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A Report on a Survey of Science Instruction in the High Schools of Iowa

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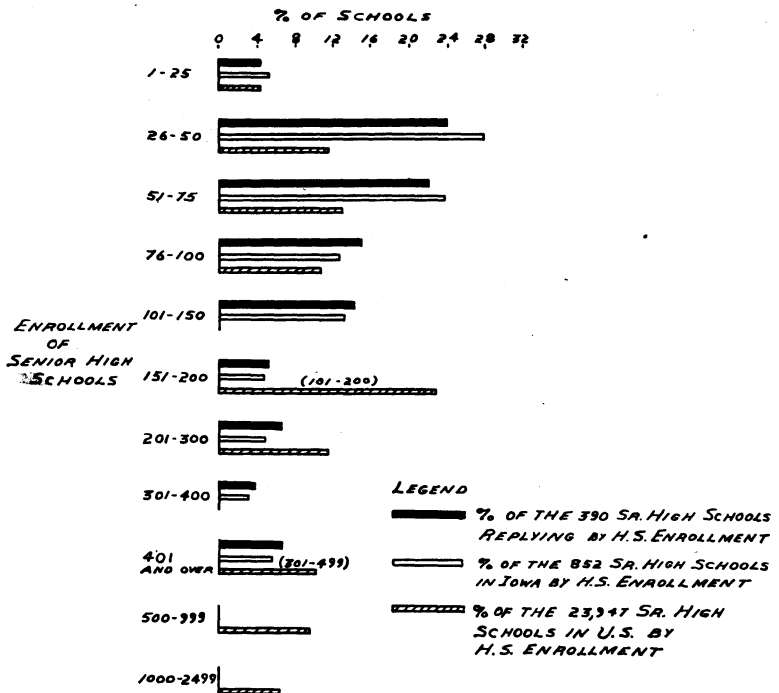
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A Report on a Survey of Science Instruction in the High Schools of Iowa

By JAMES W. KERCHEVAL

This is a report of a survey pertaining to some phases of the science program in the junior and senior high schools of Iowa. The data on which this report is based was gathered by a questionnaire which was sent to each high school in the state. All data unless otherwise indicated applies to the school year of 1951-52.

A total of 886 questionnaires were sent out to the junior and senior high schools, a separate blank being sent to each where it was known that the junior high was a separate school from the senior high. For example four blanks were sent to the Waterloo system: one each to East High, West High, East Junior High, and Sloan Wallace Junior High. Four hundred eighty, or 54%, of the



PERCENT BY SIZE OF SENIOR HIGH SCHOOLS REPLYING COMPARED TO ALL SENIOR HIGH SCHOOLS IN IOWA AND U.S.

Figure 1.

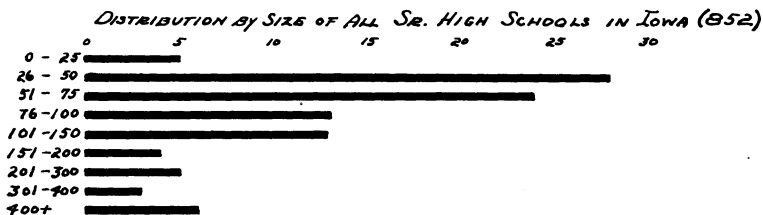
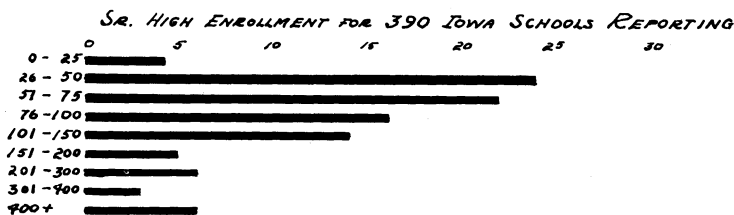
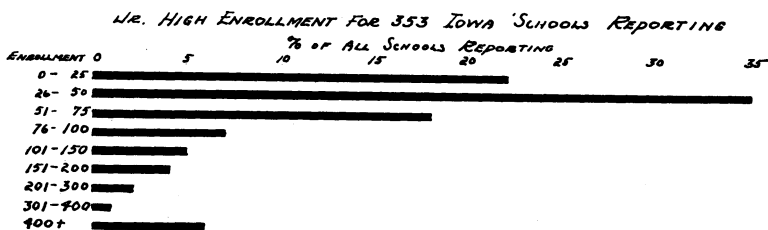


Figure 2.

blanks were returned, completed in a useable form. In summarizing the survey certain limiting factors must be kept in mind for even though it was not intended, the survey resulted in a special kind of sampling. This condition appeared because not all of the blanks were returned. Thus there is information from only an uncontrolled sample which is not necessarily a random or a representative one.

To gain some idea as to the nature of the replying schools the analysis shown in Figure 1 was made. The data shown applies to the senior high schools only, for this report is mainly concerned with science instruction at that level. There will be a lack of agreement in numbers from one set of data to another for not all schools replying gave all the information requested. In Figure 1 a comparison is made percentagewise between the total number of senior high schools having a given enrollment and the number of schools of that enrollment which replied in the survey. The graphs show quite conclusively that the sample of replies is representative of

Iowa's senior highs on the basis of size. A second unrelated bit of

information shown is a comparison of the size of Iowa's senior highs and those of the entire nation. The figures for the latter are based upon 1945-46 data (1).

In Figure 2 the lower graph (2) shows more clearly that over 50% of the Iowa senior highs have an enrollment of 75 or fewer students and that 33% have 50 or fewer students. This situation alone is one of the serious problems to be met in providing a good science program with proper instruction.

The offerings in science in our schools is shown in Table 1. All of the sciences except Geography and Physiology are more commonly offered as two semester courses. Our schools seem to be about equally divided in the credits offered in Geography.

Table 1
Number of Credits* Given in Each Science
by the Number of Schools

Course	One Credit		Two Credits	
	No. of Schools	Per cent	No. of Schools	Per cent
Biology	73	17	354	83
Chemistry	23	15	134	85
Gen. Agri.	34	26	96	74
Gen. Science	64	15	359	85
Geography	113	55	94	45
Physics	62	16	323	84
Physiology	99	76	32	24
Senior Science	11	32	23	68

*A credit in this report is regarded as a class scheduled daily for one semester.

The minimum number of science credits required for graduation from high school as reported by 402 high schools are shown in Table 2. It is a bit discouraging to note that 48% of our Iowa schools permit graduation with but two semesters of science in their students' education. Further 11% of our schools indicated that they allow junior high science to apply on this requirement. This would mean that in some cases one year of General Science is all the Science the graduating senior has had.

Table 2
Minimum Number of Science Credits Required for
Graduation from High School (402)

	Credits Required					
	1	2	3	4	5	6
Number of schools	20	172	8	176	3	23
Per cent of schools	5	43	2	44	1	6

The pattern of the year or grade of the junior or senior high in which the science courses are offered is shown in Table 3. It is informative to note that both Geography and Physiology are offered by various schools through such a range of years. It is also worthy of note that Biology is taught in almost one half of the schools at either the junior or senior level.

Table 3
Year in the Junior or Senior High for which the Science Courses are Recommended by Ten or More Schools

Course	Number of Schools Recommending for Grade						
	6th	7th	8th	9th	10th	11th	12th
Biology				36	284	168	103
Chemistry						112	112
Gen. Ag.			11	101	113	73	68
Gen. Science	47	117	133	423	83		
Geography	57	134	87	50	72	55	42
Physiology	30	57	70	26	42	41	47
Physics						241	350

The survey showed that boys and girls are enrolled in approximately equal numbers in all the sciences except Physics and General Agriculture. Estimates based on information in the questionnaire give the following comparative figures for the schools replying:

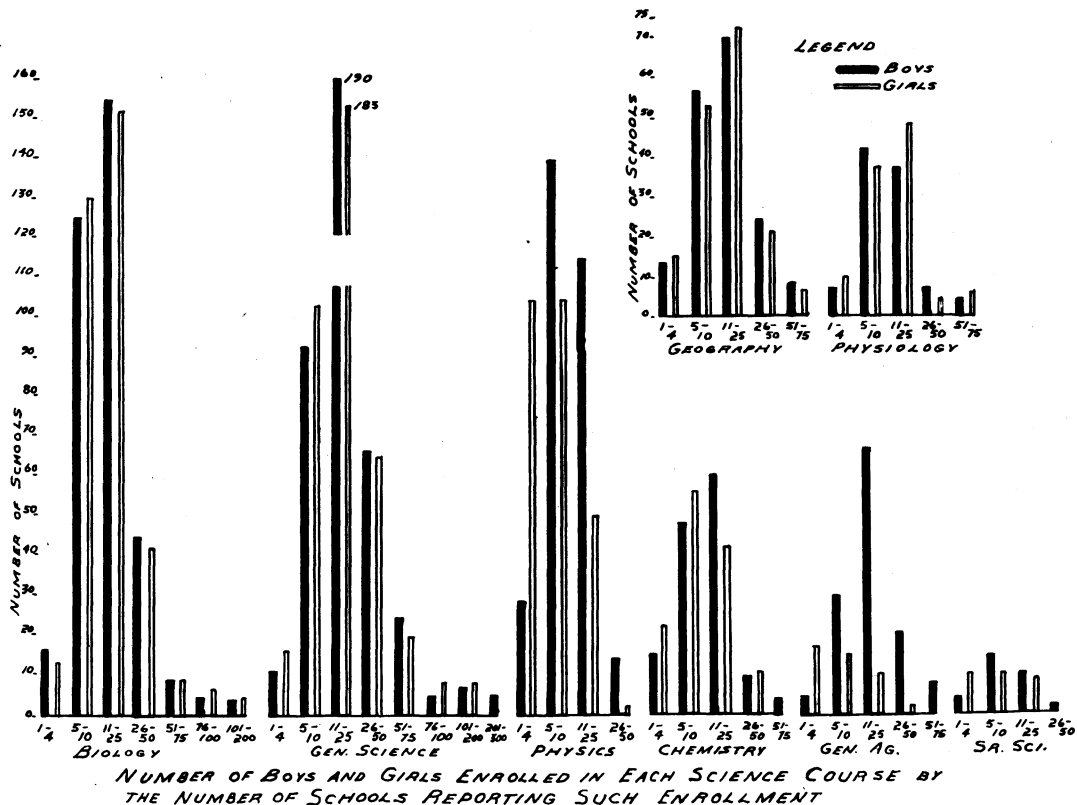
	Gen. Science	Biology	Chemistry	Physics	Gen. Ag.	Geog.	Physiol.
Boys	10,700	6,600	1,900	3,800	2,800	3,300	1,500
Girls	9,700	6,800	1,600	2,000	400	3,100	1,600

Figure 3 summarizes this data showing the number of schools with their respective boy and girl enrollments in the different sciences.

The length of a class period varies considerably throughout the state. Table 4 shows that about one-third of our schools use a forty minute period, about one-fifth a forty-five minute period, and over a third use a fifty-five or sixty minute period.

Table 4
Length of the Single Class Period (461)

Minutes	Number of Schools	Percentage
30-39	5	1
40-44	148	32
45-49	97	21
50-54	33	7
55-60	171	37
Over 60	7	2



NUMBER OF BOYS AND GIRLS ENROLLED IN EACH SCIENCE COURSE BY THE NUMBER OF SCHOOLS REPORTING SUCH ENROLLMENT

Figure 3.

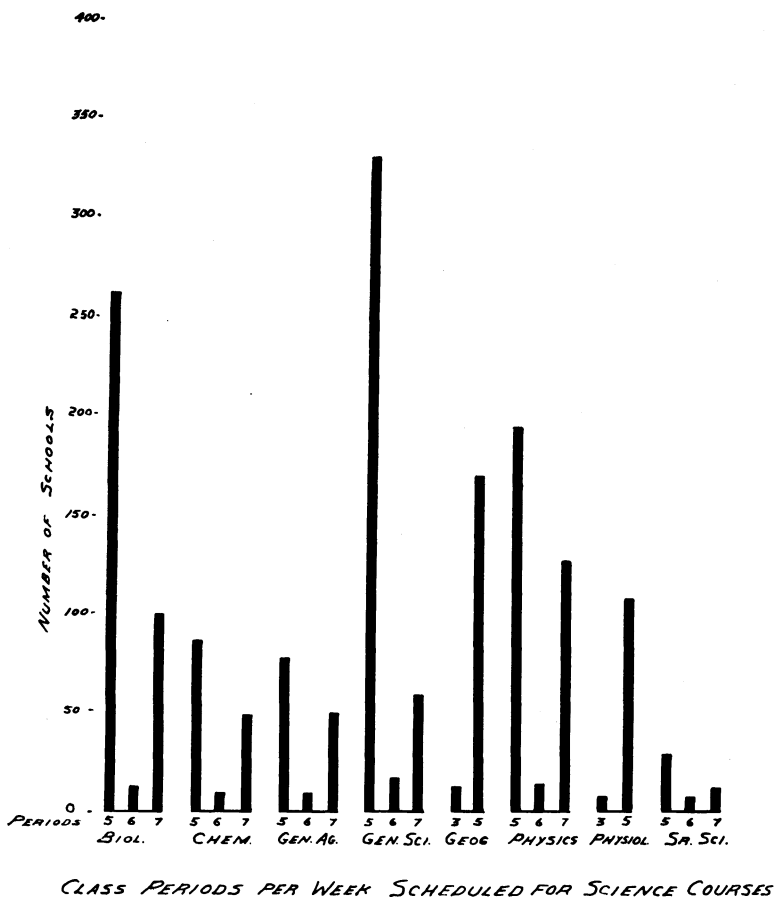
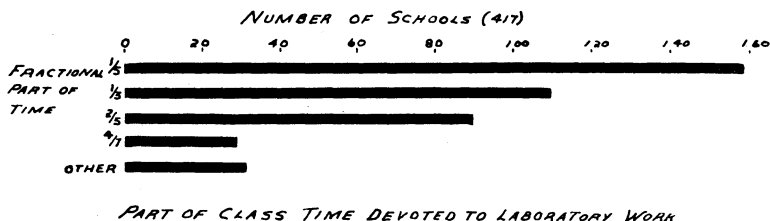


Figure 4.

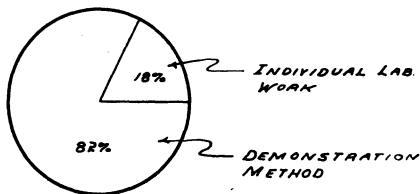
Figure 4 shows the number of class periods per week for each science scheduled by the reporting schools. Five class periods would indicate that no additional time is set aside for laboratory work. Seven periods would mean that there are two double periods used each week in the traditional laboratory pattern. This latter pattern is more common in Physics and Chemistry than in the other sciences. In Chemistry 38% of the classes used more than five periods a week; in Physics, 40%. There is an error in the graph of General Agriculture, for only about 30% of its classes use more than the five periods per week. This is comparable to the time given to Biology.

The overall estimate of time given to laboratory work by 417 of the schools is shown in the bar graph of Figure 5. Approximately two fifths of the schools report that they average about one period of

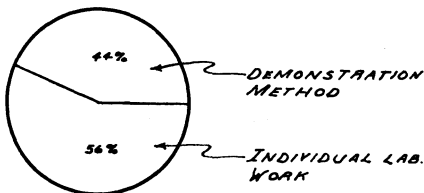
laboratory work out of the five periods a week devoted to the science courses. About one fourth report two periods out of six as an average for laboratory work. A little over a fifth report two out of five while about one thirteenth report a traditional pattern of four periods out of seven. In the main, from the data in Figures 4 and 5 it can be seen that most of our science students have an opportunity to do a relatively small amount of laboratory work. Chemistry and Physics with their more limited enrollments are about the only courses giving much time to the laboratory work.



PART OF CLASS TIME DEVOTED TO LABORATORY WORK



METHOD OF LABORATORY WORK USED MOST GENERALLY IN SCIENCE COURSES (462 SCHOOLS)



METHOD OF LABORATORY WORK USED IN CHEMISTRY

Figure 5.

The middle graph in Figure 5 indicates further that much of the scheduled laboratory time is given to demonstration work which involves but a limited number of students in active participation on any one day. The data for chemistry shows a much greater student participation in laboratory work.

Another section of the survey investigated the science teachers' situation as to teaching combinations, teaching load in terms of number of classes and number of preparations per day. Table 5 shows that out of 1160 teachers reported, only one fifth or 21% teach science and no other subjects. Table 6 shows the number of subject matter fields taught by the 79% who teach other subjects in addition to science.

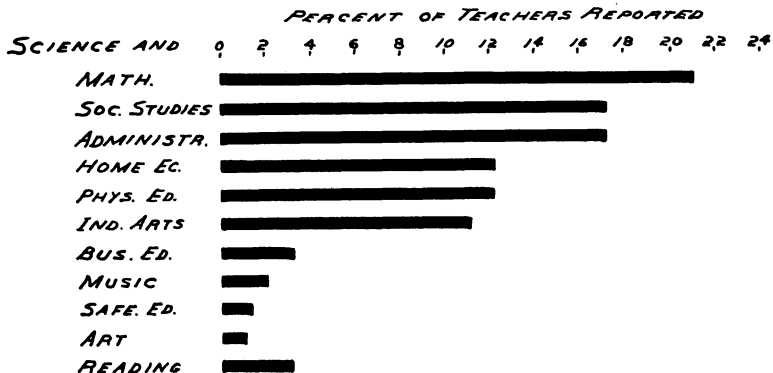
Table 5
Full and Part Time Science Teachers in
Junior and Senior Highs (1160)

	Number	%
Teach science and no other subjects	239	21
Teach both science and other subjects	921	79

Table 6
Number of Subject Matter Fields Other than Science Taught by
Junior and Senior High Science Teachers (986)

	Number	%
One field in addition to science	362	37
Two fields in addition to science	399	41
Three fields in addition to science	152	15
Four fields in addition to science	73	7

Adding the 239 teachers teaching only science and the 362 who teach in one field in addition to science, there are 601 teachers out of the 1160 reporting, or 52% of the science teachers, teaching in



*TEACHING COMBINATIONS WITH SCIENCE
IN JR. AND SR. HIGHS (946 TEACHERS)*

Figure 6.

not more than one field in addition to science. This situation seems quite desirable. Unfortunately this means that about 48% are teaching in at least three fields including science. Probably these teachers' main interest is not in science teaching but in other areas as shown in Figure 6.

Figure 7 indicates that four or five classes per day constitute a general pattern for our teachers. However, the number of different class preparations shown in the lower graph shows a much greater variation. Fortunately only about 15% of the teachers have more than four preparations per day.

The preparation and experience of our science teachers is another point of interest in the survey. Table 7 shows that over one-fifth of these teachers hold Master's degrees. Possibly this high percentage is due to the administrators who teach some science. It is also encouraging to note that only about one eighth have less than a Bachelor's degree.

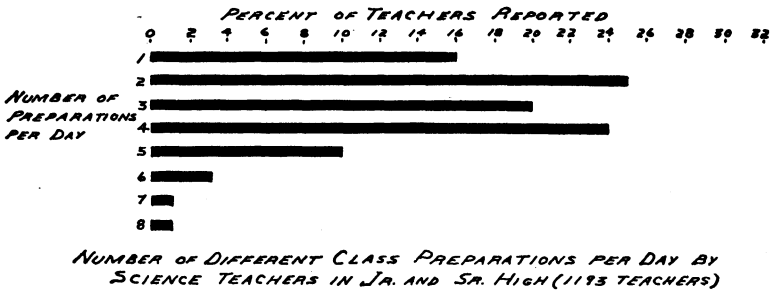
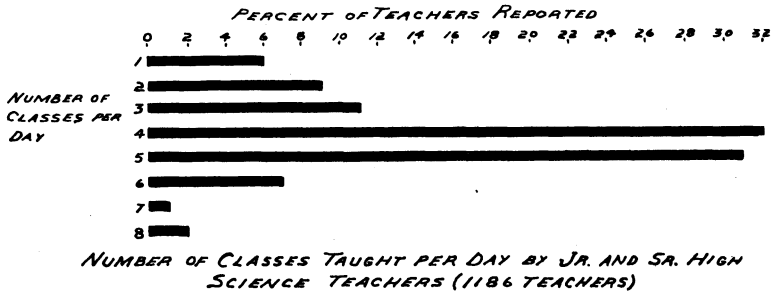


Figure 7.

Table 7
College Degrees Held by Science Teachers (1194)

	Number	%
M. A. degree	267	22
B. A. degree	789	66
Less than a B. A. degree	138	12

As shown in Table 8, less than half of our science teachers have majors in science but at least 86% have either a major or minor in this field.

Table 8
Science Teachers with Majors and Minors in Science (1190)

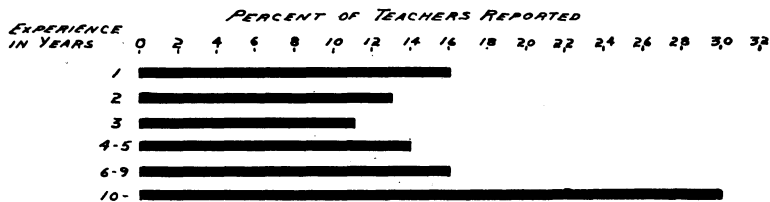
	Number	%
Major in science	490	41
Minor in science	538	45
Less than a minor in science	162	14

Table 9 shows the distribution of the majors in science by the area of specialization. Biology majors constitute about a third of the group, with Physics, Chemistry, and General Science about equally divided for the remainder.

Table 9
Major Fields of Teachers with a Science Major (549)

	Number	%
Biology	174	32
General Science	121	22
Chemistry	110	20
Physics	105	19
Others	39	7

The years of science teaching experience as given in Figure 8 shows that less than half of our teachers have five years or more experience. Further, if the year of this survey is representative of



YEARS OF EXPERIENCE OF PART AND FULL TIME SCIENCE TEACHERS IN JR. AND SR. HIGHS (1179 TEACHERS)

sciences for the past sixty years. The present Iowa enrollment is added for the purpose of comparison.

Table 10
 Percentage of Total Enrollment in Last Four Years
 of Public High Schools in the U. S. Enrolled in
 Science Courses, 1890 to 1949, and Comparable
 Per Cent in Iowa for 1949

Science	Year								Per cent in Iowa in 1949
	1890	1900	1910	1915	1922	1928	1934	1949	
Gen. Science					18.3	17.5	17.8	20.8	24.6
Earth Science		29.8	21.0	15.3	4.3	2.8	1.7	0.4	0.1
Biology			1.1	6.9	8.8	13.6	14.6	18.4	18.8
Physiology		27.4	15.3	9.5	5.1	2.7	1.8	1.0	1.2
Chemistry	10.1	7.7	6.9	7.4	7.4	7.1	7.6	7.6	3.6
Physics	22.8	19.0	14.6	14.2	8.9	6.8	6.3	5.4	8.4
Total Enrollment In Thousands	203	519	739	1165	2155	2897	4496	5399	

The decreasing enrollment in high school physics is disconcerting especially because there is nothing to indicate that another science is replacing it as was the case with physiology and earth science. Iowa compares favorably with the nation in all cases except chemistry. Time does not permit a discussion of that point. However the sum of the percentage of the enrollments in chemistry and physics in the nation and in Iowa are nearly equal. It would seem that Iowa with its high percentage of rural population should have even a greater need for physics and chemistry in its high schools than might be the case elsewhere.

ACKNOWLEDGMENT

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1. Federal Security Agency; Bulletin 1950, No. 9; The Teaching of Science in Public High Schools, Table 1, p. 2.
2. Communication from Dr. Wm. M. Slaichert of the Department of Public Instruction of Iowa.
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4. Ibid., p. 102.

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