent offering physics exceeded the percent offering chemistry, and in three other regions there was a difference which was less than that for schools of all regions.

In two of the nine geographic regions more than 25 percent of the schools in the sample offered advanced general science, and in one region over 16 percent offered advanced biology. In the following geographic regions, a notable percent of schools offered advanced courses:

Region	*Subject*
New England, Middle Atlantic, East South Central, Pacific	Advanced general science.
New England, Middle Atlantic, Mountain, Pacific	Advanced biology.
New England, Middle Atlantic, East North Central, Mountain, Pacific	Advanced chemistry.
New England, Middle Atlantic, Mountain, Pacific	Advanced physics.

Schools Offering Neither Chemistry Nor Physics

Table 4 shows, by geographic region, the number and percent of schools having the 12th grade but offering neither chemistry nor physics. The 1954 study showed that among this group of schools 23 percent offered neither subject and that these schools contained about 5.8 percent of all 12th-grade pupils. By 1956, the percent had declined to 18.2 percent, enrolling 4.8 percent of all 12th-grade pupils. The 1958 study shows a still further decline to 9.9 percent, enrolling 3.3 percent. (See figure 1.) These data are indeed encouraging. Further analysis of table 4 reveals that in each region there is a decline

Table 4.—Number and Percent of Public High Schools Having the 12th Grade but Offering Neither Chemistry nor Physics, and Number and Percent of Pupils Affected, by Geographic Region: Fall 1956 and Fall 1958

Geographic region [1]	Fall 1956				Fall 1958			
	Schools		Pupils		Schools		Pupils	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9
New England	0	0	0	0	0	0	0	0
Middle Atlantic	5	2.8	285	1.3	7	1.6	1,402	2.8
East North Central	25	7.7	416	1.6	17	2.2	370	.6
West North Central	99	27.9	1,404	9.7	128	17.6	3,117	9.4
South Atlantic	31	12.1	821	4.6	30	5.0	510	1.3
East South Central	39	25.2	961	1.3	64	16.8	1,502	8.0
West South Central	106	40.9	1,933	15.0	152	23.0	2,511	8.5
Mountain	11	12.8	125	2.5	15	6.6	158	1.2
Pacific	7	8.1	98	.8	5	1.9	58	.2
Total	323	18.2	6,623	4.8	418	9.9	9,628	3.3

[1] For names of States comprising each region, see table 50.

in the percent of schools having the 12th grade but offering neither chemistry nor physics. In contrast, however, it should be noted that the Middle Atlantic and East South Central regions show an increase in the percent of 12th-grade pupils enrolled in schools offering neither chemistry nor physics.

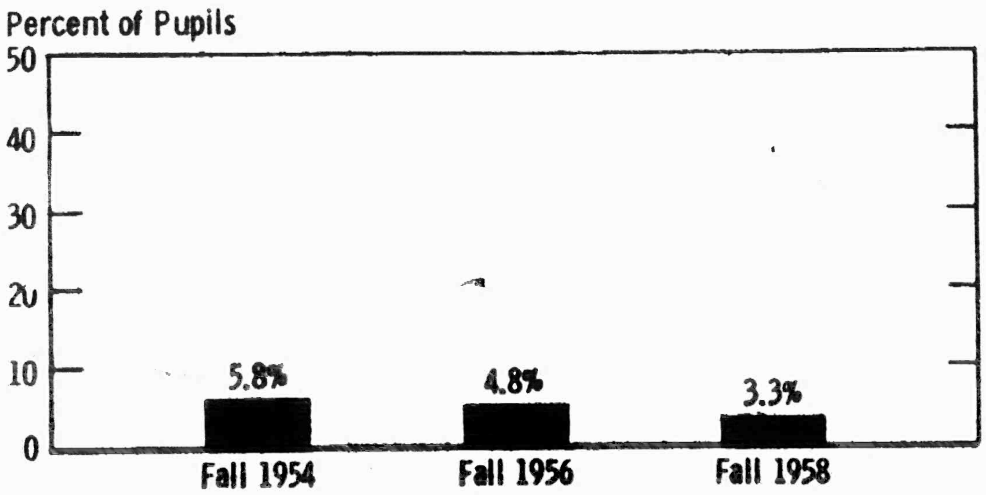

Figure 1.—Percent of 12th-Grade Pupils in Public High Schools Offering Neither Physics Nor Chemistry: Fall 1954, 1956, and 1958.

Grade Levels

In the current study, data were obtained to indicate the grade levels at which the various high school science courses were most commonly offered. Revisions in *content* of the courses as well as changes in the *patterns* of the offerings emphasized the need for these data. Illustrative of the first is the revision of biology, physics, and chem-

istry courses now in progress under the direction of such national committees as the Physical Science Study Committee, the Chemical Bond Approach Committee, and the Biological Science Curriculum Study Committee. Illustrative of the second is the trend toward offering individual sciences such as biology, earth science, and physical science in place of general science at the 9th-grade level.

General science.—Table 5 shows, by size of school, the number of schools in the sample offering general science at various grade levels.

Table 5.—Number of Public High Schools Offering General Science in Various Grades, by Size of School: Fall 1958

Size of school (enrollment)	Grades						Schools not replying	Total
	9 only	9-10	9, 10, and 11	9, 10, 11, and 12	10	Other		
1	2	3	4	5	6	7	8	9
1 to 99	637	138	2	6	16	9	276	1,084
100 to 199	723	64	7	8	12	8	203	1,025
200 to 499	917	70	7	18	4	6	242	1,264
500 or more	469	45	3	12	14	4	308	855
Total	2,746	317	19	44	46	27	1,029	4,228

Although 1,029 schools, or 24.3 percent of the sample, did not respond to this item, in those schools reporting, general science was predominantly a 9th-grade subject. In a relatively few schools, especially those with small enrollments, there was a tendency to offer the course in both 9th and 10th grades, and in still fewer schools to offer it in the 10th grade only. Of all the schools in the sample responding to this item, 85.8 percent offered general science only in the 9th grade and about 10 percent in both the 9th and 10th.

Biology.—Table 6 shows, by size of school, the number of schools in the sample offering first-year biology at various grade levels. Of the 4,228 schools in the sample, 1,236, or 29.2 percent, failed to respond to this item. Of the schools responding, there was a concentration in the

Table 6.—Number of Public High Schools Offering 1st-Year Biology in Various Grades, by Size of School: Fall 1958

Size of school (enrollment)	Grades												Schools not replying	Total
	9 only	9-10	9, 10, and 11	9, 10, 11, and 12	10	10-11	10-12	10, 11, and 12	11	11-12	12	Other		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 to 99	47	61	8	8	372	42	8	47	27	53	11	2	398	1,084
100 to 199	40	24	4	8	500	73	5	59	16	15	3	1	277	1,025
200 to 499	51	41	12	14	577	72	5	96	7	5	3	1	389	1,264
500 or more	16	54	3	15	424	63	5	82	4	4	4	0	181	855
Total	154	180	27	45	1,873	250	23	284	54	77	21	4	1,236	4,228

number, 1,873 or 62.6 percent, which offered this subject in the 10th grade. Nearly 10 percent of the schools responding offered first-year biology on each grade level of the senior high school, 8.4 percent on the 10th- and 11th-grade levels, and only 154 schools, or 5.1 percent, offered biology as a 9th-grade subject. The predominance of first-year biology as a 10th-grade offering was characteristic of every school-size category.

Chemistry.—Table 7 shows, by size of school, the number of schools in the sample offering first-year chemistry at different grade levels.

Table 7.—Number of Public High Schools Offering 1st-Year Chemistry in Various Grades, by Size of School: Fall 1958

Size of school (enrollment)	Grades				Schools not reporting	Total
	11	11–12	12	Other		
1	2	3	4	5	6	7
1 to 99	13	40	233	54	744	1,084
100 to 199	5	92	271	98	559	1,025
200 to 499	14	224	382	116	528	1,264
500 or more	16	252	283	126	178	855
Total	48	608	1,169	394	2,009	4,228

This item was answered by 2,219 schools, or 52.4 percent of the sample. Although first-year chemistry has traditionally been regarded as the standard science offering at the 11th-grade level, only 48 schools, or slightly more than 2.2 percent of the sample responding, indicated this to be the case. Six hundred and eight schools, or 27.4 percent, indicated that chemistry was offered both as an 11th- and a 12th-grade subject; and 1,169 schools, or 52.7 percent of those responding, showed first-year chemistry as a 12th-grade offering. Thus, nearly 80 percent of the schools in the sample that responded to the item offer chemistry either in both of the last 2 years, or in the last year, of high school. The size of school appeared to be a factor.

Physics.—The number of schools in the sample offering first-year physics at various grade levels is shown in table 8, by size of school.

Table 8.—Number of Public High Schools Offering 1st-Year Physics in Various Grades, by Size of School: Fall 1958

Size of school (enrollment)	Grades				Schools not reporting	Total
	11	11–12	12	Other		
1	2	3	4	5	6	7
1 to 99	18	187	56	8	815	1,084
100 to 199	33	236	105	10	641	1,025
200 to 499	89	248	296	14	617	1,264
500 or more	110	175	369	10	191	855
Total	250	846	826	42	2,264	4,228

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Of the 4,228 schools, only 1,964, or 46.4 percent, responded to this item. Of those schools responding, 250, or 12.7 percent, indicated that physics was an 11th-grade subject; 826 schools, or 42 percent, that it was a 12th-grade subject; and 846 schools, or 43 percent, that it was offered in both the 11th and 12th grades. Thus, although these data show that physics was more commonly a 12th-grade subject than chemistry was an 11th-grade subject, it is also evident that physics was offered in both the 11th and 12th grades about as often as in the 12th grade alone. The size of school appeared to influence the offering of physics as an 11th-grade, an 11th- and 12th-grade, and a 12th-grade subject. The number of cases in which physics was offered in grades other than those described above appeared to be negligible.

Advanced general science.—Table 9 shows, by size of school, the number of schools in the sample offering advanced general science in various grades. Since only 373 schools, or fewer than 1 percent, responded to the item, it appears that this subject was not widely offered among the schools of the sample. In those schools where it was offered, it was most commonly given either in both of the last 2 years of high school or in the last year only.

Trends in Emphasis

It seemed reasonable to assume that the responding schools in this study might be able to reflect any shift in emphasis on science in their schools over the 3 years immediately preceding. Accordingly, they were asked to respond to the question, "What is the present emphasis

Table 9.—Number of Public High Schools Offering Advanced General Science in Various Grades, by Size of School: Fall 1958

Size of school (enrollment)	Grades				Schools not reporting	Total
	11	11-12	12	Other		
1	2	3	4	5	6	7
1 to 99	2	19	8	11	1,044	1,084
100 to 199	8	17	15	15	970	1,025
200 to 499	7	47	32	28	1,150	1,264
500 or more	18	35	64	27	691	835
Total	35	138	119	81	3,955	4,228

on science in your school as compared to 3 years ago?" The responses were made on a 3-point scale: (1) Less emphasis, (2) the same emphasis, (3) more emphasis.

Table 10 distributes the responses by size of school. Of the 97 percent of schools in the sample that responded, about two-thirds indicated a greater emphasis, and one-third an unchanged emphasis. Only a fraction of 1 percent in each category of school size indicated less emphasis.

Table 10.—Number and Percent of Public High Schools Giving Certain Degrees of Emphasis to Science as Compared With Emphasis in Fall 1955, by Size of School: Fall 1958

Emphasis	Size of school (enrollment)								Total	
	1–99		100–199		200–499		500 or more			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
More	609	56.2	655	63.9	907	71.8	625	73.1	2,796	66.1
Same	428	39.5	326	31.8	321	25.4	213	24.9	1,288	30.5
Less	9	.8	8	.8	2	.1	2	.2	21	.5
No reply	38	3.5	36	3.5	34	2.7	15	1.8	123	2.9
Total	1,084	100.0	1,025	100.0	1,264	100.0	855	100.0	4,228	100.0

The size of school appeared to be a factor influencing greater emphasis: from the smallest to the largest schools there was a progressively greater percent indicating more emphasis as compared to that of 3 years earlier.

Table 11 gives the same kind of information as table 10, except that it classifies the high schools by their grades. Less emphasis on science, as compared with 3 years earlier, appeared in only a fraction

Table 11.—Number and Percent of Public High Schools Giving Certain Degrees of Emphasis to Science as Compared With Emphasis in Fall 1955, by Grades in School: Fall 1958

Emphasis	Grades in school								Total	
	9–12 [1]		9 only [2]		10, 11, and 12 [3]		Other			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
More	2,248	66.8	339	63.3	134	70.9	75	64.1	2,796	66.1
Same	1,031	30.6	172	32.1	51	27.0	34	29.1	1,288	30.5
Less	15	.4	5	.9	1	.5	0	0	21	.5
No reply	82	2.2	20	3.7	3	1.6	8	6.8	123	2.9
Total	3,396	100.0	536	100.0	189	100.0	117	100.0	4,228	100.0

[1] Includes regular 4-year high schools and 6-year junior-senior high schools.
[2] Junior high school.
[3] Senior high school.

of 1 percent in each grade category. Somewhat fewer than one-third of the schools in each category indicated less emphasis, while there was a range from 63.3 percent to 70.9 percent among the categories in those schools that reported more emphasis. Although the differences among the categories in this latter respect are not marked, the schools with 10th, 11th, and 12th grades (the senior high schools) reported the greatest trends toward more emphasis. Fewer than 3 percent of schools in all categories failed to answer the question.

Table 12.—Number and Percent of Public High Schools Giving Certain Degrees of Emphasis to Science as Compared With Emphasis in Fall 1955, by Geographic Region: Fall 1958

Emphasis	Geographic region [1]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
More	134	71.7	301	70.3	459	60.5	417	57.4	439	73.3	249	65.4	500	75.9	131	57.7	166	63.4	2,796	66.1
Same	49	26.2	121	28.3	274	36.1	282	38.9	136	22.7	110	28.9	141	21.4	88	38.8	87	33.2	1,288	30.5
Less	0	0.0	0	0.0	2	.2	5	.7	4	.7	4	1.0	3	.4	1	.4	2	.7	21	.5
No Reply	4	2.1	6	1.4	24	3.2	22	3.0	20	3.3	18	4.7	15	2.3	7	3.1	7	2.7	123	2.9
Total	187	100.0	428	100.0	759	100.0	726	100.0	599	100.0	381	100.0	659	100.0	227	100.0	262	100.0	4,228	100.0

[1] For names of States comprising each region, see table 50.

Finally, table 12 assembles the information on science emphasis by geographic region. Of the 4,228 schools in the sample, 123, or 2.9 percent, failed to respond to this item. In all geographic regions, 1 percent or fewer indicated that there had been some decrease in the emphasis. The range in the percent of schools indicating unchanged emphasis was from 21.4 in the West South Central region to 38.9 in the West North Central. In four of the geographic regions more than 70 percent indicated a greater emphasis. Three of the four geographic regions in which more than 70 percent of the schools indicated more emphasis were on the eastern seaboard; the fourth region in this group, the West South Central, showed the largest percent--75.9.

Trends in Curriculum Revision

There is evidence to support the contention that the climate for science teaching over the country has been improving during the past 4 or 5 years. The present study sought information on whether the improved climate had resulted in curriculum revision. Table 13 shows, by size of school, how the schools in the sample responded to the question, "Is the science curriculum in your school being revised

Table 13.—Number and Percent of Public High Schools Replying to the Question, "Is the Science Curriculum Being Revised This Year?", by Size of School: Fall 1958

Reply	Size of school (enrollment)								Total	
	1–99		100–199		200–499		500 or more			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
Yes	385	35.5	341	33.3	505	39.9	361	42.2	1,592	37.6
No	616	56.8	603	58.8	682	54.0	445	52.0	2,346	55.5
No reply	83	7.7	81	7.9	77	6.1	49	5.8	290	6.9
Total	1,084	100.0	1,025	100.0	1,264	100.0	855	100.0	4,228	100.0

this year?" For schools of all sizes there was a considerably higher percentage answering "No" than answering "Yes." The range in percent for schools of all sizes was about the same for those answering "yes" as for those answering "no." If we can assume that somewhat more than one-third of the schools revise their curriculums annually, it might be inferred that the life duration of a course of study has decreased over the past few years. Some caution should be used with these data, since they do not of course reveal anything about possible science curriculum revisions in the year or years immediately preceding the 1 year in the question ("this year") or in the year following.

The data on schools that were revising their science curriculums in 1958–59 are distributed according to the grades in school, in table 14.

Table 14.—Number and Percent of Public High Schools Replying to the Question, "Is the Science Curriculum Being Revised This Year?", by Grades in School: Fall 1958

Reply	Grades in school								Total	
	9–12 [1]		9 only [2]		10, 11, and 12 [3]		Other			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
Yes	1,250	36.9	210	39.2	85	45.0	47	40.2	1,592	37.6
No	1,919	56.7	280	52.2	90	47.6	57	48.7	2,346	55.5
No reply	217	6.4	46	8.6	14	7.4	13	11.1	290	6.9
Total	3,386	100.0	536	100.0	189	100.0	117	100.0	4,228	100.0

[1] Includes regular 4-year high schools and 6-year junior-senior high schools.
[2] Junior high school.
[3] Senior high school.

Although most schools of all types reported no curriculum revision that year, the range of percents between those reporting "yes" and those reporting "no" was greater in the 4- or 6-year high schools than in the other high schools.

When the data bearing on the question of current curriculum revision in science are distributed by geographic region, as in table 15, they seem to indicate that this is a nationwide endeavor. In every region at least 30 percent of the schools indicated that curriculum revision was being undertaken during the school year 1958–59, and in three regions the revision ranged upward to above 46 percent of the schools. This might be interpreted to mean that the current favorable conditions for science teaching, together with other factors, were impelling school districts to assess their offerings in high school science, perhaps with the intent of modernizing and updating them.

Enrollments

Data on public high school enrollments in science have been collected biennially since 1954 in the current series of studies. Before then, these data had been taken at intervals even as far back as 1890. Thus, it is possible to see the trends which have emerged under the influence of many and variable forces.

For the past several years a recognizable shortage has existed in trained scientists, engineers, technicians, and science teachers. Each of these groups is a potent factor in the security and well-being of a nation as highly industrialized as the United States. The flow of

Table 15.—Number and Percent of Public High Schools Replying to the Question, "Is the Science Curriculum Being Revised This Year?", by Geographic Region: Fall 1958

Reply	Geographic region [1]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Yes	91	48.7	198	46.3	226	29.8	216	29.7	235	39.2	138	36.2	313	47.5	79	34.8	96	36.6	1,592	37.7
No	86	46.0	208	48.6	488	64.3	458	63.1	315	52.6	208	54.6	302	45.8	131	57.7	150	57.3	2,346	55.5
No reply	10	5.3	22	5.1	45	5.9	52	7.2	49	8.2	35	9.2	44	6.7	17	7.5	16	6.1	290	6.8
Total	187	100.0	428	100.0	759	100.0	726	100.0	599	100.0	381	100.0	659	100.0	227	100.0	262	100.0	4,228	100.0

[1] For names of States comprising each region, see table 50.

excellently trained scientists and engineers into industry and society must begin in the public high schools.

It is therefore exceedingly important that studies of offerings and enrollments in science be made frequently to enable us to judge the trends and the current forces influencing them.

Table 16 shows the percentage of pupils in the last 4 years of public high school who have been enrolled in certain science courses from

Table 16.—Percent of Pupils in the Last 4 Grades in Public High School Taking Certain Science Courses: 1889–90 Through 1958–59

Year	Percent of pupils in —				Year	Percent of pupils in —			
	General science	Biology	Chemistry	Physics		General science	Biology	Chemistry	Physics
1	2	3	4	5	6	7	8	9	10
1890 [1]			10.1	22.8	1934	17.8	14.6	7.6	6.3
1900			7.7	19.0	1949	20.8	18.4	7.6	5.4
1910		1.1	6.9	14.6	1954–55 [3]		19.6	7.3	4.6
1915		6.9	7.4	14.2	1956–57 [4]	21.8	20.5	7.5	4.4
1922	18.3	8.8	7.4	8.9	1958–59 [4]	21.2	21.3	8.9	5.0
1928	17.5	13.6	7.1	6.8					

[1] "Biennial Survey of Education in the United States—1948–50" ch. 5, "Offerings and Enrollments in High School Subjects, 1948–49", p. 107, table 7. U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1951. 118 pages.

[2] Brown, Kenneth E. "Offerings and Enrollments in Science and Mathematics in Public High Schools, 1954" (Pamphlet No. 118), p. 11, table 5. U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1956. 24 pages. (General science figures, 1954 and after, include pupils in Advanced General Science.)

[3] ——— and Ellsworth S. Obourn. "Offerings and Enrollments in Science and Mathematics in Public High Schools, 1956" (Pamphlet No. 120), p. 9, table 3. U.S. Department of Health, Education, and Welfare, Office of Education Washington: U.S. Government Printing Office, 1957. 44 pages.

[4] Estimates based on this study.

1890 to 1958. Some interesting, and perhaps significant, trends are indicated by these data. (Also see figures 2 and 3.)

During the first two decades of this century, general science gradually became the standard offering for 9th-grade science, replacing physical geography. Beginning about 1910, biology replaced the the older courses of botany and zoology as standard offering for 10th-grade science.

Between 1928 and 1956, general science showed an almost steady increase in the percent of the total high school population which it enrolled. This ranged from 17.5 percent in 1928 to 21.8 percent in 1956.

Between 1956 and 1958, general science (including advanced general science) showed a decline from 21.8 percent to 21.2 percent of the total high school population enrolled. It is possible only to speculate on the factors which may have been responsible for this decline in percent of pupils enrolled in general science. Perhaps no level of science offering in the public school is undergoing more scrutiny at this time than the 9th-grade level. There seems to be a rather general feeling in educational circles that one of the original functions

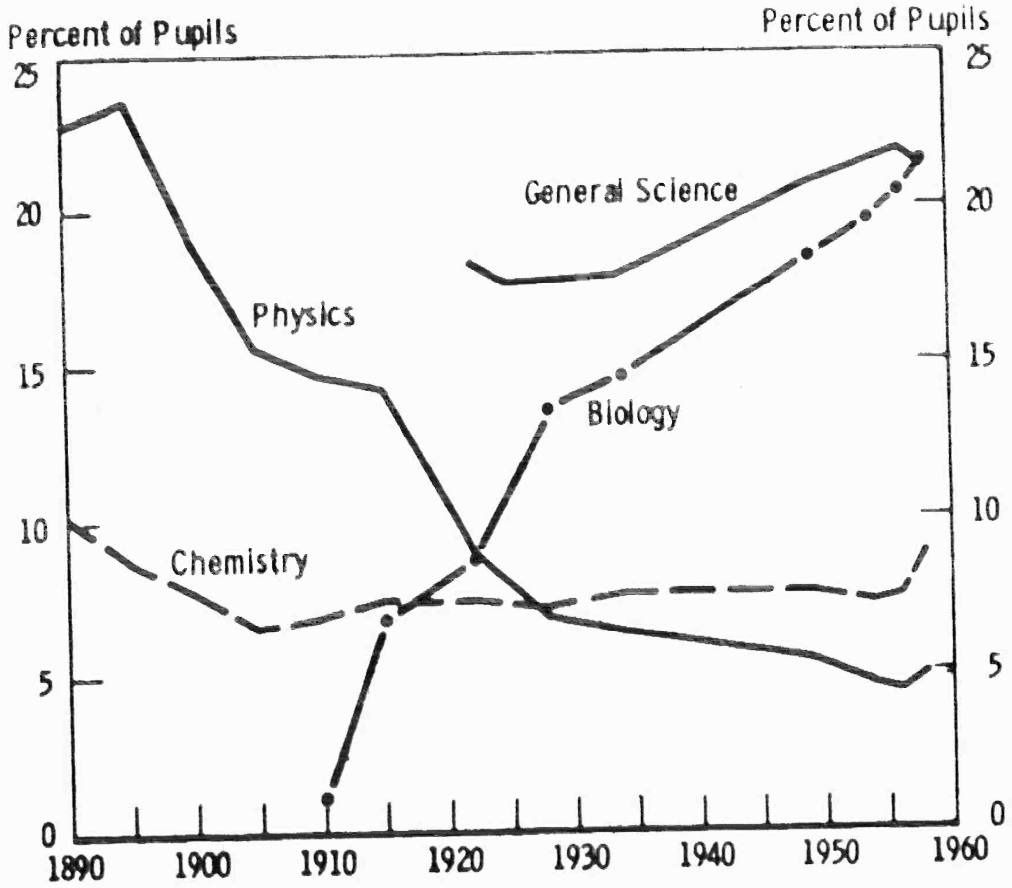


Figure 2.—Percent of Pupils in Last Four Grades of Public High Schools Enrolled in Certain Science Courses: 1890–1958.

of the first-year science course, that of exploration, has become somewhat outmoded with the gradual increase in elementary science offerings. There is also a feeling that the 9th-grade general science content was repetitious of things taught at lower levels and that an economy of time might be effected by confining the teaching of general science to the first eight grades.

As a result of the reappraisal of 9th-grade general science, there is a growing tendency to offer in its stead such sciences as general biology, earth science, or physical science. The degree to which this tendency and other factors have had an influence in reducing the percent of the total high school population enrolled in general science is not clear and it is still too early to know whether the reduction is temporary (as was the case between 1922 and 1928) or whether it is indicative of a more permanent trend.

Biology

Biology has maintained its steady rate of growth as the common science offering at the 10th-grade level. In fact, during the 1956–58 biennium, enrollment in biology increased from 20.5 percent to

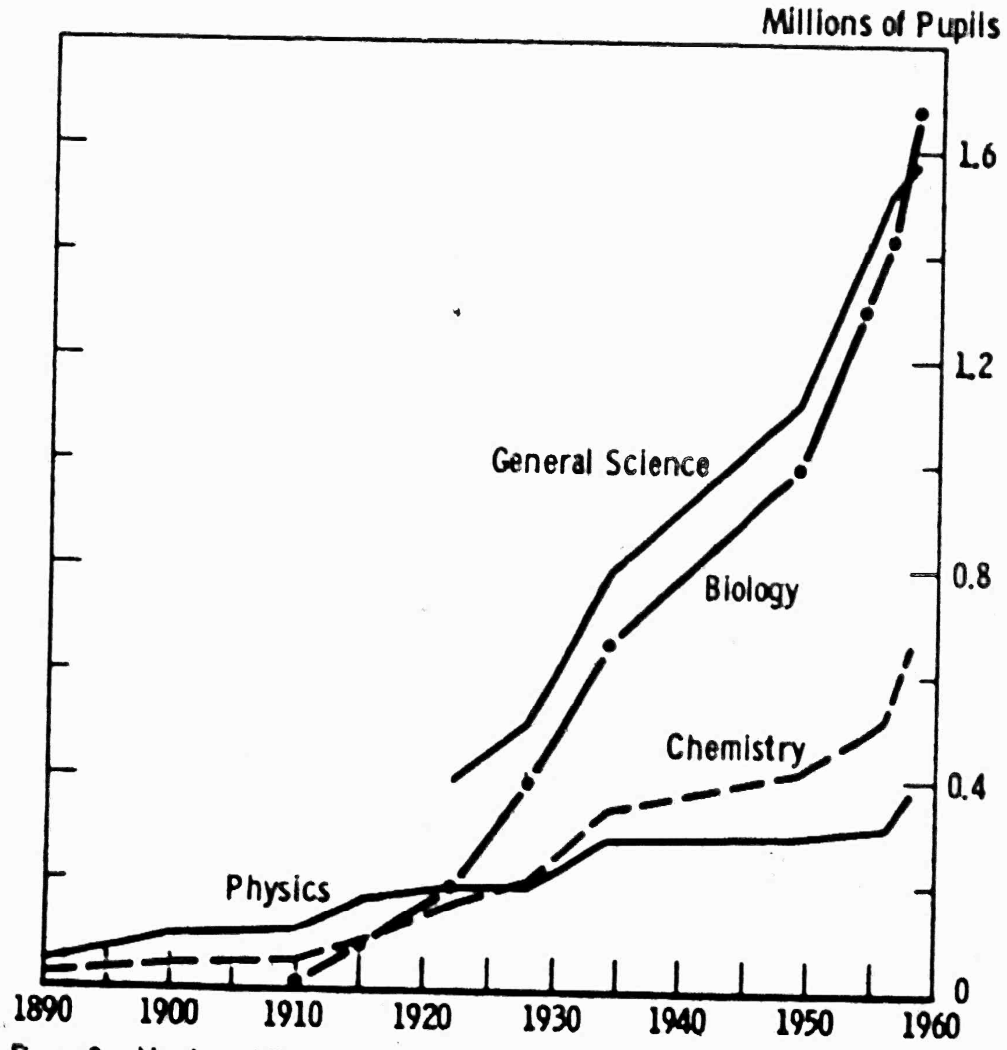


Figure 3.—Number of Pupils in Last Four Grades of Public High Schools Enrolled in Certain Science Courses: 1890–1958.

21.3 percent of the total high school population. Although still the most common 10th-grade science, it appears to be increasing as a multigrade offering.

Chemistry

Chemistry was a standard offering in the public high schools even before 1890, the date when enrollment statistics were first available. In the closing decade of the last century the percent of the total high school population enrolled in chemistry declined from 10.1 to 7.7. Between 1900 and 1956, this percent fluctuated only slightly between 6.9 and 7.7; but between 1954 and 1956, it increased from 7.3 to 7.5. In the last 2 years there has been a still further increase to 8.9 percent. Thus, chemistry enrollments, in terms of percent of the total high school population, appear now to be at the highest point in this century. The data did not permit an analysis to assess the factors

which may have brought about this increase. It seems reasonable, however, to assume that the present favorable climate for science teaching, together with the many programs to improve courses, may have been one of the factors.

Considerable care should be exercised in the use of the statistics on chemistry enrollments. At first glance, even with the percentage increase over the past 2 years, it might seem that there has been relatively little change in total enrollment over the past 60 years. In fact, conclusions of this sort have been drawn on several occasions.

A closer examination of the data reveals that, while the percentage enrollments have changed but slightly over the last 60 years, the actual enrollments in terms of numbers have grown from 40,084 in 1900 to an estimated 657,000 on the basis of this study. (See figure 4.) This is a 15-fold increase in the number of high school students taking chemistry. Figure 2 shows the growth very clearly.

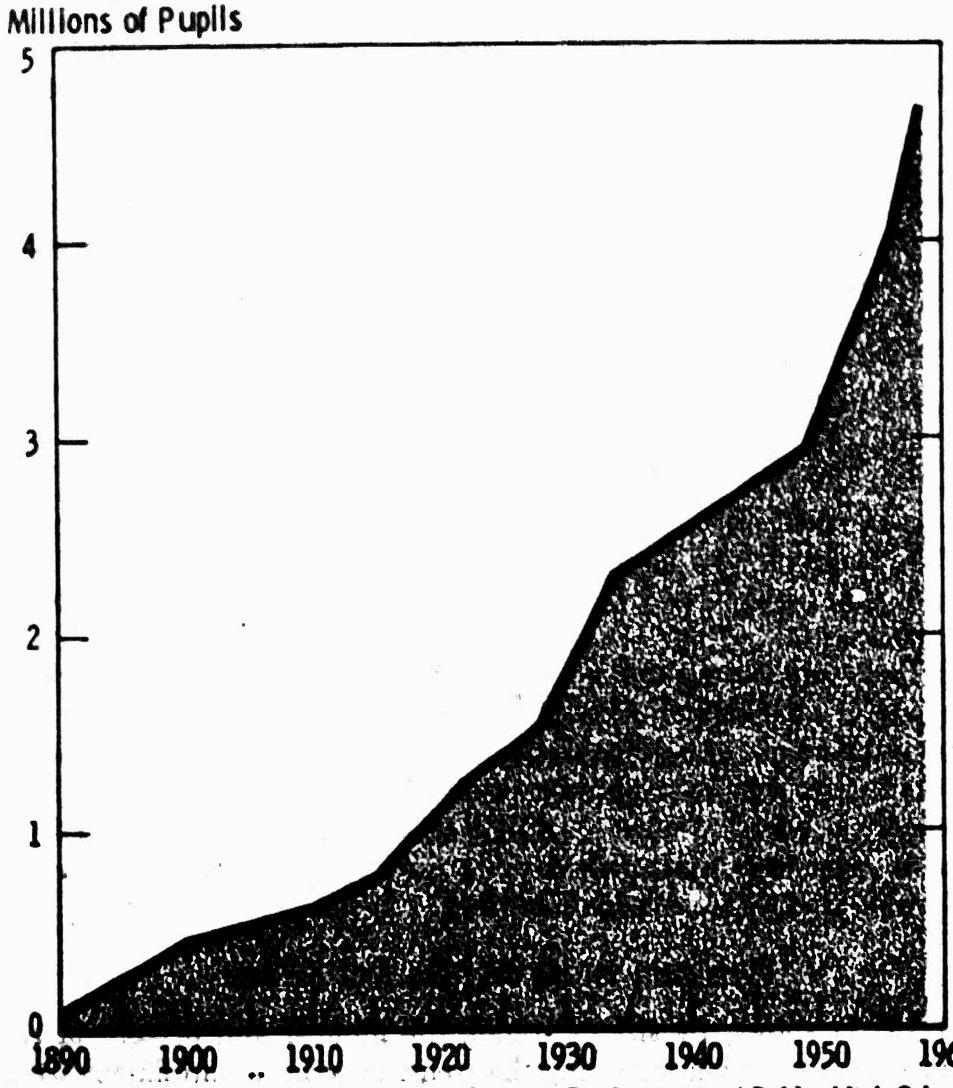


Figure 4.—Total Enrollments in Science Courses, Grades 9–12 of Public High Schools: 1890–1958.

Physics

Physics has generally been regarded as the standard science offering in the 12th grade of public high schools. Since 1890, when data were first available, the percent of the total high school population enrolled in this course has shown a steady decline from 22.8 to 4.4 in 1956. This study reveals an interesting halt to this decline and a slight upturn to 5 percent. Whether or not the upturn represents a trend will have to be left for future studies to reveal.

The steady decline of percentage enrollment in physics between 1890 and 1956, together with the slight percentage increase in enrollments over the past 2 years, requires careful analysis. In the first place, the decline from 1890 to 1956 should in no way be interpreted to mean a decline in actual enrollment, as has been done by some interpreters in the past. In 1900, for example, 19 percent of the total public high school population was enrolled in physics. The actual number enrolled was 98,846. At that time physics was usually offered as a 10th-grade subject and was required of all pupils. By 1954, the percent had fallen to 4.6, but the number actually enrolled had increased to 302,800. The 1956 study revealed a further increase to 309,600 despite a continued decline in percent to 4.4. With the slight increase of 0.6 percent in the past two years it is now estimated that about 379,000 pupils are enrolled in public high school physics throughout the Nation.

Advanced General Science

Advanced general science enrolls approximately 1.2 percent of the total public high school population, or 6.8 percent of all pupils enrolled in the 12th grade. Although these data indicate a slight increase in enrollment, the evidence does not show that the subject is widely accepted as a high school science. By geographic region the course appears to have its heaviest enrollment in the Pacific and New England areas.

Sciences other than those specified above and offered as a part of the public high school curriculum attract about 3.5 percent of the total public high school population, grades 9–12. An estimate based on the sample used in this study would place the enrollment in "other sciences" at about 278,000. In 1958 this category also shows a slight increase over 1956, and again the increase may be due to the generally favorable climate for science teaching.

Enrollment Trends Over the Past 3 Years

Table 17 shows, by size of school, the number and percent of responses to a question regarding the trend in science enrollment over the past 3 years. Only a small percent (1.6) of the schools of all sizes

Table 17.—Number and Percent of Public High Schools Indicating the Trend in Science Enrollment During the Previous 3 Years, by Size of School: Fall 1958

Trend	Size of school (enrollment)								Total	
	1–99		100–199		200–499		500 or more			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
Decrease	34	3.1	14	1.4	8	0.6	10	1.2	66	1.6
Increase	465	42.9	285	27.8	278	22.0	131	15.3	1,159	27.4
Same	527	48.6	668	65.2	922	73.0	682	79.8	2,799	66.2
No reply	58	5.4	58	5.6	56	4.4	32	3.7	204	4.8
Total	1,084	100.0	1,025	100.0	1,264	100.0	856	100.0	4,228	100.0

indicated a decrease and 27.4 percent indicated an increase. The fact that in two-thirds of the schools of all sizes there has been little change is somewhat surprising when one considers the current favorable climate for science and the many forces which have been at work to gain this end. It is encouraging to note, however, that nearly 43 percent of the smallest schools show an increase.

The size of schools appears to have had little influence where there was a decreasing trend in science enrollments, but seems to have been a factor both where enrollment remained the same and where it increased. Where the enrollment trend was increasing, the percentage of schools in the various size categories was in inverse relation to school size, and where enrollments were constant, the percentage of schools increased with school size.

Table 18 and figure 5 show the enrollment trends over the past 3 years by categories based on the grades in the school. Among schools

Table 18.—Number and Percent of Public High Schools Indicating the Trend in Science Enrollment During the Previous 3 Years, by Grades in School: Fall 1958

Trend	Grades in school								Total	
	9–12[1]		9 only[2]		10, 11, and 12[3]		Other			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
Decrease	46	1.4	14	2.6	3	1.6	3	2.6	66	1.6
Increase	854	25.2	244	45.5	24	12.7	37	31.9	1,159	27.4
Same	2,338	69.0	241	45.0	155	82.0	65	55.2	2,799	66.2
No reply	148	4.4	37	6.9	7	3.7	12	10.3	204	4.8
Total	3,386	100.0	536	100.0	189	100.0	117	100.0	4,228	100.0

[1] Includes regular 4-year high schools and 6-year junior-senior high schools.
[2] Junior high school.
[3] Senior high school.

of all types, the highest percentages reported that the trend was the same. This was especially marked in the senior high school category, where 82 percent of the sample indicated this trend. As for increased enrollment, the trend appeared greatest in the category "9th grade only", with 45.5 percent. On the other hand, only one-fourth of the 4- and 6-year high schools reported such a trend and only half of the senior high schools. Considering all categories, only a few schools reported a trend toward decreased enrollments.

Table 19 presents the same kind of information as table 18, but by geographic region. A predominant number of the schools in the sample reported that science enrollments remained about the same during 1956–58, as shown in figure 5. It is interesting and perhaps

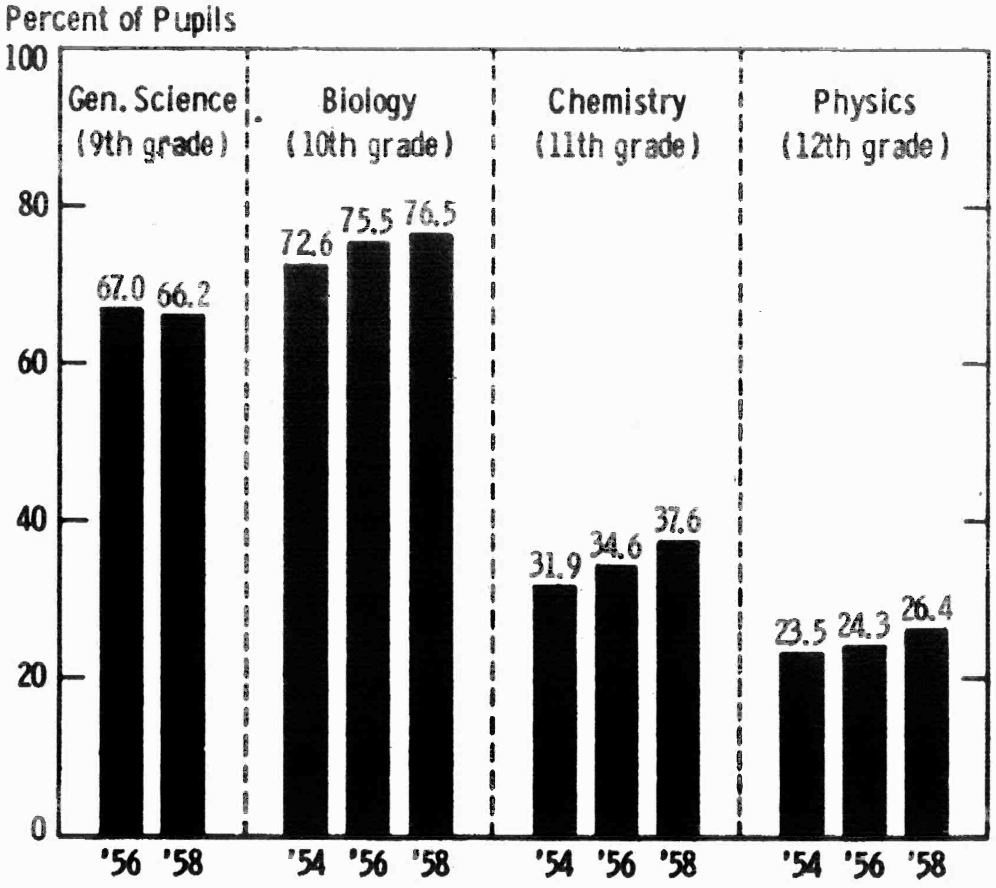


Figure 5.—Percent of Pupils in Certain Public High School Science Courses as a Ratio to Pupils in Grade Where Course Is Usually Offered: Fall 1954, 1956, and 1958.

significant that in all regions from one-fifth to one-third of the schools reported an increasing trend. Regions with the highest percentage of schools having increased science enrollments were the West North Central, Mountain, and East South Central. The East South Central region also reported the highest percent showing a decrease.

Table 19.—Number and Percent of Public High Schools Indicating the Trend in Science Enrollment During the Previous 3 Years, by Geographic Region: Fall 1958

Trend	Geographic region [1]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Decrease	2	1.0	5	1.2	6	0.8	12	1.7	7	1.2	14	3.7	15	2.3	2	0.9	3	1.1	66	1.6
Increase	48	25.7	111	25.9	209	27.5	243	33.5	138	23.0	120	31.5	158	24.0	73	32.1	59	22.5	1,159	27.4
Same	129	69.0	292	68.2	506	66.7	438	60.3	423	70.6	228	59.8	457	69.3	138	60.8	188	71.8	2,799	66.2
No reply	8	4.3	20	4.7	38	5.0	33	4.5	31	5.2	19	5.0	29	4.4	14	6.2	12	4.6	204	4.8
Total	187	100.0	428	100.0	759	100.0	726	100.0	599	100.0	381	100.0	659	100.0	227	100.0	262	100.0	4,228	100.0

[1] For names of States comprising each region, see table 50.

Enrollments by Geographic Region

Table 20 and figure 6 compare, by geographic region, the fall 1954, 1956, and 1958 enrollments in certain science courses [3] in terms of the percent of pupils in the respective grades where the courses are most commonly offered. The table should be read as follows: In the East North Central region the number of pupils enrolled in chemistry in 1954 was 30.9 percent of the number enrolled in the 11th grade; for the same region, the percent was 32.6 in 1956 and 37.9 in 1958.

Table 20.—Enrollments in Certain Public High School Science Courses Expressed as a Percent of the Pupils in the Grade Where Course Is Usually Offered, by Geographic Region: Fall 1954, 1956, and 1958

Course, by year	Geographic region [1]									
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Total
1	2	3	4	5	6	7	8	9	10	11
General science: [2]										
1956	58.0	90.6	60.1	75.7	64.2	65.5	67.1	54.1	43.9	67.0
1958	64.5	79.8	53.8	71.7	72.7	74.7	77.9	52.0	45.7	66.2
Biology:										
1954	67.8	70.0	73.6	70.4	87.7	75.1	66.3	78.6	60.8	72.6
1956	66.9	70.1	76.7	73.8	90.0	73.6	75.5	83.0	64.7	75.5
1958	69.5	72.2	74.9	77.4	91.3	80.7	82.3	81.6	60.1	76.5
Chemistry:										
1954	39.7	39.8	30.9	26.0	32.8	30.8	23.6	30.6	28.5	31.9
1956	39.0	41.8	32.6	31.9	35.6	33.1	28.2	35.0	32.0	34.6
1958	39.3	42.2	37.9	31.2	40.9	36.8	37.7	38.4	30.8	37.6
Physics:										
1954	32.8	31.3	27.8	21.3	17.3	22.5	12.8	20.6	16.2	23.5
1956	34.5	36.2	25.8	25.0	17.0	20.3	13.5	27.1	17.0	24.3
1958	36.9	34.1	28.8	27.1	24.8	21.8	17.3	25.9	17.4	26.4
Advanced general science: [3]										
1958	8.7	8.0	5.4	3.6	7.6	8.1	3.5	5.1	11.9	6.8
All other sciences: [3]										
1958	26.3	31.3	14.9	9.2	13.4	7.3	7.7	16.8	36.5	18.8

[1] For names of States comprising each region, see table 50.
[2] Data for 1954 are not available.
[3] Data for 1954 and 1956 are not available.

These data reveal some interesting patterns of variation in percentage enrollments, both from one science subject to another and from one region to another. In four of the nine regions, general science shows percentage decreases, with the sharpest in the Middle Atlantic. If the 6-year interval is considered, biology shows an overall percentage increase in every region but the Pacific, with the greatest increase (16 percent) falling in the West South Central.

Generally speaking, the percentage enrollments in chemistry showed a steady trend upward in every region, with the sharpest rise again in the West South Central, from 23.6 percent for 1954 to 37.7

[3] General science enrollment data were not collected in the 1954 study, and enrollment data for advanced general science were not collected in the 1954 and 1956 studies.

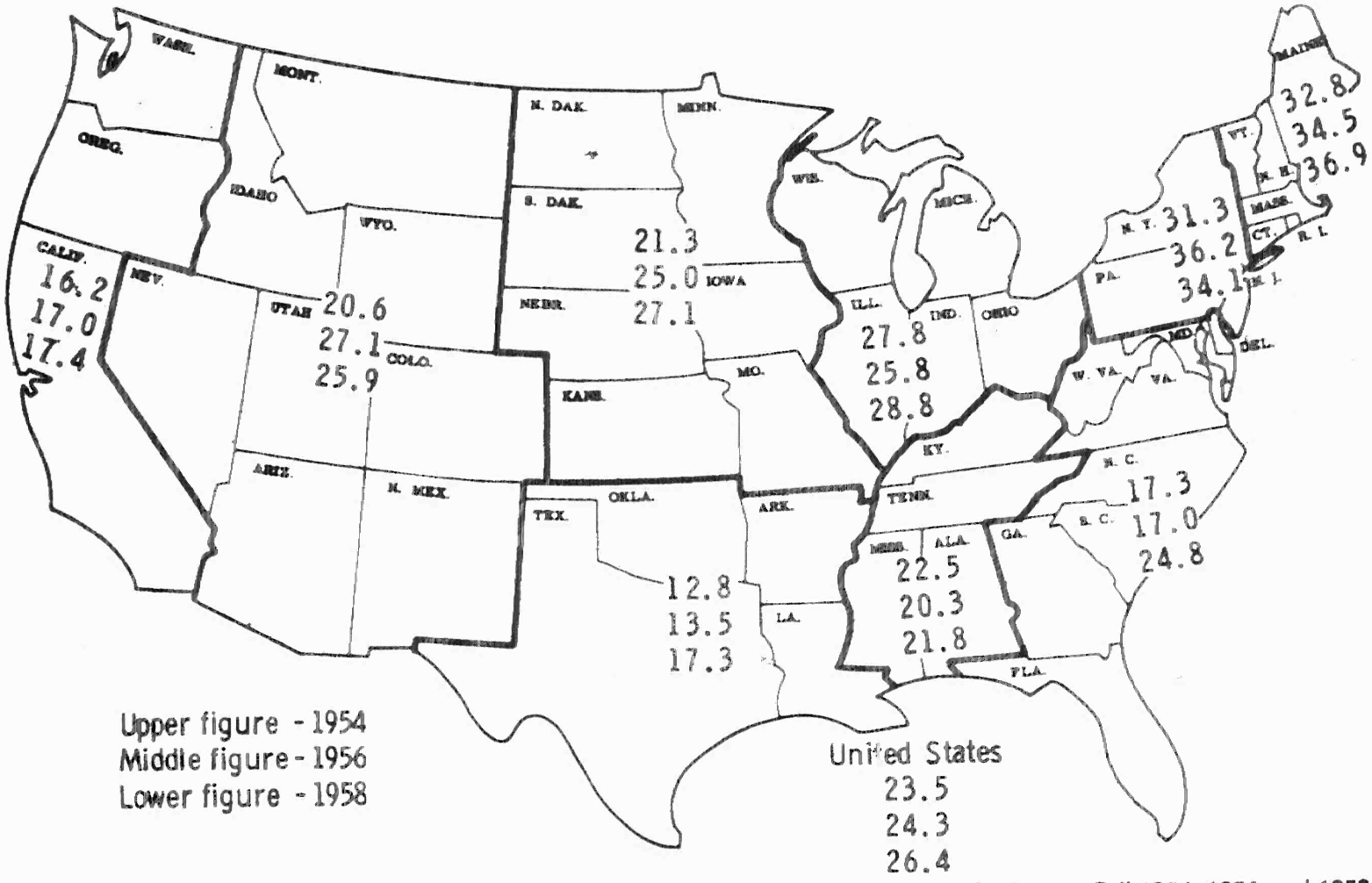


Figure 6.—Percent of 12th-Grade Public High School Pupils Enrolled in Physics, by Geographic Region: Fall 1954, 1956, and 1958.

percent for 1958. In all regions but one, the physics enrollment also reveals an overall gain during the 6-year period, with the greatest gain (7.5 percent) in the South Atlantic.

A further interesting, if perhaps not significant, pattern of variation appears in table 20. In 1956, the range in percentage enrollment among the regions was, respectively: *General science*, 46.7 percent; *biology*, 25.3 percent; *chemistry*, 13.6 percent; and *physics* 22.7 percent. In 1958, these same subjects showed percentage ranges as follows: *General science*, 34.1 percent; *biology*, 31.2 percent; *chemistry*, 11.4 percent; and *physics*, 19.6 percent. In both 1956 and 1958 as the course level increased, the tendency toward variations among regions appeared to grow less.

The variations in percentage enrollments from region to region raise some serious questions regarding science courses. Considering only the data for 1958, why should there be such a wide percentage difference for 9th-grade general science enrollments in the Middle Atlantic and Pacific regions? Why the disparity of 31.2 percent between enrollments in biology in the South Atlantic and Pacific regions? Why should the percent of young people taking physics in the New England region be twice that in the Pacific region? What factors are at work to account for the consistently low percentage enrollment in all sciences in the Pacific region?

Enrollments in Schools Not Offering Certain Sciences

Tables 21 and 22 show, respectively, by size of school and grades in school, the number and percent of pupils enrolled in those public high schools that did not offer certain science courses. As a general

Table 21.—Number and Percent[1] of Public High School Pupils in Schools NOT Offering Certain Science Courses, by Size of School: Fall 1958

Course	Size of school (enrollment)								Total	
	1–99		100–199		200–499		500 or more			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
General science	3,113	14.3	5,499	9.4	11,394	6.7	27,494	12.4	47,500	10.0
Biology	2,847	17.6	1,646	4.7	1,395	1.5	9,756	3.4	15,644	3.6
Chemistry	7,488	54.7	10,767	34.9	7,246	9.7	4,782	1.9	30,283	8.3
Physics	7,722	63.6	12,351	48.6	12,468	20.2	5,707	2.9	38,226	13.0
Advanced general science	24,491	94.8	51,661	93.2	116,884	85.9	327,513	74.2	520,549	79.0
Advanced biology	25,479	98.7	54,999	99.3	133,273	98.0	363,242	82.3	576,993	87.6
Advanced chemistry	25,624	99.2	55,125	99.5	134,925	99.2	387,703	87.8	603,377	91.6
Advanced physics	25,714	99.6	55,114	99.5	134,763	99.1	408,566	92.6	624,157	94.8
Science research seminar	12,082	99.6	25,298	99.5	60,458	98.5	183,793	94.7	281,631	96.1
All other sciences	61,378	96.2	142,059	95.5	366,298	92.2	560,880	58.9	1,130,615	72.4

[1] The percent is the ratio between the enrollment in the grade where the course is usually offered, in those schools not offering the course, and the enrollment in that grade in the schools of the sample.

Table 22.—Number and Percent [1] of Public High Schools Pupils in Schools NOT Offering Certain Science Courses, by Grades in School: Fall 1958

Course	Grades in school								Total	
	9–12 [2]		9 only [3]		10, 11, and 12 [4]		Other			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
General science	38, 927	11.6	5, 193	4.0			3, 380	33.5	47, 500	10.0
Biology	12, 740	3.7			2, 630	3.1	274	4.3	15, 644	3.6
Chemistry	28, 843	9.9			1, 071	1.5	369	9.3	30, 283	8.3
Physics	36, 183	15.3			1, 772	3.1	271	12.6	38, 226	13.0
Advanced general science	433, 911	82.4			81, 075	64.2	5, 563	91.2	520, 549	79.0
Advanced biology	474, 547	90.1			96, 350	76.4	6, 086	99.8	576, 993	87.6
Advanced chemistry	489, 315	92.9			109, 211	86.5	4, 851	79.5	603, 377	91.6
Advanced physics	504, 394	95.8			114, 860	91.0	4, 903	80.4	624, 157	94.8
Science research seminar	226, 611	96.2			52, 886	95.2	2, 134	100.0	281, 631	96.1
All other sciences	886, 372	73.8	120, 280	92.8	106, 209	50.9	17, 754	78.7	1, 130, 615	72.4

[1] The percent is the ratio between the enrollment in the grade where the course is usually offered, in those schools not offering the course, and the enrollment in that grade in the schools of the sample.
[2] Includes regular 4-year high schools and 6-year junior-senior high schools.
[3] Junior high school.
[4] Senior high school.

thing, 10 percent of the 9th-grade pupils in the sample were in schools enrolling 9th graders but not offering general science; 3.6 percent of the 10th-grade pupils in schools enrolling 10th graders but not offering biology; 8.3 percent of the 11th-grade pupils in schools enrolling 11th graders but not offering chemistry; and 13 percent of the 12th-grade pupils in schools enrolling 12th graders but not offering physics. (See figure 7.)

Although these data may represent fairly large numbers of pupils in the case of chemistry and physics, it is quite possible, especially in the small schools, that these courses were alternated from one year to

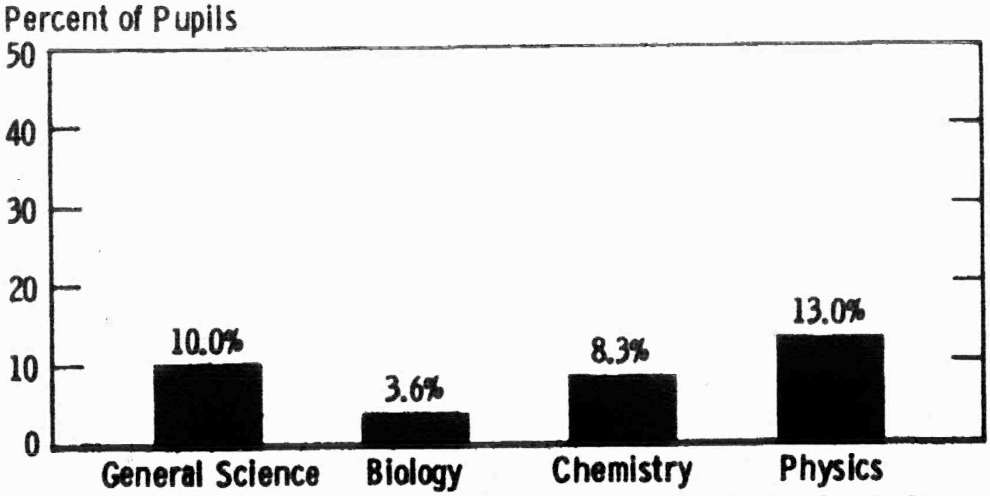


Figure 7.—Percent of Pupils in Public High School NOT Offering Certain Science Courses: Fall 1958.

NOTE.—The percent is the ratio between the enrollment in the grade where the course is usually offered, in those schools not offering the course, and the enrollment in that grade in the schools of the sample.

another so that the percentages do not reflect the true situation. The data become more encouraging when viewed in relation to those shown in table 4, which reveal that only 9.9 percent of the schools having the 12th grade offered neither physics nor chemistry. And further, these schools enrolled only 3.3 percent of all 12th grade pupils.

The data also show, as might be anticipated, that the percentages of pupils in schools not offering advanced courses were high—they ranged from 79 percent for advanced general science to 94.8 percent for advanced physics.

A closer examination of table 21 shows that in schools with enrollments of 199 and below the percentages of pupils were large except in the case of general science and biology. In the case of both chemistry and physics, however, one finds that as the school enrollment increases, the percent of pupils attending schools where these sciences were not offered, tends to decrease.

Among schools with 500 or more pupils, only 1.9 percent of the pupils attended schools where chemistry was not offered, and only 2.9 percent attended schools where physics was not offered. However, in the next smaller category (200 to 499 pupils) these percentages increase rapidly to 9.7 percent for chemistry and 20.2 percent for physics. The percent of pupils enrolled in the smallest schools where chemistry was not taught is 28.8 times as great as the percent in the largest schools. For physics this same relationship is about 22 times as great.

Table 22 presents the same kind of information as table 21, but by categories based on the grades in the school. This table is to be read as follows: In the schools of the sample having grades 9–12, 9.9 percent of the pupils were enrolled in those schools which had 11th-grade pupils, but which did not offer chemistry.

The percentage enrollment for biology, in schools having the 10th grade but NOT offering biology, was about the same for schools having grades 9–12 as it was for schools having grades 10–12. However, when the same comparison of percentage enrollments is made for chemistry, in schools having the 11th grade but not offering the subject, the percentage enrollment was approximately six times larger in schools having grades 9–12. For physics, in schools having the 12th grade but not offering the subject, the ratio was approximately five times greater in schools having grades 9–12 than in schools having grades 10–12.

The percent of pupils attending high schools that did not offer advanced general science, advanced biology, advanced chemistry, or advanced physics was significantly higher in every case for schools with grades 9–12 than for schools with grades 10–12.

Course Enrollments and Ratio to Enrollments in Grade Where Course is Usually Taught

Table 23 shows the number of pupils enrolled in certain science courses and the ratio of these enrollments, both to the enrollments in grades 9–12 and to the enrollments in the grade where the course is usually offered, as well as projections to the national level. These data are to be interpreted as follows: In the fall of 1958, the schools

Table 23.—Enrollments in Certain Science Courses and the Percent Which These Enrollments Are to Enrollments in Grades 9–12 and to Enrollments in Grade Where Course is Usually Offered: Fall 1958

Course	Sample			Estimates for United States		
	Enrollment	Percent [1] (grades 9–12)	Percent [2] (course-grade)	Enrollment	Percent [1] (grades 9–12)	Percent [2] (course-grade)
1	2	3	4	5	6	7
General science	312, 760	20. 0	66. 2	1, 581, 000	20. 2	63. 8
Biology	329, 381	21. 3	76. 5	1, 677, 000	21. 4	76. 4
Chemistry	137, 744	8. 9	37. 6	667, 000	8. 4	37. 8
Physics	77, 408	5. 0	26. 4	379, 000	4. 8	26. 5
Advanced general science	20, 004	1. 2	6. 8	98, 000	1. 2	6. 8
All other sciences	55, 010	3. 5	18. 8	278, 000	3. 5	19. 4

[1] The percent is the ratio between the course enrollment and the enrollment in grades 9–12.
[2] The percent is the ratio between the course enrollment and the enrollment in the grade where the course is usually offered.

making up the sample for this study enrolled 312,760 pupils in general science. This number was equal to 20 percent of all pupils enrolled in grades 9–12, and to 66.2 percent of all pupils enrolled in grade 9, of the sample schools. When these data are projected to the national level, it is estimated that they would represent approximately 1,581,000 pupils enrolled in 9th-grade general science. In a similar way, that number represents approximately 20.2 percent of all pupils enrolled in grades 9–12 and 63.8 percent of all pupils enrolled in grade 9 over the Nation at large. A similar interpretation can be made from the table for biology, chemistry, physics, advanced general science, and "other sciences."

It is interesting to note that within the sample of this study and that of the 1956 study, only general science has shown a dip in the ratio of percent of pupils enrolled in that course to the total enrollment in grades 9–12, while the ratio between general science enrollment and 9th-grade enrollment has remained almost unchanged. All other sciences have shown some increase in both of these percentages. Another interesting and perhaps significant factor arises when these percentages for general science are examined more closely. Between 1956 and 1958, the ratio to grades 9–12 enrollments dipped from 21.6 percent to 20 percent, while the ratio to 9th-grade enrollments

only, remained about constant. This might be attributed to the effect of the bulge in school population. It may also indicate an improved holding power on the part of general science.

Ratio of Boys to Girls

A U.S. Office of Education survey made in 1947–48[4] revealed the fact that 55.7 percent of the enrollment in public high school chemistry classes and 71 percent of the enrollment in public high school physics classes were boys. Over the past decade the percent of boys enrolled in chemistry moved slowly upward to 57 percent in 1954, 58 percent in 1956, and 59.1 percent in 1958. In the same period the percent of boys enrolled in physics jumped rather sharply to 80 percent in 1954, declined to 77.8 percent in 1956, and then dropped still further to 75.6 percent in 1958. These data appear in table 24 and figure 8.

Table 24.—Percent of Pupils in Certain Public High School Science Courses Who Were Boys: Fall 1949, 1954, 1956, and 1958

Course	Fall 1949	Fall 1954	Fall 1956	Fall 1958
	Percent	Percent	Percent	Percent
1	2	3	4	5
General science	47.9	.....	53.0	53.2
Biology	46.8	49.1	49.5	50.6
Chemistry	55.7	57.0	58.0	59.1
Physics	71.0	80.0	77.8	75.6

Although the percent of boys enrolled in general science and in biology has increased somewhat, it is less than in the case of physics and more nearly similar to the changes that have taken place in chemistry.

Tables 25 and 26 show by grades in school (type) and size of school, respectively, the percent of boys enrolled in science courses. The data in table 25 indicate that, for schools of all types and in every science subject except biology, the enrollment of boys exceeded that of girls. Only in the single instance of biology in the senior high schools is there a slight margin in favor of girls enrolled and this difference could be of a statistical nature. The ratio of boys to girls is most nearly the same in biology, in general science the boys exceed the girls by a small margin, in chemistry the difference is still more, but in physical science and physics the difference is more pronounced.

[4] Johnson, Philip G. *The Teaching of Science in Public High Schools, 1947–48* (Bulletin 1950, No. 9). Federal Security Agency, Office of Education. Washington: U.S. Government Printing Office, 1950. 48 pages.

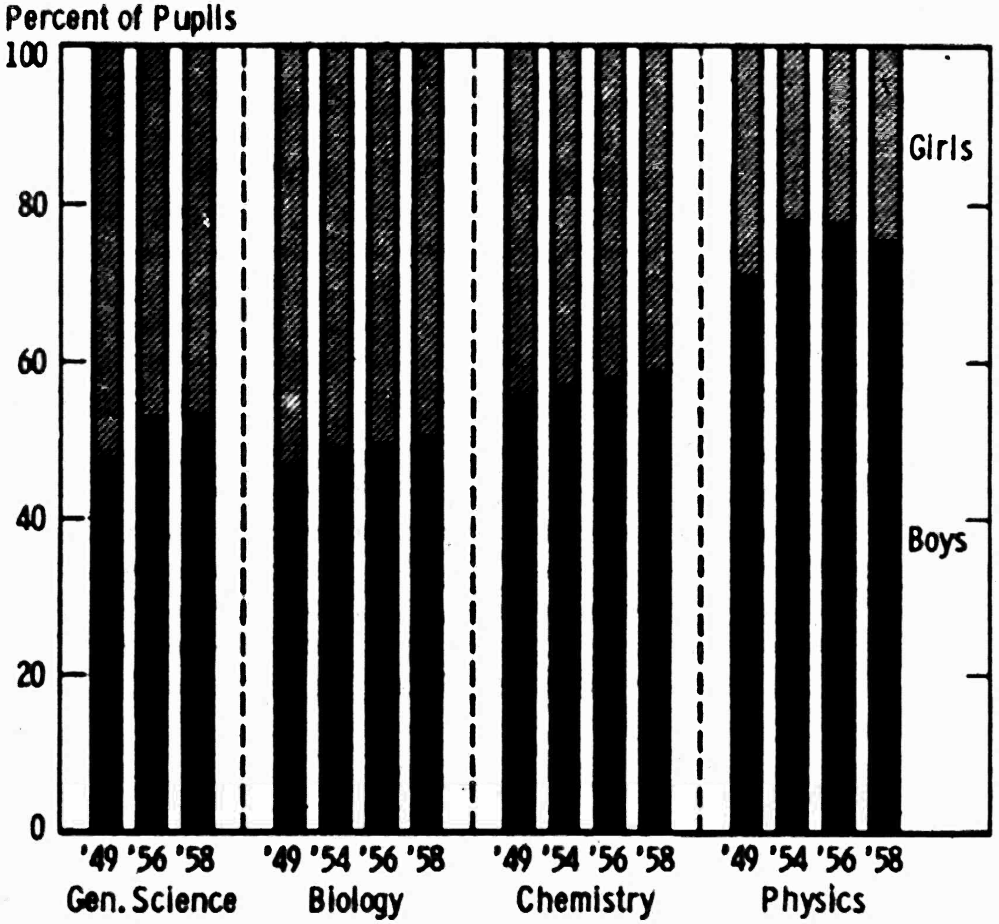


Figure 8.—Percent of Pupils in Certain Public High School Science Courses Who Were Boys: Fall 1949, 1954, 1956, and 1958.

The grades in the school appear to have had very little influence on the ratio of boys to girls in science classes, as evidenced by the reasonably consistent percentages of boys enrolled in each course in all types of schools.

In table 26, the reasonably consistent percentages shown in general science, biology, and chemistry for schools of all sizes would

Table 25.—Percent of Pupils in Certain Public High School Science Courses Who Were Boys, by Grades in School: Fall 1958

Course	Grades in school				Total
	9–12 [1]	9 only [2]	10, 11, and 12 [3]	Other	
1	2	3	4	5	6
General science	53.4	52.8	----	53.5	53.2
Biology	50.9	----	49.0	50.6	50.5
Chemistry	58.4	----	57.8	57.9	58.1
Physics	75.4	----	76.6	75.1	75.6
Advanced general science	64.4	----	61.5	73.6	63.8

[1] Includes regular 4-year high schools and 6-year junior-senior high schools.
[2] Junior high school.
[3] Senior high school.

Table 26.—Percent of Pupils in Certain Public High School Science Courses Who Were Boys, by Size of School: Fall 1958

Course	Size of school (enrollment)				Total
	1–99	100–199	200–499	500 or more	
1	2	3	4	5	6
General science	52.6	52.8	53.1	53.6	53.2
Biology	51.3	50.7	50.2	50.6	50.6
Chemistry	57.4	58.3	58.1	58.7	58.1
Physics	68.0	70.4	72.9	77.8	75.5
Advanced general science	58.0	58.3	63.4	64.8	63.7

appear to indicate that for these subjects school size was not especially influential in determining the ratio of boys to girls.

Both for physics and advanced general science, however, there is some indication that as the size of school increased there was a tendency toward higher percentages of boys in these classes. It seems possible that some factor or combination of factors, other than type or size of school, tends to influence girls to elect physics in the public high schools.

Size of Classes

The size of classes is one factor which may influence the effectiveness of high school science teaching.

In the present study data were collected to determine how the average size of science classes varied by size of school, by grades in school, and by geographic region. In the 1954 and 1956 studies, no enrollment data were collected on general science nor on any science by size of school. It should also be noted here that the present study uses a set of categories for the types of schools slightly different from the set used in either of the two previous studies.

Table 27 shows, by size of school, the average class size for the various sciences commonly taught in grades 9–12. The average class size for each science was determined by dividing the total en-

Table 27.—Average Size of Certain Public High School Science Classes, by Size of School: Fall 1958

Course	Size of school (enrollment)				Total
	1–99	100–199	200–499	500 or more	
1	2	3	4	5	6
General science	21.0	24.8	29.7	30.4	28.4
Biology	19.7	22.6	27.7	30.2	28.1
Chemistry	14.2	16.5	21.9	26.0	23.2
Physics	12.4	13.6	18.8	24.1	20.6
Advanced general science	17.1	13.5	24.9	28.6	25.9
All other sciences	8.2	21.9	25.0	28.9	25.7

rollment in schools of all sizes in a given science by the total number of sections reported in that science from the sample. The overall average class size as shown in the "total" category does not appear to have been excessive in any single science course. As might be expected, the average class size in 9th-grade general science, biology, advanced general science, and "other sciences," is somewhat larger than in physics and chemistry. The size of school does appear to have been a determinant of the average class size. Every science shows a progressive increase in average class size from the smallest through the largest schools.

Table 28 shows, by grades in school, a comparison for 1954, 1956,

Table 28.—Average Size of Certain Public High School Science Classes, by Grades in School: Fall 1954, 1956, and 1958

Course, by Year	Grades in school				Total
	9-12 [1]	9 only [2]	10, 11, and 12 [3]	Other	
1	2	3	4	5	6
General science:					
1956	27.5		29.9		28.9
1958	27.9	30.0		28.5	28.4
Biology:					
1954	26.6		30.6		27.2
1956	26.4		30.0		27.7
1958	27.6		30.4	28.7	28.1
Chemistry:					
1954	21.8		26.0		22.4
1956	21.1		26.0		22.8
1958	22.5		26.7	23.6	23.2
Physics:					
1954	18.4		24.7		19.5
1956	17.7		24.5		19.9
1958	19.8		25.0	22.0	20.6
Advanced general science:					
1958	23.7		30.9	20.8	25.3
All other sciences:					
1954	22.2		27.7		24.2
1956	23.3		27.9		25.6
1958	25.8		26.1	18.6	25.7

[1] Includes regular 4-year high schools and 6-year junior-senior high schools.
[2] Junior high school.
[3] Senior high school.

and 1958 of the average class size in certain science courses. As mentioned previously, the categories of school types were changed slightly in the 1958 study from those in the previous studies. The Johnson study made in 1947–48 indicated the average class size at that time as 26 in general science and biology, 23 in chemistry, and 19 in physics. The 1956 offerings and enrollment study showed an average class size of 28.9 in general science for all high schools. Considering the three specialized sciences, biology, chemistry, and physics, there has been relatively little change in average class size over the past decade. The average class size for general science has changed but slightly over the past 2 years. A slow and gradual increase in average class size for the three specialized sciences seems to have occurred in the

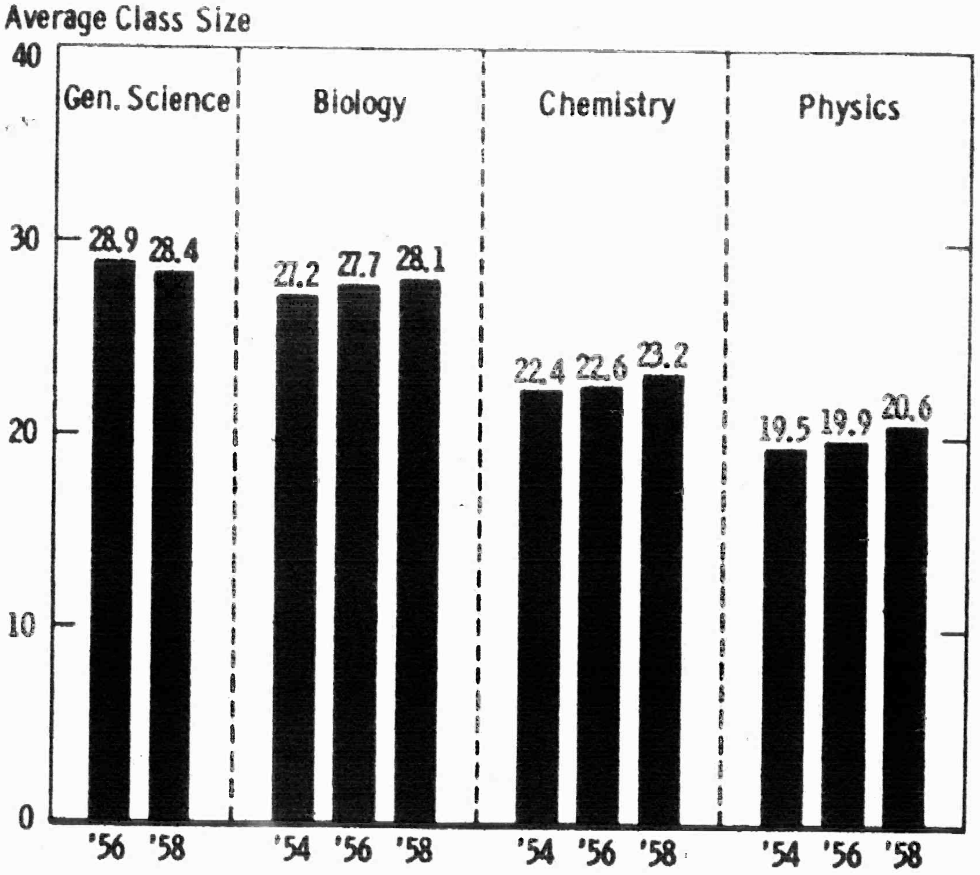


Figure 9.—Average Class Size of Certain Public High School Science Courses: Fall 1954, 1956, and 1958.

4-year period from 1954 to 1958. However, since the changes are small, they may not be statistically significant.

The grades in the school appear to have been a factor in determining average class size when the 4- and 6-year high schools are compared with those having only grades 10, 11, and 12. For each of the years under consideration in the table, and for each science course, the average class size was larger in the 3-year senior high schools than in the 4- and 6-year high schools.

Table 29 distributes the data on average class size for the years 1954, 1956, and 1958 according to geographic region. A comparison of the average class size for all regions shown in table 29 with the average class size 10 years ago, in each of the three specialized sciences, shows that there has been an increase of 2.1 pupils in biology, 0.27 in chemistry, and 1.6 in physics. This seems to indicate that class sizes in science for all geographic regions have tended to change but slightly. For most geographic regions and for most sciences there has been relatively little shift in average class size since 1954. However, there are a few exceptions: for example, chemistry in the Pacific

region, physics in the West North Central region, and "all other sciences" in four regions. It should be pointed out that even these apparent shifts might be due to sampling errors.

Table 29.—Average Size of Certain Public High School Science Courses, by Geographic Region: Fall 1954, 1956, and 1958

Course, by year	Geographic region [1]									Total [2]
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	
1	2	3	4	5	6	7	8	9	10	11
General science:										
1956	27.4	30.3	29.6	26.5	29.6	28.9	27.4	26.1	29.9	28.9
1958	26.2	29.3	28.7	26.4	31.0	25.5	27.8	27.2	29.6	28.4
Biology:										
1954	25.3	28.9	27.3	24.2	28.5	28.5	24.9	27.7	28.7	27.2
1956	26.4	29.9	26.5	23.9	29.9	28.5	27.7	26.1	28.9	27.7
1958	26.0	29.0	28.4	26.0	29.8	26.8	26.7	27.1	30.0	28.1
Chemistry:										
1954	21.4	25.6	21.7	19.4	22.7	21.7	19.3	22.0	17.3	22.4
1956	23.0	25.1	21.1	20.0	23.5	22.9	21.2	20.9	23.9	22.6
1958	22.0	25.8	23.2	20.2	24.1	21.3	21.6	21.4	24.9	23.2
Physics:										
1954	20.2	23.4	19.4	14.3	19.0	21.5	16.4	19.0	19.5	19.5
1956	20.0	22.5	19.5	17.1	19.7	21.6	17.9	19.8	19.7	19.9
1958	19.8	24.5	20.8	18.0	20.7	22.2	17.9	16.2	20.2	20.6
Advanced general science:										
1958	21.7	26.6	26.1	21.0	26.4	16.8	23.8	21.0	33.5	25.3
All other sciences:										
1954	22.8	26.0	24.2	23.7	18.6	24.6	20.2	30.1	25.9	24.2
1956	22.9	26.7	25.6	23.4	27.4	14.1	25.6	27.5	27.9	25.6
1958	24.7	27.9	26.8	23.4	29.3	28.9	16.2	19.4	25.8	25.7

[1] For names of States comprising each region, see table 50.
[2] Combines data for the 1954, 1956, and 1958 studies.

Summary of Findings

The science data in this study can be summarized in a number of short statements under appropriate headings. These statements follow below.

Offerings

1. *The percentage increases* from 1956 to 1958 in the number of schools in the two samples that enrolled pupils in the 9th, 10th, 11th, and 12th grades and offered general science, biology, chemistry, and physics in those respective grades are shown in the following tabulation:

Schools enrolling—	*Percentage increase*	
	From	*To*
9th-grade pupils and offering general science	85.5	87.7
10th-grade pupils and offering biology	89.0	92.0
11th-grade pupils and offering chemistry	57.0	72.3
12th-grade pupils and offering physics	52.0	63.9

2. *The most commonly offered sciences* in the schools of the sample and the percentages of those schools offering them are the following:

Science	Percent of schools offering the science
Biology	92.0
General science	87.7
Chemistry	72.3
Physics	63.9

3. *Advanced courses* in biology, chemistry, and physics, as well as project research seminars were offered by a small but significant number of schools in every part of the country.

4. *The number of schools offering chemistry and physics* has increased percentagewise to a greater degree over the past few years than has the number offering general science and biology.

5. *The number of senior high schools* offering biology, chemistry, and physics has changed very little percentagewise over the past few years; but the number of 4-year and 6-year high schools offering these subjects has increased steadily, percentagewise.

6. *From one geographic region to another*, a wide variation is revealed in the percent of schools offering various science courses.

Enrollments

1. General science.—The percent of the total high school population enrolled in 9th-grade general science grew steadily between 1928 and 1956, but in the last 2 years this growth appears to have been arrested, showing a slight decline from 21.8 percent in 1956 to 21.2 percent in 1958. Despite this percentage decrease the actual number of pupils enrolled in general science shows an increase from 1,518,000 in 1956 to approximately 1,581,000 in 1958.

2. Biology.—The percent of the total high school population enrolled in biology has continued the steady growth begun in 1910. During the last biennium it increased from 20.5 to 21.3 and the actual enrollment grew from 1,430,000 to approximately 1,677,000.

3. Chemistry.—In terms of the total high school population the percent of students enrolled in chemistry is at an alltime high for this century. The actual number of pupils enrolled is likewise at an alltime high. The current study shows an increase from 7.5 percent to 8.9 percent and from 520,000 pupils to 657,000 between 1956 and 1958.

4. Physics.—The downward trend in the percent of the total high school population enrolled in physics, beginning around the turn of the century, may have been arrested, since the current study shows

a small increase over the past 2 years from 4.4 percent to approximately 5 percent. It is estimated that the enrollment increased from 309,600 to 379,000.

5. **Advanced sciences.**—The percent of pupils enrolled in schools not offering advanced science courses ranges from 79 percent for advanced general science to 94.8 percent for advanced physics.

6. **Schools not offering certain sciences.**—Ten percent of all 9th graders were in schools enrolling 9th graders but offering no general science; 3.6 percent of all 10th graders were in schools enrolling 10th graders but offering no biology; 8.3 percent of all 11th graders were in schools enrolling 11th graders but offering no chemistry; and 13 percent of all 12th graders were in schools enrolling 12th graders but offering no physics.

7. **Schools offering neither chemistry nor physics.**—Only 9.9 percent of the schools enrolling 12th graders offered neither chemistry nor physics and these schools enrolled only 3.3 percent of all 12th graders.

Ratio of Boys to Girls

Over the past decade the number of boys in the four sciences of this study has exceeded the number of girls in the sample area. The percent of boys taking general science, biology, and chemistry rose slowly but steadily; while the percent taking physics rose sharply until 1954, but after that year declined. Specifically, the percents were the following:

	Percent		
	1949	1954	1958
General science	47.9	———	53.2
Biology	46.8	49.1	50.6
Chemistry	55.7	56.9	59.1
Physics	71.0	80.0	75.6

Class Size

Very little change has occurred over the past 6 years in the average size of science classes. For each of four sciences the size in the 1958 sample was as follows:

Science	Average class size (number of pupils)
General science	28.4
Biology	28.1
Chemistry	23.2
Physics	20.6
Advanced general science	25.3

Trends in Emphasis

1. Approximately two-thirds of the schools in this study reported an increased emphasis on science over the past 3 years.
2. Both size and type of school appeared to be factors related to the trend of emphasis.
3. There is some evidence that the increased emphasis on science over the past few years has been greater in certain Eastern States than in States of other parts of the Nation.

Offerings and Enrollments in Mathematics

Offerings

In this study, 3,881 (95.6 percent) of the schools with the 9th grade had pupils enrolled in elementary algebra. Generally, the schools with no pupils enrolled in this subject had very small school enrollments. About 60 percent with the 9th grade had pupils enrolled in general mathematics. Thus, most 9th-grade pupils had an opportunity to take a course in 9th-grade mathematics. (See figure 10.)

Plane geometry was given in 84.3 percent of the schools with 10th-grade pupils. Since plane geometry and intermediate algebra may be given in alternate years in very small schools, it is evident that more than 84.3 percent of the schools provided the opportunity for pupils to take plane geometry, usually a 10th-grade course.

For many years trigonometry and solid geometry have been offered in alternate semesters. This trigonometry-solid geometry combination is losing ground in favor of a trigonometry-advanced algebra combination. Intermediate or advanced algebra, usually an 11th-grade course, was offered in 73 percent of the schools. Solid geometry

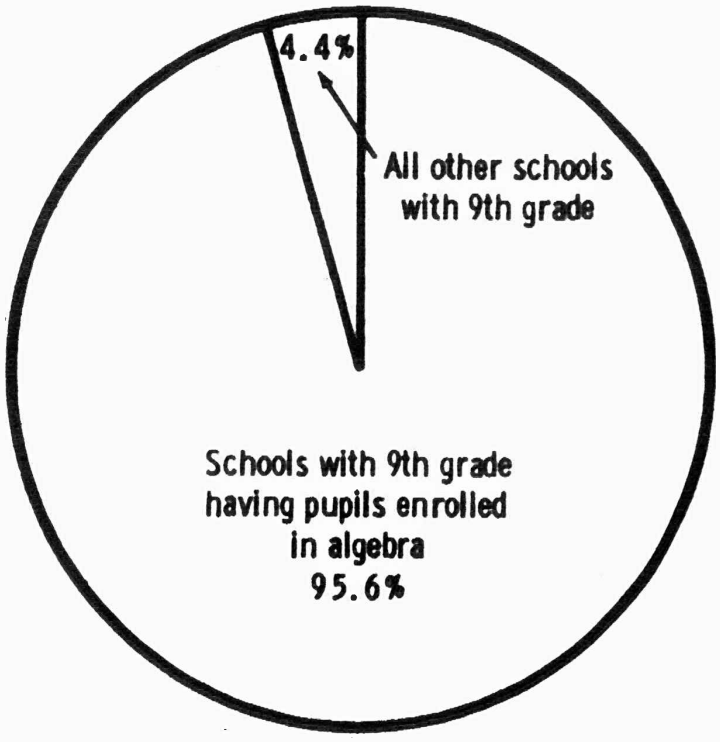


Figure 10.—Percent of Public High Schools With 9th Grade Having Pupils Enrolled in Algebra: Fall 1958.

may be included in plane geometry and frequently a separate course in solid geometry is not offered. In this study, 41.8 percent of the schools with 12th-grade pupils (the grade where trigonometry is usually offered) gave trigonometry. Only 13.7 percent of the schools had pupils enrolled in solid geometry. College mathematics for advanced standing was offered in 3.8 percent of the schools.

The attempt to provide non-college-bound 11th- or 12th-grade pupils with a course in mathematics is reflected in the number of schools that offered advanced general mathematics. Of the schools in this study 16.2 percent offered such a course.

The percentages of schools offering the various mathematics courses, distributed according to the grades in school, are given in table 30. Of the regular 4-year high school and the 6-year junior-

Table 30.—Number and Percent [1] of Public High Schools Offering Certain Mathematics Courses, by Grades in School: Fall 1958

Course	Grades in school								Total	
	9–12 [2]		9 only [3]		10, 11, and 12 [4]		Other			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
General mathematics (9th grade)	2,005	58.6	382	69.7	0	0.0	53	52.4	2,440	60.1
Elementary algebra	3,299	96.5	498	90.9	0	.0	84	83.1	3,881	95.6
Plane geometry	2,886	84.4	0	0.0	177	95.7	46	45.5	3,109	84.3
Intermediate algebra	2,458	71.9	0	.0	179	96.8	24	23.8	2,661	73.0
College algebra	153	4.5	0	.0	24	13.0	1	0.9	178	4.9
Trigonometry	1,375	40.2	0	.0	138	74.6	5	5.0	1,518	41.8
Solid geometry	430	12.6	0	.0	65	35.1	1	0.9	496	13.7
College mathematics for advanced standing	103	3.0	0	.0	33	17.8	2	2.0	138	3.8
All other college preparatory mathematics except business mathematics	298	8.7	31	5.7	20	10.8	5	5.0	354	8.3
Advanced general mathematics	520	15.2	0	.0	66	35.7	0	.0	586	16.2
All other noncollege preparatory mathematics except business mathematics	428	12.5	45	8.2	77	41.6	10	9.9	560	13.2
Total number of schools	3,420		548		185		101		4,254	

[1] In computing the percentage only those schools are included that have pupils in the grade where the course is usually offered. For example, if a school did not have pupils in the 10th grade that school was not included in the data on plane geometry regardless of whether or not it offered plane geometry.
[2] Includes regular 4-year high schools and 6-year junior-senior high schools.
[3] Junior high school.
[4] Senior high school.

senior high school (grades 9–12 and grades 7–12), 15.2 percent gave a course in advanced general mathematics; and of the senior high schools, 35.7 percent. The senior high school category (grades 10–12) is composed of large schools, while the regular 4-year or the 6-year high school category (grades 9–12 or grades 7–12) contains many small schools whose offerings are limited. Of the senior high schools, 95.7 offered plane geometry, while only 84.4 percent of the 4-year or 6-year high school did so. In the category "other grades" only 45.5 percent offered plane geometry; however, many schools in

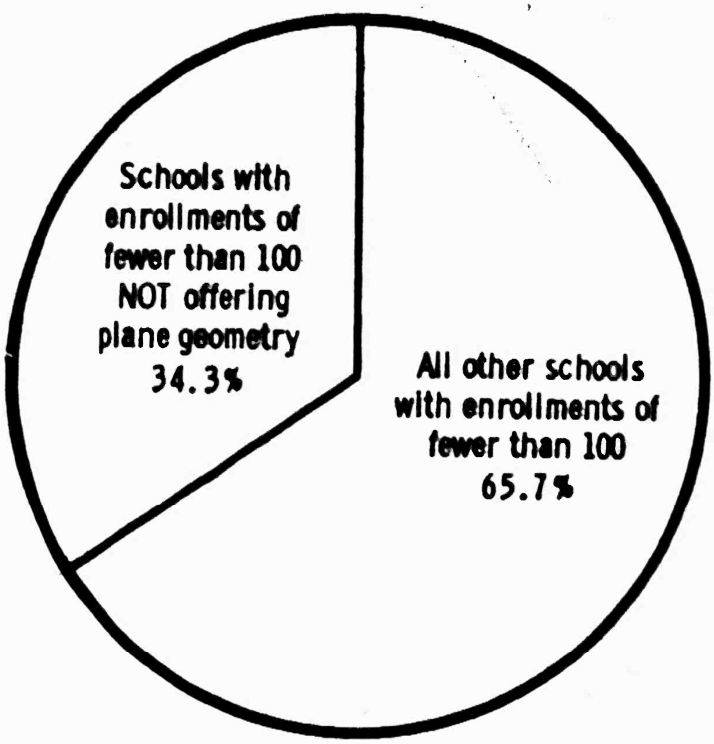
this category may not have had 10th-grade pupils. In all other categories the percentages are based on schools that had pupils in the grade where the course is normally offered. Since 15 percent of the schools did not offer plane geometry, one might conclude that 15 percent of the pupils did not have an opportunity to study this course, which is usually required of pupils going to college. Such a conclusion, however, is false, because the schools not offering plane geometry were small ones.

The number and percent of schools offering certain mathematics courses is shown by geographic region in table 31. In the Pacific region 92.2 percent offered plane geometry and in the East South Central, 75.2 percent; in the Middle Atlantic and West North Central regions the percent was 94.5 and 77.7 respectively. The largest and smallest percents for trigonometry were 76.5 and 24.5 percent in the Middle Atlantic and East South Central regions, respectively. Is the lower percent due to smaller schools with limited offerings, or to fewer college-bound pupils? Irrespective of the cause, all pupils in this study did not have an equal opportunity to take mathematics. Approximately three-fourths of the West North Central schools that had pupils in the 12th grade did not give a course in trigonometry and only a little more than half provided a course in intermediate algebra.

The pupils in this study had a much better opportunity to take mathematics if they were in a high school whose enrollment was 500 or more. (See table 32.) Among the schools with enrollments of fewer than 100, 445 (48.2 percent) offered intermediate algebra, while among those with enrollments of 500 or more, 95.2 percent offered it. Only one in eight of the small schools offered trigonometry. Even non-college-bound pupils in high schools with enrollments of 500 or more had 5 times the probability of being able to get a general mathematics course in their junior or senior year than pupils in 930 high schools with enrollments below 100 and with 12th-grade pupils. If there was mathematical talent in these small schools, apparently opportunity for its development was not being provided. Research shows that very little if any dormant mathematics talent can be awakened later if it has not had the opportunity for a good high school foundation.

Trends in Emphasis

In this study, high school principals were asked to indicate the emphasis their schools were placing on mathematics as compared with 3 years earlier. Nearly two-thirds indicated more emphasis, and about one-third, the same emphasis. Fewer than 1 percent



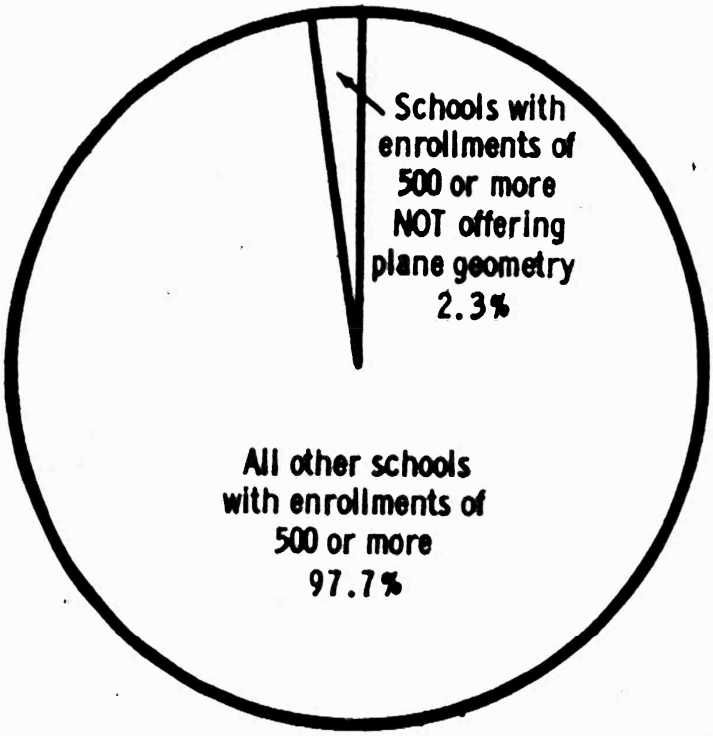


Figure 11.—Percent of Public High Schools With Enrollments of Fewer Than 100 and of 500 or More NOT Offering Plane Geometry: Fall 1958.

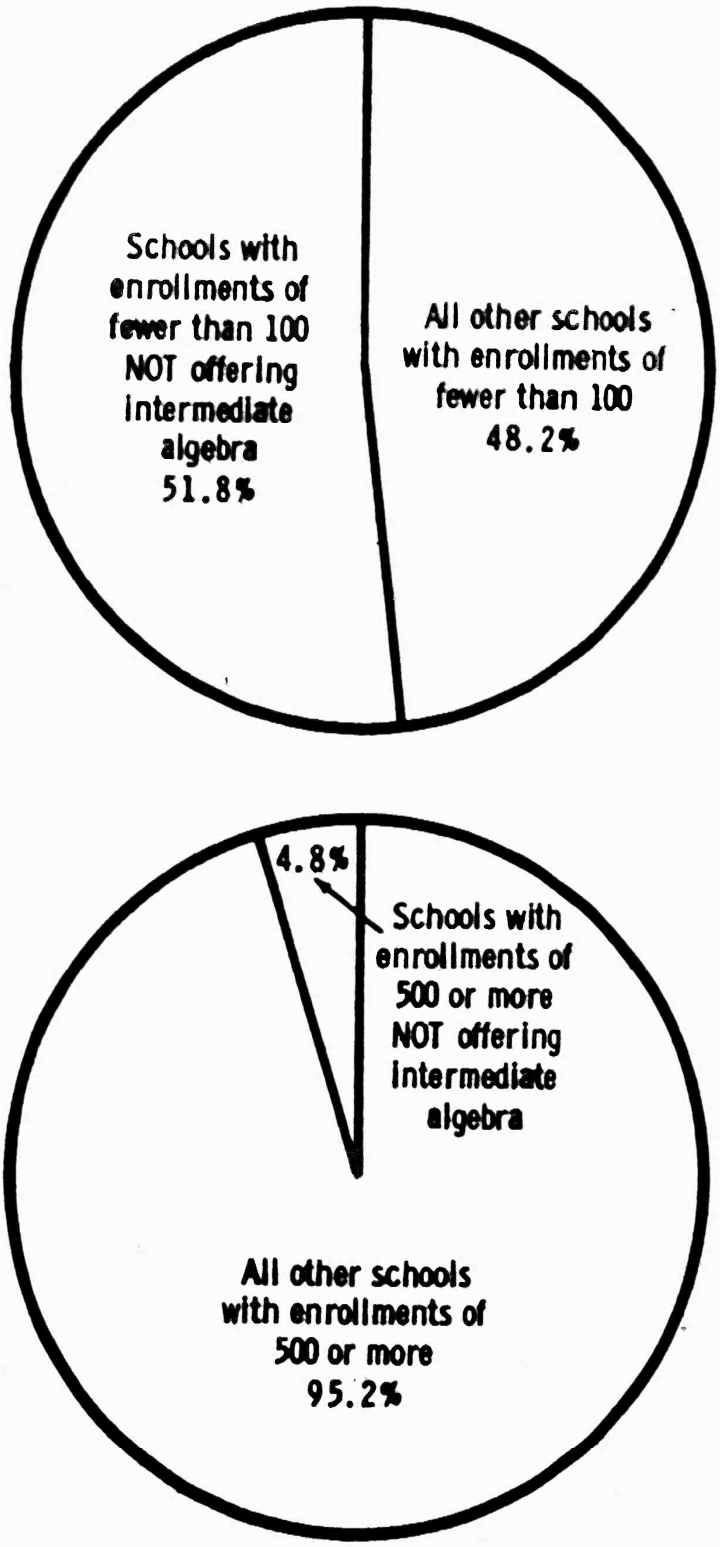


Figure 12.—Percent of Public High Schools NOT Offering Intermediate Algebra: Fall 1958.

Table 31.—Number and Percent [1] of Public High Schools Offering Certain Mathematics Courses, by Geographic Region: Fall 1958

Course	Geographic region [2]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
General mathematics (9th grade)	122	69.7	240	60.8	483	65.4	367	52.0	372	64.6	262	69.5	315	49.4	116	52.7	163	70.3	2,440	60.1
Elementary algebra	172	98.3	393	99.5	727	98.4	668	94.5	543	94.3	338	89.7	602	94.4	209	95.0	229	98.7	3,881	95.6
Plane geometry	128	86.5	328	94.5	628	92.2	527	77.7	426	81.6	255	75.2	471	80.0	169	88.0	177	92.2	3,109	84.3
Intermediate or advanced algebra	128	87.7	318	93.3	506	75.0	400	58.3	404	78.4	234	69.8	405	69.9	112	60.2	154	80.6	2,661	73.0
College algebra	13	9.0	46	13.5	51	7.6	13	1.9	29	5.7	6	1.8	8	1.4	2	1.1	10	5.2	178	4.9
Trigonometry	109	75.2	260	76.5	338	50.1	179	26.4	185	36.1	81	24.5	161	28.2	92	49.2	113	59.2	1,578	41.8
Solid geometry	12	8.3	70	20.6	151	22.4	61	9.0	57	11.1	38	11.5	57	9.9	27	14.4	23	12.0	496	13.7
College mathematics for advanced standing	14	9.7	27	7.9	22	3.3	11	1.6	23	4.5	8	2.4	14	2.5	9	4.8	10	5.2	138	3.8
All other college preparatory mathematics except business mathematics	21	11.2	63	14.8	65	8.6	34	4.7	62	10.2	22	5.6	50	7.5	18	7.9	19	7.3	354	8.3
Advanced general mathematics	34	23.4	98	28.8	76	11.3	53	7.8	107	20.9	62	18.7	72	12.6	22	11.8	62	32.5	586	16.2
All other noncollege preparatory mathematics except business mathematics	51	27.2	109	25.6	97	12.8	48	6.6	73	12.0	24	8.1	47	7.0	35	15.3	76	29.2	560	13.2
Total number of schools	188	------	425	------	768	------	723	------	606	------	292	------	671	------	229	------	260	------	4,254	------

[1] In computing the percentage, only those schools are included that have pupils in the grade where the course is usually offered. For example, if a school did not have pupils in the 10th grade, that school was not included in the data on plane geometry regardless of whether or not it offered plane geometry.

[2] For names of States comprising each region, see table 50.

Table 32.—Number and Percent [1] of Public High Schools Offering Certain Mathematics Courses, by Size of School: Fall 1958

Course	Size of school (enrollment)								Total	
	1–99		100–199		200–499		500 or more			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
General mathematics (9th grade)	450	41.8	614	59.3	842	67.5	534	76.4	2,440	60.1
Elementary algebra	940	87.4	1,015	97.8	1,232	98.7	694	99.3	3,881	95.6
Plane geometry	626	65.7	725	81.1	959	93.7	799	97.7	3,109	84.3
Intermediate or advanced algebra	445	48.2	580	64.9	858	84.6	778	95.2	2,661	73.0
College algebra	8	0.9	11	1.2	40	4.0	119	14.7	178	4.9
Trigonometry	120	12.9	258	29.3	519	51.6	621	76.6	1,518	41.8
Solid geometry	35	68.2	69	7.8	138	13.7	254	31.3	496	13.7
College mathematics for advanced standing	7	0.8	14	1.6	26	2.6	91	11.2	138	3.5
All other college preparatory mathematics except business mathematics	71	6.5	60	5.8	108	8.4	115	13.6	354	8.3
Advanced general mathematics	61	6.6	103	11.7	167	16.6	256	31.6	587	16.2
All other noncollege preparatory mathematics except business mathematics	37	3.4	78	7.5	144	11.3	301	35.5	560	13.2
Total number of schools	1,088	.....	1,039	.....	1,288	.....	847	.....	4,264	.....

[1] In computing the percentage only those schools are included that have pupils in the grade where the course is usually offered. For example, if a school did not have pupils in the 10th grade, that school was not included in the data on plane geometry, regardless of whether or not it offered plane geometry.

indicated less emphasis. The interest in the question is shown by the fact that 97.4 percent of the principals answered it.

Table 33 shows the variation in change of emphasis among the geographic regions. In the South Atlantic region 70.6 percent of the responding schools were placing greater emphasis on mathematics, and in the Mountain region 55.5 percent. In each region more than half the schools of the sample had increased their emphasis on mathematics since 3 years previous.

Table 34 gives the same information as table 33, only by grades in school. Of the schools having pupils in grades 9–12, 2,229 schools, or 65 percent, emphasized mathematics more than 3 years previous. For the schools enrolling 9th-grade pupils but no 10th-, 11th-, or 12th-grade pupils, the percent was 49.6; and for the schools having only 10th-, 11th-, and 12th-grade pupils, it was 76.8. Although the number in the sample in each of these two categories was small, and therefore generalizations should be made with caution, it may be that emphasis on mathematics has been increased more in the senior high schools than in the regular 4-year high schools.

Table 35 contains the same information as the two previous tables, but presents it by size of school. The data in the three tables reflect the national concern regarding the amount of mathematics offered in our public high schools.

Table 33.—Number and Percent of Public High Schools Giving Certain Degrees of Emphasis to Mathematics as Compared With Emphasis in Fall 1955, by Geographic Region: Fall 1958

Emphasis	Geographic region [1]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
More	119	63.3	287	67.5	474	62.4	418	57.8	428	70.6	235	59.9	444	66.2	127	55.5	166	63.8	2,698	63.4
Same	64	34.0	132	31.1	267	35.1	288	39.8	158	26.1	135	34.4	201	30.0	91	39.7	88	33.8	1,424	33.5
Less	1	0.5	0	0.0	3	0.4	1	0.1	5	0.8	6	1.5	3	0.4	1	0.4	0	0.0	20	0.5
No reply	4	2.1	6	1.4	16	2.1	16	2.3	15	2.5	16	4.1	23	3.4	10	4.4	6	2.3	112	2.6
Total	188	100.0	425	100.0	760	100.0	723	100.0	606	100.0	392	100.0	671	100.0	229	100.0	260	100.0	4,254	100.0

[1] For names of States comprising each region, see table 50.

Table 34.—Number and Percent of Public High Schools Giving Certain Degrees of Emphasis to Mathematics as Compared With Emphasis in Fall 1955, by Grades in School: Fall 1958

Emphasis compared with 1955	Grades in school								Total	
	9–12 [1]		9 only [2]		10, 11, and 12 [3]		Other			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
More	2,229	65.2	272	49.6	142	76.8	54	53.5	2,697	63.4
Same	1,092	31.9	261	47.6	38	20.5	32	31.7	1,423	33.5
Less	15	0.4	0	0.0	0	0.0	2	2.0	17	0.4
No reply	84	2.5	15	2.7	5	2.7	13	12.8	117	2.7
Total	3,420	100.0	548	100.0	185	100.0	101	100.0	4,254	100.0

[1] Includes regular 4-year high schools and 6-year junior-senior high schools.
[2] Junior high school.
[3] Senior high school.

Trends in Curriculum Revision

The high school principals were also asked: "Is the mathematics curriculum in your school being revised this year?" To this question 40 percent of the answers were in the affirmative. The percent ranged from around 36 in small schools to 48 in large schools. (See table 36.) In 1952[1] a study was made of curriculum guides. Approximately 50 percent of the guides available at that time were at least 3 years old. Hence, if 40 percent of the schools actually revised curriculum materials during 1957, activity in this area has increased notably.

Table 35.—Number and Percent of Public High Schools Giving Certain Degrees of Emphasis to Mathematics as Compared With Emphasis in Fall 1955, by Size of School: Fall 1958

Emphasis	Size of school (enrollment)								Total	
	1–99		100–199		200–499		500 or more			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
More	586	53.9	632	60.8	871	68.0	609	71.9	2,698	63.4
Same	458	42.1	370	35.6	376	29.4	220	26.0	1,424	33.5
Less	8	0.7	8	0.8	3	.2	1	.1	20	.5
No reply	36	3.3	29	2.8	30	2.4	17	2.0	111	2.6
Total	1,088	100.0	1,039	100.0	1,280	100.0	847	100.0	4,254	100.0

[1] Brown, Kenneth E. *Curriculum Materials in High-School Mathematics* (Bulletin 1954, No. 9). U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1954. 40 pages.

Table 36.—Number and Percent of Public High Schools Replying to the Question, "Is the Mathematics Curriculum Being Revised This Year?", by Size of School: Fall 1958

Reply	Size of school (enrollment)								Total	
	1–99		100–199		200–499		500 or more			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
Yes	398	36.6	368	35.4	532	41.6	408	48.2	1,706	40.1
No	620	57.0	602	57.9	674	52.7	398	47.0	2,294	53.9
No reply	70	6.4	69	6.6	74	5.7	41	4.8	254	6.0
Total	1,088	100.0	1,039	100.0	1,280	100.0	847	100.0	4,254	100.0

Table 37 gives the same information as table 36, but by grades in school. Exactly half the schools with 10th, 11th, and 12th grades were revising the mathematics curriculum. Nearly 40 percent of the schools having pupils at the 9th-grade level only were doing so. Thus, irrespective of the grades in the school, this survey indicates considerable activity in mathematics curriculum development. Table 38 shows the extent by geographic region.

Enrollment

The percentages of pupils in the last 4 years of public high schools enrolled in algebra, geometry, and trigonometry from 1889–90 through 1958–59 are shown in table 39. Algebra includes all algebra offered in high school; likewise geometry includes both plane geometry and solid geometry. Although trigonometry includes both plane trigonometry and spherical trigonometry, the number enrolled in spherical trigonometry in recent years has been very small.

Table 37.—Number and Percent of Public High Schools Replying to the Question, "Is the Mathematics Curriculum Being Revised this Year?", by Grades in School: Fall 1958

Reply	Grades in school								Total	
	9–12 [1]		9 only [2]		10, 11, and 12 [3]		Other			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11
Yes	1,358	39.7	217	39.6	88	47.6	39	38.6	1,702	40.0
No	1,852	54.2	305	55.7	88	47.6	48	47.5	2,293	53.9
No reply	210	6.1	26	4.7	9	4.9	14	13.9	259	6.1
Total	3,420	100.0	548	100.0	185	100.0	101	100.0	4,254	100.0

[1] Includes regular 4-year high schools and 6-year junior-senior high schools.
[2] Junior high school.
[3] Senior high school.

Table 38.—Number and Percent of Public High Schools Replying to the Question, "Is the Mathematics Curriculum Being Revised This Year?", by Geographic Region: Fall 1958

Reply	Geographic region [1]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Yes	96	51.1	225	52.9	280	36.8	254	35.1	254	41.9	140	35.7	275	41.0	80	34.9	102	39.3	1,706	40.1
No	81	43.1	177	41.6	453	59.6	420	58.1	312	51.5	222	56.6	348	51.9	133	58.1	148	56.9	2,294	53.9
No reply	11	5.8	23	5.5	27	3.6	49	6.8	40	6.6	30	7.7	48	7.1	16	7.0	10	3.8	254	6.0
Total	188	100.0	425	100.0	760	100.0	723	100.0	606	100.0	392	100.0	671	100.0	229	100.0	260	100.0	4,254	100.0

[1] For names of States comprising each region, see table 50.

The percentage of pupils enrolled in algebra declined steadily from 1900 to 1954. From the school year 1954–55 to the school year 1958–59, there was an increase from 24.8 to 30.1 percent. Of course, the question of concern to those interested in the supply of scientific manpower is whether the increase has been in the number enrolled in second-year algebra (usually an elective) or first-year algebra (in many cases a required subject). Data on this question will be presented later.

A subject usually recommended for college preparatory pupils, especially those who plan on scientific careers, is geometry. For many years the percentage of pupils enrolled in this subject declined. In fact, from 1934 to 1954, while high school enrollments as a whole were increasing, the actual geometry enrollments were decreasing. Table 39 shows that from 1956–57 and 1958–59 there was a slight decrease in the percent taking geometry. The percent taking trigonometry has varied since 1890 between 1.3 and 2.9 percent of the total high school population. Percentages of pupils taking geometry and trigonometry in 1958–59 were slightly lower than for 1956–57. These slight differences, however, may not be statistically significant.

Table 39.—Percent of Pupils in the Last 4 Years of Public High Schools in Certain Mathematics Courses: 1889–90 Through 1958–59

Year	Percent of pupils in—			Year	Percent of pupils in—		
	Algebra	Geometry	Trigonometry		Algebra	Geometry	Trigonometry
1	2	3	4	1	2	3	4
1890 [1]	45.4	21.3	1.9	1934 [1]	30.4	17.1	1.3
1900 [1]	56.3	27.4	1.9	1949 [1]	26.8	12.8	2.0
1910 [1]	56.9	30.9	1.9	1952–53 [2]	24.6	11.6	1.7
1915 [1]	48.8	26.5	1.5	1954–55 [3]	24.8	12.3	2.6
1922 [1]	40.2	22.7	1.5	1956–57 [4]	28.7	13.6	2.9
1928 [1]	35.2	19.8	1.3	1958–59 [5]	30.1	13.1	2.7

[1] "Biennial Survey of Education in the United States—1948–50", ch. 5. "Offerings and Enrollments in High School Subjects, 1948–49", p. 187, table 7. U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1951. 118 pages.
[2] Brown, Kenneth E. "Mathematics in Public High Schools" (Bulletin 1953, No. 5), p. 34. U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1953. 47 pages.
[3] ——— "Offerings and Enrollments in Science and Mathematics in Public High Schools, 1954" (Pamphlet No. 118), p. 11, table 5. U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1956. 24 pages.
[4] ——— and Ellsworth S. Obourn. "Offerings and Enrollments in Science and Mathematics in Public High Schools, 1956" (Pamphlet No. 120), p. 9, table 3. U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1957. 44 pages.
[5] Estimates based on this study.

In further interpretation of table 39, at least two other facts should be observed. First, the percentage given is the ratio of pupils taking the subject to all the pupils in the last 4 years of high school. For example, the percentage for trigonometry in 1958 is 2.7, which means that 2.7 percent of all those enrolled in the last 4 years of public high school were enrolled in trigonometry. If all pupils in the 12th grade (where trignonometry is usually offered) were enrolled in trig-

onometry, the percentage would be less than 25. Second, since the number of high school pupils has increased in recent years, the percentage of pupils in a subject may have remained constant or may even have decreased, while the number actually has increased. For example, the percentage of pupils enrolled in trigonometry has remained rather constant over the years, but the number has constantly increased until now it is 20 times the number in 1900.

Course Enrollments and Ratio to Enrollments in Grade Where Course Is Usually Taught

A different, perhaps more accurate, picture of mathematics enrollments is given by using, as a base, the enrollments in the grade where the course is usually offered, rather than the total enrollment in the last 4 years of high school.

Table 40 shows mathematics enrollments expressed as the percentage of pupils in the grade where the course is usually offered. It may be read as follows: The number of pupils enrolled in elementary algebra in all schools of the study in 1958 is 332,444, which is 71.6 percent of the number of 9th-grade pupils. The data on elementary algebra pupils in New England may be read in this manner: The number of pupils this study enrolled in elementary algebra in New England is 15,589, or 64 percent of the New England 9th-grade pupils in the sample. Thus, the table gives the percentage of elegible pupils taking the indicated subject. The percentage varies widely from region to region. For example, in intermediate algebra the percentage is 51.6 in the West South Central States and 23.8 in the Pacific States. A comparison of tables 31 and 40 shows a lack of correlation between the geographic regions that have the greatest number of schools offering a course in mathematics and the greatest percentage of pupils enrolled in the course. One might raise the question as to why in one region half the pupils are enrolled in intermediate algebra and, in another, only one-fourth. It hardly seems possible that only half as many pupils in one region as those in another region can profit from studying the subject.

Information, similar to that in the present study, on percentages of pupils taking mathematics, was compiled in 1954[2] and 1956.[3] Table 41 compares the data. Over this period (1954–58) an increase has occurred in the percentage of pupils taking all courses in mathematics except general mathematics (9th grade) and solid geometry.

[1] Brown, Kenneth E. *Offerings and Enrollments in Science and Mathematics in Public High Schools* (Pamphlet No. 118). U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1956. 24 pages.

[2] ——— and Ellsworth S. Obourn. *Offerings and Enrollments in Science and Mathematics in Public High Schools* (Pamphlet No. 120). U.S. Department of Health, Education, and Welfare, Office of Education. Washington: U.S. Government Printing Office, 1958. 44 pages.

Figure 13.—Percent of Public High School Pupils in Intermediate Algebra, Expressed as the Percent of Pupils in Grade Where the Course Is Usually Offered, by Geographic Region: Fall 1958.

Table 40.—Number and Percent [1] of Pupils in Certain Public High School Mathematics Courses, by Geographic Region: Fall 1958

Course	Geographic region [2]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
General mathematics	7,287	29.9	19,896	27.7	31,709	32.4	15,177	33.9	30,825	43.7	14,057	46.7	18,670	36.7	6,280	26.4	15,778	31.7	159,679	34.4
Elementary algebra	15,589	64.0	47,789	66.6	66,285	67.7	34,948	77.9	48,748	69.1	25,296	83.9	43,586	85.6	17,122	71.9	33,081	66.4	332,444	71.6
Plane geometry	10,870	48.9	35,649	48.9	42,799	47.0	19,183	45.7	21,897	34.8	10,440	34.4	22,275	50.4	8,810	46.8	20,405	44.2	192,328	44.7
Intermediate algebra	8,918	46.7	28,892	44.3	21,285	27.6	10,131	27.4	22,444	45.4	10,393	43.5	18,455	51.6	4,413	27.8	9,776	23.8	134,707	37.0
Trigonometry [3]	2,817	18.9	8,039	15.6	6,135	9.9	2,949	9.3	4,299	11.0	1,493	7.6	3,335	11.2	1,550	12.3	2,962	9.4	33,579	11.5
Solid geometry [3]	478	3.2	1,990	3.9	3,100	5.0	1,311	4.2	1,310	3.3	717	3.7	1,545	5.2	512	4.1	552	1.8	11,515	3.9
All other	6,525	8.1	24,863	9.3	16,884	8.2	4,176	13.2	18,083	8.1	5,133	4.9	8,187	8.0	5,282	7.4	15,852	8.9	103,515	6.7

[1] The percent is based on the number of pupils in the grade where the course is usually offered.
[2] For names of States comprising each region, see table 50.
[3] Usually half-year subjects.

Table 41.—Enrollments in Certain Public High School Mathematics Courses Expressed as a Percent of the Pupils in the Grade Where the Course is Usually Offered, by Geographic Region: Fall 1954, 1956, and 1958

Course by year	Geographic region [1]									Total
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	
1	2	3	4	5	6	7	8	9	10	11
General mathematics (9th grade)										
1954	30.8	32.1	40.8	44.2	61.0	55.2	46.7	49.0	45.8	44.5
1956	33.7	30.7	40.6	42.4	58.7	57.8	44.8	44.6	42.8	43.1
1958	29.9	27.7	32.4	33.9	43.7	46.7	36.7	26.4	31.7	34.4
Elementary algebra										
1954	60.8	60.3	60.7	66.4	64.2	72.5	72.2	81.8	69.9	64.5
1956	59.8	63.7	65.6	72.8	61.9	74.8	83.2	76.9	57.2	67.0
1958	64.0	66.6	67.7	77.9	69.1	83.9	85.6	71.9	66.4	71.6
Plane geometry										
1954	44.1	44.8	37.7	36.3	26.4	33.6	45.7	37.5	32.3	37.4
1956	45.3	47.7	42.7	43.9	28.1	36.8	43.3	52.1	41.5	41.6
1958	48.9	48.9	47.0	45.7	34.8	34.4	50.0	46.8	44.2	44.7
Intermediate algebra										
1954	34.0	37.3	16.8	16.2	37.9	36.5	45.1	15.2	12.8	28.5
1956	38.4	42.0	21.5	22.1	40.6	38.2	41.7	24.6	20.4	32.2
1958	46.7	44.3	27.6	27.4	45.4	43.5	51.6	27.8	23.8	37.0
Solid geometry										
1954	12.9	8.7	6.8	4.8	4.8	4.7	5.5	5.0	5.0	6.5
1956	10.3	10.4	8.5	7.1	6.9	6.9	5.2	8.8	4.5	7.6
1958	3.2	3.9	5.0	4.2	3.3	3.7	5.2	4.1	1.8	3.9
Plane trigonometry										
1954	13.1	12.7	6.3	5.3	5.6	4.4	4.4	6.7	6.0	7.4
1956	13.4	15.1	9.2	6.4	6.3	5.3	6.0	12.8	8.3	9.2
1958	18.9	15.6	9.9	9.3	11.0	7.6	11.2	12.3	9.4	11.5

[1] For names of States comprising each region, see table 50.

The percentage of pupils enrolled in general mathematics has decreased from 44.5 to 34.4 and the decrease has been rather uniform in all geographic regions. The increase in the percentage taking elementary algebra has been from 64.5 to 71.6, which does not equal the decrease in general mathematics. The net result is a decrease in the percentage of pupils taking 9th-grade mathematics. The reader will observe that the sum of the percentages of pupils in elementary algebra and general mathematics exceeds 100. This is because some 10th-grade pupils took elementary algebra.

In many schools, solid geometry is not offered as a separate course but is included in the plane geometry course. Instead of the separate course in solid geometry, algebra is given. This trend is reflected in the decrease in the percentage of pupils taking solid geometry (6.5 to 3.9) and the increase in the percentage taking intermediate algebra (28.5 to 37).

Pupils in Schools Not Offering Mathematics

Previous tables have shown that schools *not* offering mathematics were small ones. Table 42 shows, by geographic region, the number and percent of pupils in the sample schools not offering mathematics who were enrolled in the grades where the course is usually given.

Table 42.—Number and Percent [1] of Pupils in Public High Schools NOT Offering Certain Mathematics Courses, by Geographic Region: Fall 1958

Course [2]	Geographic region [3]																		Total	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
General mathematics (9th grade)	6,641	27.3	21,370	27.5	26,021	26.6	14,760	32.9	18,916	26.8	8,378	27.8	17,630	34.6	10,067	42.3	13,114	26.3	136,897	29.5
Elementary algebra	120	.5	375	.5	603	.6	964	2.2	2,357	3.3	1,003	3.3	1,154	2.2	119	.5	323	.6	7,018	1.5
Plane geometry	740	3.3	2,947	4.0	2,496	2.7	3,641	8.7	6,414	10.2	3,565	11.7	3,153	7.1	669	3.6	480	1.0	24,105	5.6
Intermediate or advanced algebra	534	2.8	2,707	4.2	7,200	9.3	7,143	19.3	5,691	11.5	4,140	17.3	4,258	11.9	2,065	13.0	1,692	4.1	35,430	9.7
Trigonometry	1,268	8.5	10,153	19.8	22,074	35.6	15,265	48.4	15,194	38.7	10,776	55.0	12,591	42.2	2,787	22.1	6,992	22.2	97,100	33.2
Solid geometry	12,067	81.1	35,508	69.1	39,186	63.2	24,511	77.7	30,799	78.5	14,977	76.5	19,430	65.2	9,117	72.4	26,280	83.5	211,875	72.4

[1] The percent is the ratio of the enrollment in the grade where the course is usually offered in those schools not offering the course and the enrollment in that grade in the schools of the sample.
[2] Information not available on college algebra, college mathematics for advanced standing, all other college preparatory mathematics courses, and advanced general mathematics.
[3] For names of States comprising each region, see table 50.

The table should be read as follows: The schools that did not offer general mathematics (9th grade) enrolled 136,897 9th-grade pupils, or 29.5 percent of all 9th-grade pupils in the study. Schools not offering general mathematics in the New England region enrolled 27.3 percent of the 9th-grade pupils in the sample schools of that region.

The schools that did not offer elementary algebra enrolled 7,018 pupils, or 1.5 percent of all 9th-grade pupils in the sample.

About one-third of all 12th-grade pupils were in schools that did not offer trigonometry in the fall of 1958. It should not be assumed that one-third of the eligible pupils could not enroll in trigonometry, which is usually a half-year subject. Many schools not offering trigonometry in the fall may offer it in the spring. Small schools may offer a course in alternate years, thus making it possible for a student to take it in one or the other year.

The variation by geographic region in the number of pupils enrolled in schools not offering the six mathematics courses named is revealing. Nearly 20 percent of all 11th-grade pupils in the West North Central region were in schools not offering intermediate algebra. Although schools not offering certain mathematics courses are usually small ones, still the total number of pupils denied an opportunity to develop their potential in mathematics is considerable.

Ratio of Boys to Girls

The number of boys exceeded the number of girls in all the mathematics courses of this study. In 9th-grade algebra, 53.2 percent of the pupils were boys. In elective courses the percentage of boys was higher. (See figure 14.) In solid geometry, usually an elective 12th-grade course, 78.4 percent of the pupils were boys.

Table 43 shows the percentage of pupils who were boys in the various mathematics courses for 1954, 1956, and 1958. The 1958 data are not strictly by grade organization. All schools with only 9th-grade enrollments in the last 4 years of high school are placed in the junior high school category. Those with enrollments in only grades 10, 11 and 12 are placed in the senior high school category. The regular 4-year high schools (grades 9–12) in the 1958 sample were not separated from the junior-senior high schools (grades 7–12); hence, the latter are all grouped together in the tables with the 4-year high schools. The schools with enrollments in other combinations of grades, or schools without grade divisions, were grouped under the category "other."

The ratio of boys to girls varies little from one type of school organization to another or from one year to another. Since considerable publicity has been given to the need for more scientists and

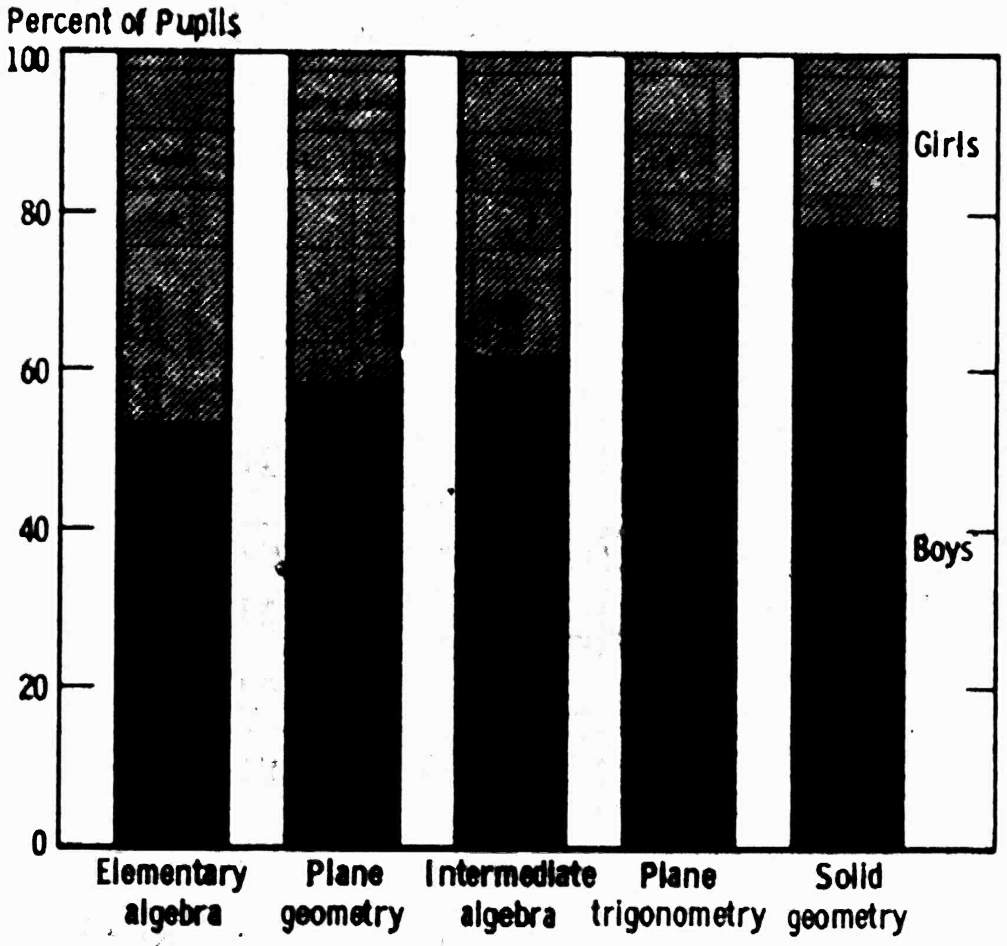


Figure 14.—Percent of Pupils in Certain Public High School Mathematics Courses Who Were Boys: Fall 1958.

engineers, one might expect the ratio of boys to girls to increase, especially in the advanced courses. The data, however, do not support this conclusion.

Table 44 shows the number of boys and girls in the 1958 sample of certain mathematics courses. In some courses the sum of the boys and the girls does not equal the total enrollment in the course as shown in other tables. This is due to the fact that some reports gave total enrollment data, but none for boys and girls separately. Thus, the ratio of boys to girls is the actual ratio of boys to girls as reported in the sample. No estimates were made for the few schools that did not supply the data. In some categories, the number is too small for valid generalizations. For example, the number of boys and girls taking geometry or intermediate algebra in schoools with no pupils higher than grade 9 is small. Since only a few schools offer algebra to 8th-grade pupils, the number of pupils eligible for geometry or intermediate algebra in the 9th grade is small. In fact, the 1956 survey showed that the number enrolled in such courses was negligible.

Table 43.—Percent of Pupils in Certain Public High School Mathematics Courses Who Were Boys, by Grades in School: Fall 1954, 1956, and 1958

Course, by year	Grades in school					
	9–12 [1]	9 only	10, 11, and 12	7–12	Other	Total
1	2	3	4	5	6	7
General mathematics (9th grade):						
1954	53.9	51.3	55.4	53.3	51.1	52.9
1956	54.7	51.1	53.8	52.3	50.8	52.8
1958	53.9	52.1	55.1	----	52.6	53.5
Elementary algebra:						
1954	53.0	50.2	51.8	52.4	50.0	52.5
1956	53.1	50.5	54.2	52.4	52.5	52.6
1958	53.5	50.3	56.6	----	52.2	53.2
Plane geometry:						
1954	58.7	----	58.8	58.1	58.4	58.0
1956	58.1	----	58.7	58.6	58.1	58.9
1958	58.5	51.6	57.6	----	57.3	58.3
Intermediate algebra:						
1954	60.8	----	63.9	60.9	57.7	60.9
1956	61.8	----	62.5	63.9	60.5	62.3
1958	62.0	54.4	61.5	----	58.4	61.8
Plane trigonometry:						
1954	81.4	----	80.9	75.7	74.8	78.5
1956	79.2	----	79.8	77.7	78.1	78.9
1958	76.3	----	77.3	----	67.6	76.4
Solid geometry:						
1954	81.3	----	80.3	75.9	78.3	78.8
1956	79.7	----	79.4	77.5	82.5	79.3
1958	78.9	----	76.2	----	86.9	78.4
Other high school mathematics:						
1954	61.2	----	63.8	64.9	48.5	61.7
1956	62.1	----	63.1	58.0	57.2	61.3
1958	60.3	43.2	58.2	----	53.6	58.8

[1] For 1958 only, also includes 6-year junior senior high schools.

Tables 45 and 46 also deal with the same areas as table 44 and again show what percentages of the pupils were boys, but by geographic region in the case of the former and size of school (enrollment) in the case of the latter.

Size of Classes

The largest classes reported by the present study were algebra classes in schools having enrollments of 500 or more. The average class size was 29.3. (See table 47.) The size was computed by dividing the enrollment in the course by the number of course sections. For example, 4,819 elementary algebra sections in schools of 500 or more enrollment had 141,170 pupils. Thus the average class size was 141,170 divided by 4,819, or 29.3.

It must be admitted that this single index (average class size) does not actually reflect the true classroom situation. There is usually no class of "average size"—all classes are either larger or smaller than the average. The actual number of very large classes and the actual number of very small classes were not secured in this survey. The best available index to class size is therefore *average* class size.

Table 44.—Number of Boys and Girls in Certain Public High School Courses, and Percent Who Were Boys, by Grades in School: Fall 1958

Course	Grades in school												Total		
	9–12 [1]			9 only [2]			10, 11, and 12 [3]			Other					
	Boys	Girls	Percent [4]	Boys	Girls	Percent [4]	Boys	Girls	Percent [4]	Boys	Girls	Percent [4]	Boys	Girls	Percent [4]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
General mathematics (9th grade)	58, 918	50, 299	53. 9	19, 570	17, 976	52. 1	932	761	55. 1	1, 447	1, 305	52. 6	80, 867	70, 341	53. 5
Elementary algebra	123, 381	107, 057	53. 5	28, 783	25, 489	50. 3	9, 833	6, 935	58. 6	3, 340	3, 082	52. 2	165, 337	145, 543	53. 2
Plane geometry	82, 837	58, 764	58. 3	254	244	51. 0	17, 748	13, 864	57. 6	1, 799	1, 340	57. 3	102, 638	73, 412	58. 3
Intermediate advanced algebra	61, 101	37, 412	62. 0	361	303	54. 4	18, 441	8, 422	61. 5	1, 195	851	58. 4	76, 098	46, 988	61. 8
College algebra	3, 862	1, 185	76. 5	0	0	0. 0	853	333	71. 9	26	12	68. 4	4, 741	1, 530	75. 6
Trigonometry	19, 223	5, 975	78. 3	0	0	0. 0	4, 249	1, 251	77. 3	171	82	67. 6	23, 643	7, 308	76. 4
Solid geometry	5, 962	1, 592	78. 9	0	0	0. 0	1, 733	540	76. 2	53	8	86. 9	7, 748	2, 140	78. 4
College mathematics for advanced standing	1, 443	592	70. 9	0	0	0. 0	712	251	73. 9	42	26	61. 8	2, 197	869	71. 7
Advanced general mathematics	13, 457	10, 698	55. 7	376	333	53. 0	3, 780	2, 849	57. 0	304	305	49. 9	17, 917	14, 185	55. 8
All other noncollege preparatory mathematics except business mathematics	16, 257	9, 642	62. 8	1, 656	2, 191	43. 0	5, 617	3, 734	60. 1	556	420	57. 0	24, 086	15, 987	60. 1

[1] Includes regular 4-year high schools and 6-year junior-senior high schools.
[2] Junior high school.
[3] Senior high school.
[4] Percent of pupils who are boys.

Table 45.—Number of Boys and Girls in Certain Public High School Mathematics Courses, and Percent Who Were Boys, by Geographic Region: Fall 1958

Course	Geographic region [1]														
	New England			Middle Atlantic			East North Central			West North Central			South Atlantic		
	Boys	Girls	Percent [2]	Boys	Girls	Percent [2]	Boys	Girls	Percent [2]	Boys	Girls	Percent [2]	Boys	Girls	Percent [2]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
General mathematics (9th grade)	4,021	3,018	57.1	10,605	8,326	56.0	15,785	13,546	53.8	7,714	6,595	53.9	15,377	13,987	52.4
Elementary algebra	8,465	6,519	56.5	25,168	19,812	56.0	33,415	28,953	53.6	16,894	15,331	52.4	23,041	22,857	50.2
Plane geometry	6,134	3,858	61.4	20,318	12,956	61.0	23,315	16,532	58.5	10,034	7,120	58.5	11,145	9,127	55.0
Intermediate or advanced algebra	5,110	3,051	62.6	16,341	10,091	62.0	13,796	5,824	70.3	6,106	3,025	66.9	11,043	9,532	53.7
College algebra	301	141	68.1	1,701	418	80.1	1,521	403	79.0	180	53	77.2	682	333	67.2
Trigonometry	1,966	558	77.9	5,589	1,981	74.0	4,596	1,186	79.5	2,056	605	77.8	2,922	1,088	72.9
Solid geometry	336	142	70.3	1,374	346	79.9	2,371	529	81.8	830	178	82.3	867	221	79.7
College mathematics for advanced standing	149	61	71.0	504	115	81.4	364	66	84.7	148	58	71.8	418	261	61.6
Advanced general mathematics	857	479	64.1	4,250	2,766	60.6	2,631	2,127	55.3	802	734	52.2	3,674	3,297	52.7
All other noncollege preparatory mathematics except business mathematics	1,999	874	69.6	7,036	4,076	63.3	3,675	2,173	62.8	758	633	54.5	3,167	2,610	54.8

Course	East South Central			West South Central			Mountain			Pacific			Total		
	Boys	Girls	Percent [2]	Boys	Girls	Percent [2]	Boys	Girls	Percent [2]	Boys	Girls	Percent [2]	Boys	Girls	Percent [2]
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
General mathematics (9th grade)	7,254	6,803	51.6	9,397	8,845	51.5	3,162	2,801	53.0	7,552	6,420	54.0	80,867	70,341	53.5
Elementary algebra	12,311	12,083	50.5	21,270	19,827	51.8	8,394	7,391	53.2	16,379	12,770	56.2	165,337	145,543	53.2
Plane geometry	5,504	4,214	56.6	11,282	8,919	55.8	4,794	3,423	49.8	10,112	7,263	58.2	102,638	73,412	58.3
Intermediate or advanced algebra	5,204	4,246	55.0	9,840	7,463	56.9	2,763	1,387	66.6	5,895	2,369	71.3	76,098	46,988	61.8
College algebra	52	51	50.5	165	89	65.0	14	2	87.5	125	40	75.8	4,741	1,530	75.6
Trigonometry	1,048	354	74.8	2,225	751	74.8	1,210	283	81.0	2,031	502	80.1	23,643	7,308	76.4
Solid geometry	408	152	72.9	942	379	71.3	347	138	71.5	273	55	83.2	7,748	2,140	78.4
College mathematics for advanced standing	95	125	43.2	311	137	69.4	103	31	76.9	105	15	87.5	2,197	869	71.7
Advanced general mathematics	1,324	1,013	56.7	1,504	1,471	50.6	699	679	50.7	2,176	1,619	57.3	17,917	14,185	55.8
All other noncollege preparatory mathematics except business mathematics	453	338	57.3	1,097	1,015	51.9	1,631	1,192	57.8	4,270	3,076	58.1	24,086	15,987	60.1

[1] For names of States comprising each region, see table 50.
[2] Percent of pupils who were boys.

Table 46.—Number of Boys and Girls in Certain Public High School Mathematics Courses, and Percent Who Were Boys, by Size of School: Fall 1958

Course	Size of school (enrollment)												Total		
	1–99			100–199			200–499			500 or more					
	Boys	Girls	Percent [1]	Boys	Girls	Percent [1]	Boys	Girls	Percent [1]	Boys	Girls	Percent [1]	Boys	Girls	Percent [1]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
General mathematics (9th grade)	4,483	4,108	52.2	11,113	9,853	53.0	30,629	27,446	52.7	34,642	28,934	54.5	80,867	70,341	53.5
Elementary algebra	9,846	9,013	52.2	21,272	20,147	51.4	55,233	52,281	51.4	78,986	64,102	55.2	165,337	145,543	53.2
Plane geometry	5,016	3,744	57.3	8,467	6,373	57.1	20,669	15,097	57.8	68,486	48,198	58.7	102,638	73,412	58.3
Intermediate or advanced algebra	3,215	2,176	59.6	6,201	4,299	59.1	16,849	12,038	58.3	49,833	28,475	63.6	76,098	46,988	61.8
College algebra	37	35	51.4	66	49	57.4	435	201	68.4	4,203	1,245	77.1	4,741	1,530	75.6
Trigonometry	594	234	71.7	1,649	532	75.6	5,228	1,711	75.3	16,172	4,831	77.0	23,643	7,308	76.4
Solid geometry	129	52	71.3	391	107	78.5	1,282	361	78.0	5,946	1,620	78.6	7,748	2,140	78.4
College mathematics for advanced standing	59	57	50.9	152	116	56.7	294	117	71.5	1,692	579	74.5	2,197	869	71.7
Advanced general mathematics	534	435	55.1	1,333	1,156	53.6	3,644	3,284	52.6	12,406	9,310	57.1	17,917	14,185	55.8
All other noncollege preparatory mathematics, except business mathematics	241	214	53.0	1,556	1,264	55.2	3,772	3,005	55.7	18,517	11,504	61.7	24,086	15,987	60.1

[1] Percent of pupils who were boys.

Table 47.—Average Class Size of Certain Public High School Mathematics Courses, by Size of School: Fall 1958

Course	Size of school (enrollment)				Total
	1–99	100–199	200–499	500 or more	
1	2	3	4	5	6
General mathematics (9th grade)	16.8	24.3	27.2	28.6	26.5
Elementary algebra	17.5	25.7	28.4	29.3	27.4
Plane geometry	12.5	17.6	23.5	28.0	24.6
Intermediate algebra	9.5	16.4	22.4	27.6	23.5
Plane trigonometry	6.3	8.3	13.2	22.4	17.0
Solid geometry	5.3	7.4	11.9	22.3	17.5
Other high school mathematics	11.8	21.4	23.8	28.3	25.9

The small schools had the small classes. (See table 47.) In the advanced mathematics classes the average class size was smaller; this was especially pronounced in the small schools with enrollments under 100.

The 1954 and 1956 surveys collected data similar to those in the present study. The average class sizes for the three periods of 1954, 1956, and 1958 are compared in table 48. The 9th-grade junior high school had the largest classes over this span of years. At the

Table 48.—Average Class Size of Certain Public High School Mathematics Courses, by Grades in School: Fall 1954, 1956, and 1958

Course, by year	Grades in school				Total
	9–12 [1]	9 only	10, 11, and 12	Other	
1	2	3	4	5	6
General mathematics (9th grade):					
1954	25.9	26.7	(2)	25.8	26.6
1956	25.7	28.9	(2)	24.9	27.0
1958	25.2	28.4	(2)	27.9	26.5
Elementary algebra:					
1954	26.4	29.7	(2)	24.8	27.4
1956	25.6	30.8	(2)	24.4	27.6
1958	27.0	29.0	(2)	27.7	27.4
Plane geometry:					
1954	21.1	(2)	28.6	18.3	23.0
1956	20.6	(2)	28.9	13.7	22.6
1958	23.9	(2)	28.4	25.9	24.6
Intermediate algebra:					
1954	20.1	(2)	28.0	19.9	22.0
1956	20.4	(2)	27.9	19.3	22.4
1958	22.6	(2)	28.2	22.4	23.5
Plane trigonometry:					
1954	14.2	(2)	22.5	10.6	15.9
1956	14.9	(2)	23.6	12.1	16.1
1958	16.1	(2)	22.2	20.5	17.0
Solid geometry:					
1954	15.9	(2)	22.2	11.2	16.1
1956	16.4	(2)	21.8	12.2	16.4
1958	16.0	(2)	24.4	30.0	17.5
Other high school mathematics:					
1954	24.9	(2)	27.3	24.2	26.4
1956	19.9	(2)	27.3	17.6	24.0
1958	24.6	28.1	30.0	28.5	25.9

[1] For 1958 only, also includes 6-year junior-senior high schools
[2] Course not offered.

very time when the pupils needed individual classroom assistance to understand basic mathematical principles, they unfortunately found themselves in large classes. It is an axiom that provision for individual differences in large classes is very difficult, if not impossible.

Table 49 shows the variation in average class size among geographic regions. In elementary algebra, the West North Central region had the smallest average class size (24.6); and the Mountain and Pacific regions, the largest (each 29.4). In intermediate algebra, the West North Central region again had the smallest average class size (18) and the Middle Atlantic had the largest (26). Table 49 also shows that among the regions there was little change in average class size between 1954 and 1958.

Table 49.—Average Class Size of Certain Public High School Mathematics Courses, by Geographic Region: Fall 1954, 1956, and 1958

Course, by year	Geographic region [1]									Total
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	
1	2	3	4	5	6	7	8	9	10	11
General mathematics (9th grade):										
1954	24.4	28.5	26.4	21.1	30.5	27.2	24.6	26.1	28.8	26.6
1956	25.0	28.5	26.0	22.5	30.1	28.2	26.1	26.3	28.1	27.0
1958	25.6	27.1	26.2	23.6	28.6	26.4	26.1	25.2	27.1	26.5
Elementary algebra:										
1954	25.9	29.0	27.4	25.4	27.9	27.5	26.5	25.7	29.8	27.4
1956	26.8	30.1	27.6	22.9	28.6	28.1	26.5	28.0	31.0	27.6
1958	25.6	28.7	27.2	24.6	29.2	27.5	26.6	29.4	29.4	27.4
Plane geometry:										
1954	23.5	27.1	22.9	18.8	20.7	21.8	21.9	22.7	27.3	23.0
1956	25.2	27.2	22.4	17.2	22.3	22.3	22.4	23.5	28.2	22.6
1958	24.0	27.0	25.0	21.0	25.2	22.7	23.4	23.2	27.3	24.6
Intermediate algebra:										
1954	22.1	25.0	19.6	14.6	22.9	22.6	23.2	19.4	21.3	22.0
1956	24.5	25.5	18.0	17.7	24.6	22.1	23.5	20.0	23.8	22.4
1958	22.9	26.0	22.8	18.0	25.4	21.6	23.1	22.0	25.7	23.5
Plane trigonometry:										
1954	14.8	18.6	14.6	13.0	17.3	13.5	12.8	16.4	16.3	15.9
1956	16.6	18.2	14.2	15.1	15.5	16.0	16.3	15.2	17.4	16.1
1958	16.6	20.6	15.7	14.5	17.4	16.1	15.5	14.1	18.9	17.5
Solid geometry:										
1954	17.2	17.7	16.0	13.5	14.3	13.6	16.3	14.9	19.9	16.1
1956	18.0	18.2	14.8	16.3	14.9	16.9	17.2	16.8	16.8	16.4
1958	17.6	20.2	16.5	16.6	18.1	15.5	19.1	15.9	17.2	17.5
Other high school mathematics:										
1954	24.1	26.8	23.8	24.8	29.0	28.9	24.7	28.0	27.4	26.4
1956	25.8	25.7	24.4	18.6	22.6	15.7	22.7	29.6	26.9	24.0
1958	24.0	26.6	25.0	20.9	26.2	22.6	25.7	25.9	29.5	25.8

[1] For names of States comprising each region see table 50.

Summary of Findings

This study is based on data received from a randomly selected sample of 4,254 public high schools. The mathematical data collected were, in general, on offerings and enrollments.

Offerings

In this study, 95.6 percent of the schools with the 9th grade had pupils enrolled in elementary algebra, and about 60 percent of these schools had pupils enrolled in general mathematics. Plane geometry was given in 84.3 percent of the schools with 10th-grade pupils. Intermediate or advanced algebra, usually an 11th-grade course, was offered in 73 percent of the schools; and trigonometry, usually a 12th-grade course, in 41.8 percent. The percentage of schools offering the 11th- and 12th-grade courses varied from one geographic region to another. In the Middle Atlantic region, 76.5 percent offered trigonometry; and in the East South Central, 24.5 percent.

The pupils in the schools of this study had a much better opportunity to take mathematics if they were in high schools with an enrollment of 500 or more. Even non-college-bound pupils in high schools with an enrollment of 500 or more had five times the probability of being able to get a general mathematics course in their junior or senior year than did pupils in the 930 high schools with an enrollment below 100 and with 12th-grade pupils.

Enrollments

Elementary algebra enrollments were 71.6 percent of the number of 9th-grade pupils and plane geometry enrollments 44.7 percent of the number of 10th-grade pupils. Intermediate algerba enrolled about one-third of the 11th-grade pupils, but the percent varied from one geographic region to another: 50 percent in one region, for example, and only 25 percent in another. Generally speaking, the small school was less likely than the large school to offer mathematics in the 11th and 12th grades. In one geographic region, however, nearly 20 percent of all 11th-grade pupils were in schools *not* offering intermediate algebra.

In the elective mathematics courses about three-fourths of the pupils were boys. Data gathered for the 1954 and 1956 studies revealed a similar situation.

Classes were largest in courses of the 9th grade, which is the grade where the pupil is most likely to need individual attention.

The average class size in elementary algebra was 27.4 pupils.

Trends in Emphasis

About two-thirds of the principals reported more emphasis being given to mathematics than 3 years before, whereas fewer than 1 percent reported less emphasis.

As an indication of the increased emphasis on mathematics, 40 percent of the principals reported that the mathematics curriculum was being revised.

The general concern and interest in mathematics teaching is reflected in the fact that, during the 10-year period 1948-49 to 1958-59, while our high school population age group increased 22 percent and the number of high school pupils 45 percent, the mathematics enrollments increased 73 percent.

Characteristics of the Sample
National Generalizations
Related Studies

Characteristics of the Sample

The sample used in this study was composed of 5,097 schools, taken at random from a card file of public high schools maintained by the Statistical Services Unit, U.S. Office of Education. The three questionnaires reproduced in the appendix were each sent to these schools.

Of the 5,097 schools queried, 92 percent responded. The 403 nonrespondents were, by type, the following: 307 high schools, 83 junior high schools, 8 vocational schools, and 5 evening schools.

Some of the returns were not included in the study because their data were not usable. Most of the nonusable returns were from schools that had been discontinued, from schools that had discontinued the high school grades, or from schools that were in process of being discontinued and were offering no mathematics or science. Of the 440 nonusable mathematics returns, 38 were from discontinued schools, 226 had no pupils above the 8th grade, 44 offered no mathematics, 17 were adult schools, and 115 had vital data missing. Generally, the 44 schools that offered no mathematics were small schools containing only one high school grade and in many cases they were schools in the process of being discontinued.

Of the total responses, 4,254 of the mathematics returns and 4,228 of the science returns were usable—83.5 and 83.0 percent, respectively, of the number of questionnaires mailed.

A comparison, by geographic region, of the number of public high schools in the study with the total number in the United States is shown in table 50. The distribution of schools in the sample among the various regions is in about the same proportion as the distribution of all public high schools in the United States. The difference in any case does not exceed 1 percent.

A comparison of the enrollments in the schools surveyed by the present study and the enrollments in all public high schools for 1957–58 is shown, by geographic region, in table 51. Here too the sample is fairly representative.

Table 52 shows the number of schools in the mathematics portion of this study having pupils enrolled in grades 9–12, while table 53 gives corresponding information for the science portion.

Table 50.—Number of Public High Schools in the Study Compared With the Total Number in the United States, by Geographic Region: Fall 1958

Geographic region	Number and percent of schools in—			
	The United States (1958–59)		This study (1958–59) [1]	
	Number	Percent	Number	Percent
1	2	3	4	5
NEW ENGLAND (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)	1,093	4.5	188	4.4
MIDDLE ATLANTIC (New Jersey, New York, Pennsylvania)	2,296	9.5	425	10.0
EAST NORTH CENTRAL (Illinois, Indiana, Michigan, Ohio, Wisconsin)	4,240	17.5	760	17.9
WEST NORTH CENTRAL (Iowa, Kansas, Minnesota, Missouri) Nebraska, North Dakota, South Dakota)	3,865	16.0	723	17.0
SOUTH ATLANTIC (Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia)	3,604	14.9	606	14.2
EAST SOUTH CENTRAL (Alabama, Kentucky, Mississippi, Tennessee)	2,443	10.1	392	9.2
WEST SOUTH CENTRAL (Arkansas, Louisiana, Oklahoma, Texas)	3,883	16.0	671	15.8
MOUNTAIN (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming)	1,301	5.4	229	5.4
PACIFIC (California, Oregon, Washington)	1,485	6.1	260	6.1
Total	24,210	100.0	4,254	100.0

[1] Includes only the 4,228 schools sending in usable returns on science and the 4,254 schools sending in usable returns on mathematics.

National Generalizations

Although the questionnaire was sent to 20 percent of the schools listed in the U.S. Office of Education's public high school card file, one cannot secure valid data on a national level by multiplying all the sample data by 5 or any other factor.

Many factors must be considered when the sample data are inflated for national generalizations. For example, 92 percent of the questionnaires are returned; however, some were not usable. The total percent of the returned and usable questionnaires for science was 83 and for mathematics, 83.5. A school list is never completely current, since some schools have consolidated or closed, and new schools have opened. Large enrollments in the junior high school have forced some of these schools to transfer the 9th grade to senior high schools; thus, since they were no longer high schools, they were not included in this study.

Other factors must be considered also. A course may be a half-year course with a larger enrollment one semester than the other.

Table 51.—Number of Pupils in Grades 9–12 of the Public High Schools in the Study Compared With the Number in These Grades of All Public High Schools in the United States, by Geographic Region: Fall 1958

Geographic region	Number and percent of pupils			
	The United States (1957–58)		This study (1958–59)	
	Number	Percent	Number	Percent
1	2	3	4	5
NEW ENGLAND (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)	418, 982	5.3	80, 519	5.2
MIDDLE ATLANTIC (New Jersey, New York, Pennsylvania)	1, 373, 885	17.5	261, 130	16.8
EAST NORTH CENTRAL (Illinois, Indiana, Michigan, Ohio, Wisconsin)	1, 561, 663	20.0	327, 842	21.1
WEST NORTH CENTRAL (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota)	736, 291	9.4	155, 357	10.0
SOUTH ATLANTIC (Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia)	1, 173, 910	15.0	222, 028	14.3
EAST SOUTH CENTRAL (Alabama, Kentucky, Mississippi, Tennessee)	582, 904	7.4	103, 993	6.7
WEST SOUTH CENTRAL (Arkansas, Louisiana, Oklahoma, Texas)	793, 901	10.1	160, 657	10.4
MOUNTAIN (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming)	340, 505	4.3	71, 159	4.6
PACIFIC (California, Oregon, Washington)	859, 042	11.0	168, 595	10.9
Total	7, 841, 083	100.0	1, 551, 280	100.0

Table 52.—Number of Public High Schools in the Science Study Having Pupils Enrolled in Each Grade, 9–12, by Size of School: Fall 1958

Size (enrollment)	Grades				Total
	9	10	11	12	
1	2	3	4	5	6
1 to 99	1, 061	960	921	916	1, 084
100 to 199	1, 019	888	883	876	1, 025
200 to 499	1, 234	1, 007	994	990	1, 264
500 or more	708	822	823	819	855

Table 53.—Number of Public High Schools in the Mathematics Study Having Pupils Enrolled in Each Grade, 9–12, by Size of School: Fall 1958

Size (enrollment)	Grades				Total
	9	10	11	12	
1	2	3	4	5	6
1 to 99	1, 076	953	923	930	1, 088
100 to 199	1, 036	894	893	881	1, 039
200 to 499	1, 248	1, 023	1, 010	1, 006	1, 280
500 or more	699	818	817	811	847

For example, in the fall of 1958, about 56,000 pupils were enrolled in solid geometry, and in the spring the number was about 50,000. In using the inflated data, caution should be used, especially for solid geometry and trigonometry, since these half-year subjects are in a state of flux.

Taking all the foregoing factors into consideration, the authors of this publication have given the estimates of certain data on a national level that appear in table 54. This table shows that during the period 1948–49 to 1958–59, our population increased 22.2 percent; the number of high school pupils, 45.2 percent; the number enrolled in science, 58.6 percent; and the number enrolled in mathematics, 72.7 percent.

Table 54.—Number of Pupils and Percent of Increase in Certain Public High School Science and Mathematics Courses Compared With Population Age Group, 14–17, by Typical Grade and Typical Age Group: 1948–49, 1954–55, 1956–57, and 1958–59

Course	Typical grade	Typical age group	Year				Percent of increase
			1948–49	1954–55	1956–57	1958–59 [1]	1948–49 to 1958–59
1	2	3	4	5	6	7	8
General science	9	14	1,074,000	.....	1,518,000	1,581,000	47.2
Biology	10	15	996,000	1,294,000	1,430,000	1,677,000	68.4
Chemistry	11	16	412,000	483,000	520,000	657,000	59.5
Physics	12	17	291,000	303,000	310,000	379,000	30.2
Other science	10–12	.....	172,000	.....	266,000	376,000	118.5
Total science	9–12	.....	2,945,000	.....	4,043,000	4,670,000	58.6
Elementary algebra	9	14	1,042,000	1,205,000	1,518,000	1,775,000	70.3
Intermediate algebra	11	16	372,000	432,000	484,000	643,000	72.8
General mathematics	9	14	650,000	800,000	976,000	1,024,000	57.5
Plane geometry	10	15	599,000	664,000	788,000	979,000	63.4
Solid geometry	12	17	94,000	147,000	160,000	106,000	12.8
Trigonometry	12	17	109,000	170,000	200,000	220,000	101.8
Other mathematics	10–12	.....	92,000	.....	275,000	361,000	292.4
Total mathematics	9–12	.....	2,958,000	.....	4,401,000	5,108,000	72.7
Total enrollment, grades 9–12	.....	.....	5,399,000	6,583,000	7,305,706	7,841,000	45.2
Population age group 14–17 [2]	.....	.....	8,703,000	9,012,000	9,541,000	10,635,000	22.2

Enrollment estimates based on present study. These rough estimates should be used with caution, especially for the half-year subjects, trigonometry and solid geometry, since the data are extrapolated from fall enrollments.

[2] Department of Commerce, Bureau of the Census. Bulletin P–25, No. 193, "Current Population Reports Population Estimates." Feb. 11, 1959. 14 pages.

Related Studies

A few States and a few individuals have carried on studies related in one way or another to the study reported in this bulletin. Studies at the State level would seem to be the desirable trend, especially if the statistics are sufficiently similar to one another and to the statistics collected by the Office of Education, so that more reliable generalizations by regions and by States could be made than heretofore.

California

The California State Department of Education reports data from a study of enrollments in science made in 1958 and repeated in 1959.[1] The study reveals the following information:

1. Enrollments in science courses were 51.1 percent greater in 1959 than in 1958. General science showed the greatest increase (138.9 percent), while botany was the only course which showed an actual decrease (−19.3 percent). Percentage increases from 1958 to 1959 in other science courses were *biology* 16.6 percent; *chemistry*, 10 percent; *earth science*, 94.4 percent; *physics*, 9.4 percent; *physical science*, 41.6 percent.

2. The number of students enrolled in *biology* was 80.2 percent of the total 10th-grade enrollment, the number in *chemistry* 31.5 percent of the total 11th-grade enrollment, and the number in *physics* 14.7 percent of the total 12th-grade enrollment.

3. The enrollment in *all sciences* was 58.8 percent of the total enrollment in grades 9 through 12.

Detroit

A study of science enrollments in the public high schools of Detroit for the school year 1956–57 [2] showed the following data: 85 percent of the 10th graders were enrolled in *biology*, 34 percent of the 11th graders in *chemistry*, and 24 percent of the 12th graders in *physics*.

Florida

The Florida State Department of Education conducted a study of offerings and enrollments in science and mathematics in the public schools of that State during the school year 1957. The Department stated its general conclusions as follows:

1. Availability of specific courses in mathematics and science was closely related to the size of the school. In general, schools enrolling more than 500 students in the secondary department offered complete sequences of courses in both mathematics and science. There was a tendency for smaller schools, especially those enrolling less than 100 students in the secondary department, to offer less than a full program of either mathematics or science during the school year studied. Many of those schools, however, offered courses such as chemistry and physics, or intermediate algebra and plane geometry in alternate years.

2. Although many small schools were found most of the students were found in the larger schools where complete programs in mathematics and science were offered.

3. Enrollments in mathematics and science compared favorably with enrollments in such courses in the nation as a whole. Average class sizes

[1] California State Department of Education. *Summary of School District Enrollment Reports In Science.* Sacramento: The Department, 1959. 3 pages.

[2] Brownell, S. M. *The Detroit Science Education Story.* Detroit: Thomas Alva Edison Foundation, 1957. 20 pages.

and total enrollment figures seem to indicate that adequate numbers of students were enrolled in advanced mathematics and science courses. There is no assurance, however, that those students enrolled in advance courses were the ones who could profit most from such instructions.

4. More than 90 percent of all students in mathematics and science courses were taught by teachers who had met minimum State requirements for certification in the subject taught. One-fourth of all mathematics classes and one-fifth of all science classes enrolled more students than the recognized maximum class size for most effective teaching.[3]

Louisiana

A survey made in 1955–56 by the Louisiana Interscholastic and Literacy Association[4] of its member schools, showed the following percentages of schools that did not offer the various science subjects: *General science*, 40 percent; *biology*, 33 percent; *chemistry*, 38 percent; *physics*, 96 percent.

Maryland

The Maryland State Department of Education conducted a study in 1956 on various aspects of public high school science and mathematics in the State. The following excerpts from the study show certain significant facts about science enrollments between 1935 and 1956:

1. Enrollments in all the science offerings have kept pace with the increase in total enrollments, both showing a 100 percent increase since 1935.

2. The percentage of pupils enrolled in all science courses in comparison with total enrollments has remained quite stable and consistent over the period studied. It was 71.7 percent in 1935 and 71.9 percent in 1956.

3. The most pronounced increase in specific course enrollments has been shown in general science and biology—both of these courses now enroll practically the entire respective grade enrollments.

4. In chemistry there has been a numerical increase of about 42 percent since 1935, although the percentage of pupils taking chemistry in relation to the total school enrollment has dropped somewhat—from 11.1 percent in 1935 to 7.5 percent in 1956.

5. Similarly, enrollment in physics has increased numerically about 15 percent since 1935, while the percent of total enrollment has dropped from 7.3 percent to 4.1 percent in 1955–56. These percentage declines have resulted primarily from the increased persistency of the high school population—more pupils are staying in school for longer periods than ever before, hence there is less selectivity in the present senior high school population.[5]

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[3] State Department of Education. *Offerings and Enrollments in Mathematics and Science in Florida Public Schools.* Tallahassee: The Department, 1957. p. 56.

[4] Randall, Rogers E. *Science and Mathematics Courses Offered in Certain High Schools of Louisiana.* Southern University, Baton Rouge: Southern University, 1957.

[5] State Department of Education. *Enrollment Trends, Offerings, and Teacher Certification in Science and Mathematics.* Baltimore: The Department, 1956, p. 1.

Concerning mathematics enrollments in Maryland, the following trends, somewhat similar to those indicated for science, were revealed:

1. Enrollments in the total area of mathematics have not quite kept pace with the overall enrollment increase. Seventy-two percent of all pupils were enrolled in some mathematics course in 1935 while 70 percent were enrolled in 1956. However, the trend is currently upward following a low of 66.2 percent enrollment in 1940.

2. The most pronounced increase both in numbers and in percent of total enrollments occurred in general mathematics and in business arithmetic.

3. Perhaps the most significant trend revealed by this survey is the marked increase in recent years of enrollment in algebra. Since 1950 enrollment in this area has almost doubled—from a low of 8,674 in 1950 to 16,098 in 1956.

4. In geometry and in trigonometry enrollment patterns are similar—first a gradual decline, both in numbers and in percent of total enrollment from 1935 to 1950, then a marked numerical increase and a fairly stable trend in the percentage of total enrollment taking these subjects. More than three times as many pupils were enrolled in solid geometry and trigonometry in 1956 as compared with 1950.[6]

New York

In the fall of 1957, Clark made a study of the science enrollments in the New York State public high schools exclusive of those in New York City. The following tabulation is drawn from Clark's data:[7]

Course	*Percent of enrollment in grade where course commonly offered*	*Percent of schools offering course*
General science	93	99
Biology	60	98
Chemistry	40	84
Physics	30	82
Earth science	6	24

North Carolina

In its 1957–58 biennial report,[8] the State Department of Public Instruction in North Carolina shows what percent the various science course enrollments were of the enrollments in the grades where these courses are commonly offered. Following is a tabulation of the figures:

Course	*Grade where commonly offered*	*Percent of grade enrollment*
General science	9th	13
Biology	10th	8
Chemistry	11th	33
Physics	12th	53

[6] *Ibid.* p. 5.
[7] Clark, Roger B. *Offerings and Enrollments in New York State Secondary School Science, 1957–58.* (Unpublished thesis, Cornell University, 1957, Ithaca, N.Y.) pp. 42 and 102.
[8] State Department of Education. *Biennial Report 1957–1958.* Raleigh: The Department, 1958.

Ohio

In a sample made up of 16.5 percent of the public high schools in Ohio, Koelsche [9] found in 1957–58 the following percentages of schools not offering various science subjects: *General science*, 8 percent; *biology*, none; *chemistry*, 41 percent; *physics*, 55 percent.

The following percentage of grade enrollments taking the various science subjects was reported from the same study: *General science*, 80 percent; *biology*, 74 percent; *chemistry*, 37 percent; *physics*, 23 percent.

From the same study the following class sizes were reported: *general science*, 30; *biology*, 28; *chemistry*, 21; *physics*, 18.

Six Western States

Clark [10] reports that a study by H. Knapp of small schools having enrollments below 100 and located in six Western States reveals that from 1 to 78 percent of these schools did not offer certain science courses during the school year 1957–58. The findings in four courses were as follows:

Course	Percent by total school enrollment			
	4–24	25–49	50–74	75–99
General science	50	37	24	17
Biology	42	40	17	1
Chemistry	78	57	55	47
Physics	78	68	55	52

[9] Koelsche, Charles L. *The Status of Secondary Science Education in the State of Ohio.* Toledo: University of Ohio, 1958. 22 pages.
[10] *Op cit.*, p. 10.

Appendix

Budget Bureau No. 51-R269 Approval expires 5/31/59

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Office of Education Form SE-18

ENROLLMENT IN SCIENCE CLASSES

A. Total school enrollment in first term, 1958-59: 9th grade ____ 10th grade ____ 11th grade ____ 12th grade ____

B. SCIENCE enrollment in the first term, 1958-59: (For grades 9-12 only)

Science courses	Grades	No. of sections	Enrollment			Science courses	No. of sections	Enrollment		
			Boys	Girls	Total			Boys	Girls	Total
9th grade Gen. Sci.						Advanced Biology				
1st yr. Biology						Advanced Chemistry				
1st yr. Chemistry						Advanced Physics				
1st yr. Physics						Science Research Seminar				
Adv. Gen. Science						All other science Grades 9-12				

Is the Science curriculum being revised this year? Yes ☐ No ☐

Indicate the present emphasis on science in your school compared to 3 years ago:
Less ☐ Same ☐ More ☐

Indicate trend in science enrollments over past 3 years: Decrease ☐ Same ☐ Increase ☐

Information Supplied by

Budget Bureau No. 51-R269 Approval expires 8/31/59

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Office of Education Form SEC-17

ENROLLMENT IN MATHEMATICS COURSES

A. Total school enrollment in first term, 1958-59: 9th grade ____ 10th grade ____ 11th grade ____ 12th grade ____

B. MATHEMATICS enrollment in first term, 1958-59: (For Grades 9-12 only)

Mathematics course	No. of sections	Enrollment		
		Boys	Girls	Total
Elem. Algebra				
Plane Geometry				
Intermed. or Adv. Algebra				
College Algebra				
Trigonometry				
Solid Geometry				
Col. Math. for Adv. Standing				

Mathematics course	No. of sections	Enrollment		
		Boys	Girls	Total
All other col. prep. math. exc. Bus. Math				
9th grade Gen. Math.				
Adv. Gen. Math.				
All other non-col. prep. math. exc. Bus. Math.				
Total All Math. Grades 9-12				

Indicate the present emphasis of your school on mathematics compared with 3 years ago.
Less ☐ Same ☐ More ☐

Is the Mathematics curriculum being revised this year? Yes ☐ No ☐

Information Supplied by _____

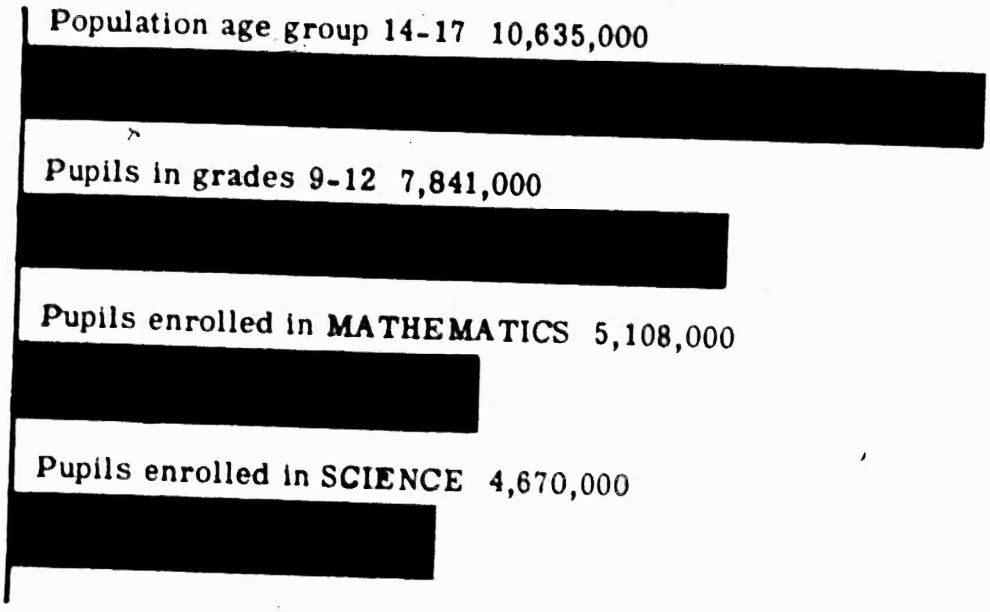

Figure 15.—Pupils Enrolled in Science and Mathematics: Fall 1958

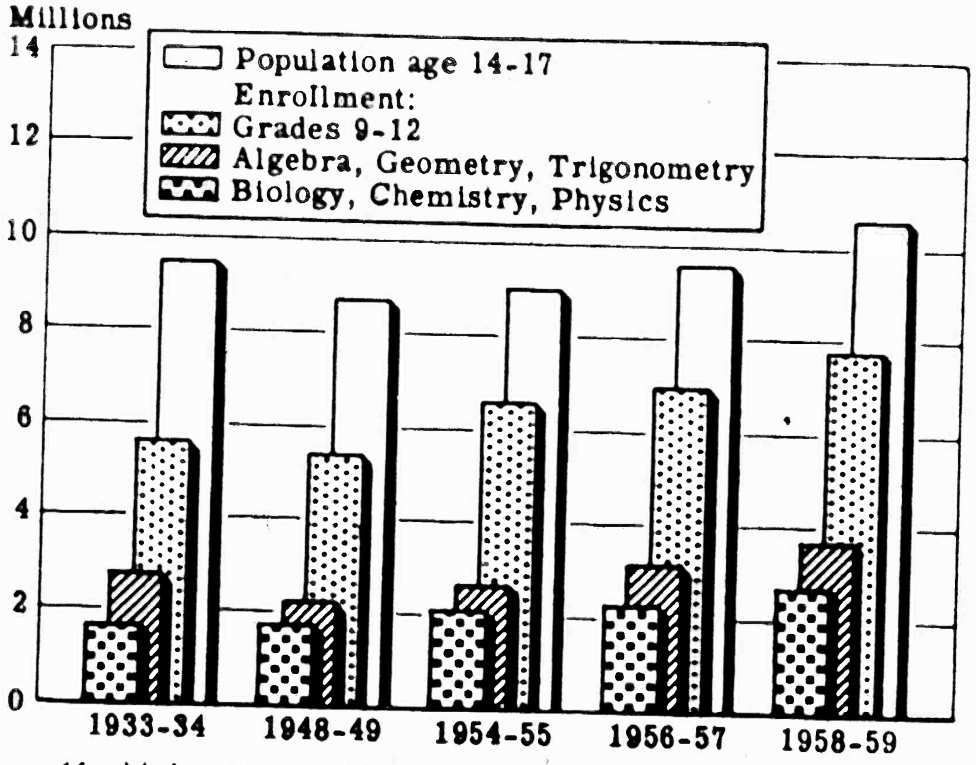

Figure 16.—Mathematics and Science Enrollments in Public High Schools: Specified Years, 1933-34 to 1958-59