

SUMMARY REPORT OF THE SURVEY IN
MATHEMATICS, SCIENCE, INDUSTRIAL ARTS, AND TRADE AND INDUSTRY
IN ARIZONA SECONDARY SCHOOLS

FALL, 1957

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Superintendent of Public Instruction

Phoenix, Arizona

June, 1958

FOREWORD

In recent months there has been much publicity regarding the lack of trained mathematicians, scientists, and specially trained industrial workers. Much of this shortage has been attributed to the lack of courses in our secondary schools, or to the small number of students who are enrolled in courses which prepare them in these fields.

This study has been undertaken (1) to determine the number of high schools who offer courses in certain Mathematics, Science, Trade and Industry, and Industrial Arts; (2) to reveal the extent to which students are enrolled in these courses; (3) to compare the number of students in the secondary schools of Arizona enrolled in these subjects with the National percentage enrolled throughout the Nation.

It is hoped that this study will stimulate a greater number of students to become interested in Science, Mathematics, and Technical Courses, and that in so doing, these students will maintain a balanced program.

Supporting Data to the Study

This study is based upon a questionnaire returned by ninety-one secondary school administrators in Public, Private, Parochial, and Federal schools during the school year 1957-58. The questionnaire was prepared in cooperation with the Maricopa County Engineers Society and the State Department of Public Instruction in hopes that more students will be directed to pursue Science and Mathematics.

What the Study Covers

This study includes the following items:

1. The number of the ninety-one secondary schools in Arizona offering courses in Chemistry, Physics, Algebra, Advanced Algebra, Geometry, Trigonometry, Industrial Arts, and Trade and Industry in the Fall of 1957.

2. The number and percentage of pupils taking the above courses in the Fall of 1957. These percentages are calculated against the number of students eligible to enroll in subject, according to grade level in which the subject is usually given. As was done in the National Report, U. S. Office of Education 1954, subjects were placed on the following grade levels:

Chemistry-----	Junior
Physics-----	Senior
Algebra I-----	Freshman
Adv. Algebra-----	Junior
Plane Geometry-----	Sophomore
Trigonometry-----	Senior
Industrial Arts-----	All Grades
Trade and Industry-----	Junior - Senior

Survey of Science, Mathematics, Trade and Industry, and Industrial Arts
(Continued)

3. Comparison of students in the eighty public schools and the eleven Private, Parochial, and Federal schools taking the above courses was made by figuring percentage of number of students taking the course and the total number enrolled.

4. A summary of findings .

5. Recommendations to stimulate more interest in these subjects.

TABLE I

NO. OF HIGH SCHOOLS RECEIVING AND RETURNING
QUESTIONNAIRES

	NO. HIGH SCHOOLS IN STATE *	NO. HIGH SCHOOLS TO WHOM QUESTIONNAIRE WAS SENT	NO. HIGH SCHOOLS RETURNING COMPLETED QUESTIONNAIRE	PERCENT OF TOTAL REPLYING TO QUESTIONNAIRE
Public	86	86	80	93.2%
Private *	15	15	11	73.3%
Total	101	101	91	90.09%

* Number taken from High School List - 1957-58.

Table I shows that 93.2% of all Public High Schools and 73.3% of Private, Parochial, and Federal Schools returned the questionnaire. This means, of the 101 Public, Private, Parochial, and Federal Schools, 91 returned the completed questionnaire to this office. Eighty of these were Public State High Schools; eleven were Private, Parochial, and Federal Schools.

TABLE II

NO. JUNE GRADUATES IN 1957 - NINETY-ONE
SCHOOLS REPORTING AND PERCENTAGE ENTERING COLLEGE, SEPT. 1957

	ENROLLMENTS IN SCHOOLS REPORT- ING SEPT. 1957	NO. GRADUATING JUNE 1957	NO. ENTERING COLLEGE SEPT. 1957	EST. NO. IN UPPER CLASS FINANCIALLY UNABLE TO ATTEND COLLEGE	PERCENTAGE OF GRADUATES ENTERING COLLEGE SEPT. 1957	ESTIMATED PERCENTAGE OF GRADUATES IN UPPER CLASS FINANCIALLY UN- ABLE TO ATTEND	PERCENTAGE OF TOTAL ENROLLMENT GRADUATING
Public Schools	52,046	7,643	3,586	265	46.9%	7.5%	14.6%
Parochial) Federal) Private) Schools)	2,057	431	208	13	48.3%	6.4%	20.9%
Total	54,103	8,074	3,794	278	47.0%	7.3%	14.9%

Table II shows that a total of 54,103 students were included in this study. In the eighty public high schools, 52,046 students were enrolled, while the eleven other high schools reporting had a total of 2,057 students. Other interesting figures in Table II show that a total of 8,074 students graduated in June 1957. Of the 7,643 graduates, 3,586 or 46.9% of the graduates from the public high schools entered college in September 1957. Of the 431 graduating from the Private, Parochial, and Federal Schools, 208 or 48.3% entered college. A few more students in the Public High Schools were unable to continue their education than those in the Private, Parochial, and Federal Schools. The per cent of the total enrollment graduating was higher in the Private, Parochial, and Federal Schools than in the State Public Secondary Schools, the difference between 20.9% and 14.6% is 6.3%.

TABLE III

NUMBER OF PUPILS TAKING MATHEMATICS IN NINETY-ONE
HIGH SCHOOLS IN ARIZONA
FALL, 1957

SUBJECT	NO. SCHOOLS TEACHING SUBJECT			NO. PUPILS TAKING SUBJECT			PERCENTAGE OF TOTAL ENROLLMENT REPORTING IN EACH SUBJECT		
	Public	Private & Others	Total	Public	Private & Others	Total	Public 52,046	Private & Others 2,056	Total Enr. 54,103
Algebra I	77	11	88	7,770	544	8,314	14.9%	26.4%	15.3%
Adv. Algebra	73	10	83	1,784	180	1,964	3.4%	8.6%	3.6%
Trigonometry	61	6	67	942	85	1,027	1.8%	4.1%	1.9%
Geometry	76	8	84	4,535	368	4,903	8.7%	13.0%	9.0%

Table III shows the number of schools offering courses in Algebra I, Advanced Algebra, Trigonometry, and Geometry. A break-down was made in each subject area to show the differences in percentage of students taking these subjects in the State Public Secondary Schools and Private, Parochial, and Federal Schools. The results of this study show the latter schools have a larger percent of their students taking these subjects than in the State Public Schools.

TABLE IV

TOTAL NUMBER OF SCHOOLS AND ENROLLMENT IN
CHEMISTRY, PHYSICS, AND INDUSTRY
SEPT. 1957

SUBJECT	NO. SCHOOLS TEACHING SUBJECT			NO. STUDENTS ENROLLED IN EACH SUBJECT			PERCENTAGE OF TOTAL ENROLLMENT IN EACH SUBJECT		
	Public	Private & Others	Total	Public	Private & Others	Total	52,046	2,057	54,103
Chemistry	75	10	85	3,159	241	3,400	6.7%	11.2%	6.3%
Physics	66	6	72	2,077	135	2,212	3.9%	6.5%	4.09%
Trade & Industry	18	1	19	1,811	61	1,872	3.48%	2.9%	3.46%
Industrial Arts	62	1	63	9,466	181	9,647	18.1%	8.8%	17.8%

Table IV shows the number of schools offering Chemistry, Physics, Trade and Industry, and Industrial Arts and the number of pupils taking each subject in both types of secondary schools. The study indicates a larger percent of the students in the Private, Parochial, and Federal Schools study Chemistry and Physics, than in the State Public Secondary Schools, while a greater percent in the State Schools study Trade and Industry, and Industrial Arts.

TABLE V

ENROLLMENT OF HIGH SCHOOLS NOT REPORTING *

HIGH SCHOOL	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL ENROLLMENT
School #1	47	41	33	21	142
School #2	82	83	65	42	272
School #3	61	56	34	28	179
School #4	27	19	8	0	54
School #5	15	9	12	3	39
Total	232	208	152	94	686

*Figures found in Annual Report of the Superintendent of Public Instruction to the Governor of Arizona for the Fiscal Year 1957-1957.

Table V shows the state's public high schools that did not answer the questionnaire and their enrollments by grade levels. These figures were needed to use in determining the number in each grade level not included in the report. Since the enrollments in the courses under study are expressed as the percentage of pupils in the grade where the course is usually offered, it was necessary to devise a plan to determine the enrollment in each grade level because this information was not requested in the questionnaire. By subtracting the number of students at each grade level in the above listed five schools from the total number of all students in the secondary schools, it was possible to get a rough figure to use in making the comparison.

TABLE VI

PUBLIC HIGH SCHOOL ENROLLMENT *

YEAR IN HIGH SCHOOL	TOTAL ENROLLMENT IN EACH GRADE 1956-1957	TOTAL ENROLLMENT FOR FIVE SCHOOLS NOT REPORTING 1956-1957	TOTAL ENROLLMENT OF EACH PUBLIC SCHOOL - GRADE LEVEL OF SCHOOLS REPORTING 1956- 1957 (MINUS FIVE HIGH SCHOOLS NOT REPORTING)	EST. ENROLLMENT FOR GRADE LEVELS BASED ON 7% INCREASE OVER PRE- VIOUS YEAR - 1957-1958
Freshmen	16,442	232	16,210	17,345
Sophomore	13,568	208	13,360	14,295
Junior	11,052	152	10,900	11,666
Senior	8,864	94	8,770	9,296
Total	49,926	686	49,240	52,602

*Figures found in the Annual Report of the Superintendent of Public Instruction to the Governor of Arizona for the Fiscal Year 1956-1957.

Table VI also has been included in this summary to determine the total number in each grade level. In order to compare our figures with percentages of those enrolled in the subjects under study with those on the national level, it was necessary to know how many pupils were enrolled in each grade level. As the questionnaire requested total enrollment without reference to grade levels, the Annual Report to the Governor for the Fiscal Year 1956-1957 was used to secure enrollments by grades. For example, in 1956-57 the 232 freshmen in the five schools not reporting was subtracted from the total number given in the report--16,442. This left a difference of 16,210. The final number 17,345 is a 7% yearly increase for growth over the enrollment (1956-57) 16,210. The total enrollment derived by this procedure shows a difference of 554 from the total one reported by school administrators, i.e. (52,602--52,046 = 554).

TABLE VII

NUMBER OF SCHOOLS OFFERING CERTAIN SCIENCE AND
MATHEMATICS COURSES AND PERCENTAGE OF NUMBER ENROLLED IN
EACH COURSE COMPARED WITH THE NATIONAL PERCENTAGE

		Freshmen	17,345	Juniors	11,666	Total Enrollment	52,602
		Sophomores	14,295	Seniors	9,296	Total No. Public Schools Involved	80
SUBJECT	NO. OF SCHOOLS OFFERING SUBJECT	NO. OF PUPILS TAKING SUBJECT	PERCENT OF PUPILS IN GRADE WHERE SUB- JECT IS REGULARLY TAUGHT		NATIONAL FIGURE OF PUPILS TAKING SUBJECT - 1954*	PLUS AND MINUS IN RELATION TO NATIONAL AVERAGE	
Algebra I (Fr.)	77	7,770	44.7%		64.5%	- 19.8%	
Adv. Algebra (Jr.)	73	1,784	15.3%		28.5%	- 13.2%	
Trigonometry (Sr.)	61	942	10.1%		10.9%	- 0.9%	
Geometry (Soph.)	76	4,535	31.9%		37.4%	- 5.7%	

* Report from the U. S. Office of Education - 1954.

Table VII shows the number of schools offering courses in Algebra I, Advanced Algebra, Geometry, and Trigonometry. Column 1 lists the courses; column 2, gives the number of the 80 public high schools that participated in the study; column 3, gives the number of pupils taking the course; column 4, shows the percentage of pupils in the course based on the enrollment of pupils at the grade level where the course is generally taught. For example, 7,770 pupils were enrolled in Algebra I and 17,345 pupils were enrolled in the freshman class, the grade where Algebra I is usually taught. The percentage of pupils in Algebra I is found by dividing 7,770 by 17,345 or 44.7% of the students in the freshman class are in that subject. The fifth column shows the national percentage of pupils taking Algebra I. The difference between columns four and five is 64.5%-44.7% which means that Arizona Public High Schools are teaching 19.8% fewer freshmen Algebra I than in the nation. The rest of the table is read similarly.

TABLE VIII

PUBLIC SCHOOLS OF ARIZONA
COMPARISON OF NUMBER TAKING VARIOUS SUBJECTS IN PERCENTAGE WITH
THOSE OF NATIONAL AVERAGE

SUBJECT	NO. OF SCHOOLS OFFERING SUBJECT	NO. OF PUPILS TAKING SUBJECT	ARIZONA PERCENT OF PUPILS TAKING SUBJECT IN GRADE WHERE SUBJECT IS GENERALLY TAUGHT	NAT. FIGURE IN PERCENTAGE OF PUPILS TAKING SUBJECT	PLUS AND MINUS RATINGS OF ARIZONA'S PERCENTAGE IN RELATION TO NATIONAL % FIGURES
Chemistry (Jr.)	75	3,159	27.08%	31.9%	- 4.82%
Physics (Sr.)	66	2,077	22.3%	23.5%	- 1.2%
Trade & Industry (Jr. & Sr.)	18	1,811	6.1%*	3.59%*	2.51%*
Industrial Arts	62	9,466	17.3%	--	--

*Figures given by Mr. J. R. Cullison, State Director of Vocational Education.

Table VIII is read the same as Table VII, except the subjects in this table are: Chemistry, Physics, Trade and Industry, and Industrial Arts, instead of Mathematics as shown in Table VII.

No comparison was possible for the course in Industrial Arts as figures were not available on the national percentage basis. Figures for Trade and Industry were quoted from Mr. J. R. Cullison, Director of Vocational Education, and deal with the current year. Trade and Industry is the only course studied in this survey that shows a plus percentage -- 2.51%.

TABLE IX

PROFESSIONAL TRAINING OF TEACHERS
WITH DEGREES AND WITHOUT DEGREES
IN SUBJECT TAUGHT--SCIENCE OR MATHEMATICS

SUBJECT	NO. TEACHERS WITH DEGREES IN SUBJECT	NO. TEACHERS WITHOUT DEGREES IN SUBJECT	NO. TEACHERS WITH MAJOR OR MINOR IN SUBJECT TAUGHT
Physics	61	21	72
Chemistry	62	29	89
Mathematics	150	57	229
Total	273	107	390

Table X shows the number of teachers who have professional training in physics, chemistry and mathematics. Since the total number of teachers is not known as there were many blanks in the report on teacher training, no comparison is possible. It is important to note that 390 secondary teachers in all secondary schools reporting meet the North Central Accrediting requirements. (24 S. hrs. in the major and 15 S. hrs. in the minor.)

TABLE X

ENROLLMENTS, BY GEOGRAPHIC REGION, IN CERTAIN SCIENCE COURSES EXPRESSED AS THE
 PERCENTAGE OF PUPILS IN GRADE WHERE COURSE IS USUALLY OFFERED
 NATIONAL--FALL, 1954 ARIZONA--FALL, 1957

COURSE	PERCENT OF ENROLLMENT BY REGION										
	NEW ENGLAND	MIDDLE ATLANTIC	EAST N. CENTRAL	WEST N. CENTRAL	SO. ATLANTIC	EAST SO. CENTRAL	WEST SO. CENTRAL	MOUNTAIN	PACIFIC	ARIZONA	ALL REGIONS
Chemistry	39.7	39.8	30.9	26.0	32.8	30.8	23.6	30.6	28.5	26.4	31.9
Physics	32.8	31.3	27.8	21.3	17.3	32.5	12.8	20.6	16.2	21.5	23.5

Table X shows the percent of students taking Chemistry and Physics in Arizona and nine (31.9-26.4 = 5.5) geographic regions in the United States. It will be noted that all regions except West So. (23.5-21.5 = 2.0) Central and West No. Central have higher percentage of students enrolled in Chemistry than Arizona Public High Schools. In Physics, five regions--West N. Central, So. Atlantic, West So. Central, Mountain, and Pacific are lower than Arizona. The 5.5% in Chemistry and the 2.0% in Physics shows that Arizona is nearer the national percentage than in the courses in Mathematics.

RECOMMENDATIONS (Continued)

6. That some encouragement be given to schools that are attempting to keep their curriculum abreast of modern developments, by a media of public recognition.
7. That each school continually evaluate its offerings and curriculum to determine how adequately it is meeting the needs of its students, the needs of its community and the needs of our society.

Summary Report
Prepared by:

Dr. Lillian B. Johnston
Curriculum Coordinator
and
Director of Secondary Education

To: M. L. BROOKS, Secretary to the Board of Education
From: Dr. Lillian B. Johnston
Re: A Survey of Science, Mathematics, Industrial Arts,
Trade, and Industry Offerings in Ninety-one High
Schools in Arizona, Fall of 1957.

This is a summary report in which various subjects in Science, Mathematics, and Industrial Education have been studied in relation to their scope and the extent of offerings in ninety-one secondary schools in Arizona. In this report tables have been developed, to show the number of high schools returning the questionnaire, the number of pupils enrolled in the various subjects, the number of teachers fully qualified to teach these subjects, and finally the percentages of the numbers enrolled in the various subjects compared to those of a report (1954) by the United States Office of Education.