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THE STATUS OF SCIENCE IN THE PUBLIC SCHOOLS OF IOWA. PART III, SENIOR HIGH SCHOOLS.

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INFORMATION WAS COLLECTED BY QUESTIONNAIRE FROM SUPERVISORS AND SCIENCE TEACHERS IN 51 SCHOOLS THROUGHOUT IOWA TO DETERMINE THE STATUS OF SCIENCE PROGRAMS IN IOWA SENIOR HIGH SCHOOLS. EQUAL NUMBERS OF SMALL-, MEDIUM-, AND LARGE-SIZED SCHOOLS WERE SELECTED. DATA COLLECTED AND ANALYZED INCLUDED (1) THE AVAILABILITY OF EQUIPMENT, SUPPLIES, BOOKS, AND VISUAL AIDS, (2) CURRICULUM DEVELOPMENT ACTIVITIES, (3) PRESENCE OF SCIENCE CONSULTANTS AND INSERVICE TRAINING PROGRAMS, (4) CLASSROOM TEACHING PRACTICES IN USE, (5) TEACHER QUALIFICATIONS, (6) COURSES OFFERED, AND (7) INDIVIDUAL COURSE CONTENT. SIMILAR REPORTS HAVE BEEN RELEASED ON THE STATUS OF SCIENCE IN THE ELEMENTARY SCHOOLS AND IN THE JUNIOR HIGH SCHOOLS OF IOWA. (RS)

The Status of Science in the Public Schools of Iowa

Part III - SENIOR HIGH SCHOOL

STATE UNIVERSITY OF IOWA

IOWA STATE DEPARTMENT OF PUBLIC INSTRUCTION

1966

The Status of Science in the Public Schools of Iowa

Part III— SENIOR HIGH SCHOOL

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STATUS OF SCIENCE IN THE SENIOR HIGH SCHOOLS IN IOWA

Introduction

This report is based on a study conducted in May, 1963. The principal purposes of the study are:

1) Ascertaining the status of present science curricula in the senior high schools in Iowa.

2) Cataloguing this information

A comparison of this information will be made with similar data collected late in 1966. The purpose of this comparison will be to measure the impact of the new state science curriculum, Science for Iowa Schools, for the senior high school science programs in the public schools of Iowa.

The information summarized in this report[1] was collected from fifty-one school systems.[2] All of these schools were chosen at random by the Iowa Department of Public Instruction on the basis of geographical location and enrollment of High School District. Thus, the schools chosen were as representative as possible of all Iowa Public Schools.

A group of seventeen of these schools had High School District enrollments of 600 or more students. This group of schools is designated as "Group I" or "large" schools. The second group of seventeen schools had a High School District enrollment of 300 - 599 students and is designated as "Group II" or "medium" schools. The third group of seventeen schools had a High School District enrollment of 100 - 299 students and is designated as "Group III" or "small" schools. The information contained herein was gathered by a science teacher or administrator from each of the seventeen "Group II" schools.[3]

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1. Reports on the status of elementary school science and junior high school science have already been issued and are available from the Iowa Department of Public Instruction.

2. See Appendix A for list of participating schools and their geographic distribution.

3. See Appendix A.

Those people administered the questionnaires to their own schools first and then each to a smaller and larger school.[1]

One supervisor for each senior high school filled out a questionnaire. Also, the two or three teachers in each senior high school filled out similar questionnaires. In addition, the supervisors and/or teachers completed a third form (basically a check-list) which furnished information concerning curriculum offerings by topic and emphasis. All of the above-mentioned information was then compiled by I.B.M. computers into a more condensed and usuable form from which tables and graphs were prepared. The following summarizes as objectively as possible the information disclosed by these tables and graphs.[2]

SECTION I: SUPERVISORS' EVALUATION

RESUME OF SENIOR HIGH SCHOOL SUPERVISORS' REPORTS

A. Curriculum in General

More than one half (57.2%) of the senior high schools reporting in this study had a planned science curriculum and 96% of these curricula were prepared during the years 1960 - 1963. Little or nothing was done in the way of curriculum planning prior to 1960. Sixty percent of these planned curricula were prepared by teacher committees while the remaining 40% were prepared by committees composed of both teachers and administrators. Of the 21 schools reporting no planned curriculum, only 12 indicated they were planning to prepare one. It is interesting to note that about the same number of junior high schools[3] reporting in this study, had no plans for preparation of a science curriculum.

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1. See Appendix B for list of school personnel gathering data for this project

2. See Appendix C for data collected from supervisors and Appendix D for data collected from teachers.

3. T.R. Porter, et al.,The Status of Science in the Public Schools of Iowa, Part II - Junior High School. Department of Public Instruction, Bulletin 1660-87DPE, 1965

More of the high school teachers (72.3%) reporting knew about the new Iowa science curriculum than did the junior high school teachers (55.3%).[1] Eight out of every ten schools planned to use this Iowa Curriculum. Nearly all of those planning to use it (87.2%) would use it only as a pattern for their science programs.

In most schools, science was coordinated with mathematics (73.5%) and to a much lesser degree with social studies (32.6%) and English (39.2%).

General science was offered most frequently at the 9th grade level (92.8%) as a terminal course (60.5%). Nearly two-thirds of the schools (63.4%) required it of all their students, but in only 44.9% of the reporting schools was it a prerequisite for advanced science courses.

More sections of biology were offered (187 sections) in all the schools studied than the total of the sections of chemistry and physics. Approximately one-half this number (82 sections) of chemistry classes were taught, and one-fourth the number of physics (46 sections) classes, compared to the number of biology classes taught.

Concerning experimental courses of study, five schools of the 51 studied were using the biology course of study as prepared by the Biological Science curriculum Study Committee (BSCS). Of these five schools, none used the Yellow version, four of the schools (all large) were following the Blue version, and one school (medium-size) was following the Green version. None of the medium-size or small schools used any of the special national programs in chemistry or physics. Only three of the large schools were using the Chemical Educational Material Study (CHEMS) course, one school the Chemical Bond Approach (CBA) materials, and five the Physical Science Study Committee Program (PSSC).

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1. Ibid.

Three of the large schools, four of the medium-size schools, and none of the small schools were incorporating ideas from the BSCS program into their local biology course. No more than 25% of any local course consisted of ideas from this special biology program. Eight large schools, four medium-size, and one small school used materials from the special courses of study in chemistry (CHEMS and CBA). Considering the time the special physics materials (PSSC) have been available, few schools were using them totally or in part. Only five large, four medium-size, and two small schools were using parts of this program.

B. Other Characteristics

1. Most schools did not have science and/or mathematics consultants; only 10% of the reporting schools had such specialists available.
2. The majority of the schools reporting held neither science workshops (77.1%) nor in-service science programs (84.4%) for their teachers.
3. About one-half of the reporting schools (46.2%) held science fairs.
4. Nearly all the high schools, regardless of size, were departmentalized in science (97.7%) as compared to 93.6% departmentalization in other areas.
5. All schools reported special science rooms.
6. Only 20% of the reporting schools had a remedial science program.
7. Slightly more (25%) of these schools had an honors program in science for accelerated students.
8. Almost all reporting schools (87.8%) offered science career counseling to varying degrees.

SECTION II: TEACHERS' EVALUATION

RESUME OF SENIOR HIGH SCHOOL TEACHERS' REPORTS

A. Background and Training

Forty percent of the teachers reporting hold master's degrees. This compares to 32.7% nationally.[1] The teachers in the large schools have more years teaching experience in science, and the teachers in the small schools the fewest years of experience. This is to be expected because most teachers aspire to teach in a large school system where the facilities and salary schedule are most favorable.

More teachers had a greater number of hours of training in biology with fewer semester[2] hours in chemistry, physics, and mathematics - in this order. This is to be expected because as reported in an earlier part of this paper, more sections of biology are taught than that of chemistry and physics combined.

B. Classroom

Equipment and Supplies

The average yearly equipment budget ranged from $150 to $8,000 in the large schools, $100 to $1,800 in the medium-size school, and $150 to $3,850 in the small schools. Although the average was requested, Table D-6 shows the extremes in these budgets. There was no indication whether the $7,000 and $8,000 figures were average budget figures or not. Also the upper budget limit for the small schools seems extremely high. Therefore, the median figures are probably better indicators of the budget conditions as they really existed.

There was great variation in the average yearly budgets for supplies, especially so in the case of the large schools. (Table D-7) Again, because of these extremes, the median figure is regarded as the best indicator of the yearly amount budgeted for supplies.

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1. National Education Assoc. Research Division Research Report, Ranking of the States, 1963,RI,p.28:This is a calculated national average based on a percentage estimate of all teachers (not just science teachers)in the United States with master's and doctors degrees. 1959-1960.
2. All quarter hours were converted to semester hours.

Approximately 90% of the teachers felt the availability of both equipment and supplies was good to excellent. (Table D-5)

The single text approach was the most common pattern with 84.7% of all reporting high schools using one text series. This is the common pattern for text materials at all grade levels, kindergarten through grade twelve. The high school science texts were given slightly better rating than those of the junior high and elementary school. Since 1963 there are many new science texts available at all grade levels. Therefore, it is anticipated that more schools may be using the multi-text approach and these books will be given a higher rating in terms of adequacy and up-to-dateness.

Text reading and discussion, followed by teacher demonstrations, were the two most frequently reported classroom methods. This was identical to the situation in both the elementary school[1] and the junior high school.[2]

Pupil experiments, directed observations, and pupil demonstrations - in this order - were the next three most frequently used methods in the high school. Similarly, these three methods were also the next most frequently used in both the elementary and the junior high schools, but in different orders.

Research reading, field trips and excursions, the use of resource people, outdoor education, and visiting scientists in this order.

Diagrams and charts were the most frequently used visual aids in all the high schools reporting. Films and models were next in order of usage. It is interesting to note that the use of live materials ranked sixth in usage in the high school as compared to a seventh ranking in junior high school and second ranking in the elementary schools. More attention should be given to the use of living materials at the junior and senior high school levels.

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1. T.R. Porter, et al.,The Status of Science in the Public Schools of Iowa, Part I-Elementary School. Department of Public Instruction,Bulletin #12640 - 11101RP, 1964. Des Moines, Iowa.
2. T.R. Porter, et al., The Status of Science in the Public Schools of Iowa, Part II-Junior High School, Department of Public Instruction, Bulletin #1660-87DPE, 1965. Des Moines, Iowa.

SECTION III: CURRICULUM AND COURSE CONTENT

A. Findings Concerning Curriculum

1. Only one school among the fifty schools reporting offered biology in ninth rather than tenth grade. Therefore, biology is definitely a tenth-grade subject. Two schools reported double-tract tenth-grade biology programs while six other schools allowed tenth and eleventh, or tenth, eleventh, and twelfth graders to enroll in high school biology. Two medium-size schools reported that they offered an advanced biology course for twelfth graders.
2. Chemistry is essentially an eleventh-grade subject. However, in more cases than was true for biology, chemistry was made available to seniors as well as juniors (11 schools) or to all three of the senior high grades (3 schools). In six schools, chemistry was a senior course.
3. Physics was primarily a twelfth-grade subject. In nine schools, juniors were admitted along with seniors into high school physics. In only one school were sophomores allowed to take physics with juniors and seniors. However, in another school, physics was open to both sophomores as well as seniors; and in the same school, chemistry was a junior and a senior course. In six schools, physics was an eleventh rather than a twelfth-grade offering; two of these six schools indicated they offered senior science courses which were classified as special science rather than advanced science courses.
4. General science was a ninth-grade subject in 48 of the 50 reporting schools. The two exceptions offered their final general science course in the eighth grade and provided an earth science course for their ninth

graders. Another school indicated its ninth grade general science was now called, "An Introduction to Physics and Chemistry" and implied that this course was different from what had been previously taught.

5. A "true"[1] advanced science course was evident in the reports from only four of the fifty schools. However, twenty-two schools reported special science courses other than biology, chemistry, and physics. These courses were physical science (12 schools), earth science (3 schools), electroncis or practical electricity courses (4 schools), physiology courses (4 schools), practical or applied science (2 schools), and courses called, "Senior Science" (2 schools). One large school which offered no advanced or special science courses, had provisions for their students to enroll in science courses at the local community college. Two other large schools reported they were planning advanced science courses but had not implemented them as yet.
6. Special student projects were more frequently included in the biology programs. Twenty-seven of the 50 schools reporting required and/or conducted such projects. Special student projects in chemistry and physics were not as numerous, with only 18 schools conducting projects in chemistry and 17 in physics. There was no apparent pattern for science projects within any given school.

B. Findings Concerning Course Content

1. Emphasis on topic areas in high school science courses differed very little among the three size classes of schools.

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1. "Advanced"refers to those college preparatory science courses which require the basic courses as prerequisites. "Special" refers to the applied science course such as a radio repair course.

2. In all three size classifications of schools the topics which may be categorized as modern biology, modern chemistry, and modern physics were greatly under-emphasized. In a few cases, school personnel indicated these topics as inappropriate.
3. Ecology was another biological topic which was not highly emphasized.
4. General principles of biology, animals, plants, and the human body (in this order) were the topics most heavily emphasized in high school biology.
5. Atoms and molecules was the topic most heavily emphasized in chemistry classes in all three sized schools. The next three topics which received heavy emphasis were states of matter, elements and compounds, and ionization. Topics such as common gases, electrochemistry, special applications of chemistry, and nuclear (modern) chemistry were much less emphasized in high school chemistry classes.
6. Mechanics, electricity and magnetism, and light were the three most highly emphasized topics in high school physics. Heat was also taught in depth in most schools, but not to the same extent. Much less emphasis was put on modern physics, sound and mathematics review.

C. <u>Findings Concerning Special Training for Teachers</u>

There was a slightly greater percentage of teachers of large schools who had attended institutes and workshops, than teachers in the medium and small size schools. The majority of the teachers were improving themselves professionally by attending institutes, most of which were sponsored by the National Science Foundation. But even so, approximately one-third of the teachers reporting had not an institute or a workshop.

A greater number of the teachers in the large schools belonged to professional organizations for science teachers. The pattern in the medium and small schools was essentially the same.

D. Findings Concerning Text Books

One text book was used almost to the exclusion of all others in each of the fields; chemistry, biology, and physics. A great variety of supplementary texts and references were used by teachers in their classes. Some teachers used a large number of these while others used few or no extra books. Many of the reference texts were rather old. A great majority of the high school teachers used their college texts as teacher references and an alarming few used professional science teacher periodical publications.

SECTION IV: CONCLUSIONS AND RECOMMENDATIONS

1. All senior high schools should have a planned science curriculum.
2. Twenty-one of the 51 schools reporting had no planned science curriculum. Nine of these 21 (or 20% of the reporting schools) had no plans for the preparation of one. This is very disturbing if these 51 schools are truly representative of all of the public high schools in Iowa. It is recommended that all schools without a planned science program now should move to correct this deficiency immediately.
3. Nearly 9 or every 10 schools plan to use the state curriculum as a guide rather than following it to the letter. This seems to be a worthwhile function of a state curriculum since no single curriculum could fit the diversified needs of the many individual school systems in any state.

4. Over 7 out of every 10 reporting schools indicated coordination of science with mathematics. This is certainly commendable and will promote student understanding and proficiency in both disciplines.
5. The fact that at least 2 of the 50 schools have dropped the old ninth-grade general science in favor of an earth science course or an introductory course in physics and chemistry may indicate a realization that the general science capstone approach is likely to be inappropriate and repetitious. More schools should make a critical study of their ninth-grade general science course in light of its objectives, overall contribution to the students' education, and relation to the science program of the earlier grades.
6. The fact that biology is taught more frequently than physics and chemistry courses combined is not disturbing in itself, but the fact that so few schools are using the BSCS, CHEMS, CBA, and the PSSC materials in total or in part is alarming. Here is a wealth of methods and materials representing untold hours of contributions from experts in the fields of biology, chemistry, physics, and science education, which is not being capitalized upon by the public school science teachers in this state. Since many dollars of Iowa taxpayers' money went into the development of these programs, better use should be made of them.
7. Only one out of every ten schools reporting had the services of a science and/or mathematics consultant. Undoubtedly, the costs involved in such non-teaching positions overshadows the intangible benefits which could be derived from them. The lack of in-service science programs and science workshops undoubtedly is related to the consultant problem because he would plan and direct such training programs.

8. Departmentalization in science in Iowa high schools appears to be almost complete and special rooms for science are provided by all of the schools included in this study.
9. More schools should give serious thought to offering a "true" advanced science course in the senior year. Such a course would require chemistry and physics as a prerequisite.
10. To allow for "true" advanced science courses in the senior year of high school, it will be necessary for schools to study their biology programs. It may be possible to offer biology to many ninth graders, thus allowing them to complete chemistry and physics in their sophomore and junior years. Close planning and cooperation with the mathematics department will be necessary so the student will have adequate mathematical background for these courses.
11. Topics from the contemporary fields of modern biology, modern chemistry, and modern physics are drastically underemphasized in the schools reporting in this study. Iowa schools should examine their curricula in terms of updating them by including more of these topics. Perhaps other topics may be excluded to make room for the modern science concepts which are becoming increasingly necessary for tomorrow's scientist as well as tomorrow's citizen, taxpayer, and voter.

APPENDIXES

A. SCHOOLS SELECTED FOR SCIENCE SURVEY AND THEIR GEOGRAPHICAL DISTRIBUTION

B. SCHOOL PERSONNEL COLLECTING DATA FOR THIS STUDY

C. DATA COLLECTED FROM SUPERVISORS

D. DATA COLLECTED FROM TEACHERS

E. INFORMATION CONCERNING TOPIC EMPHASIS IN SCIENCE

APPENDIX A

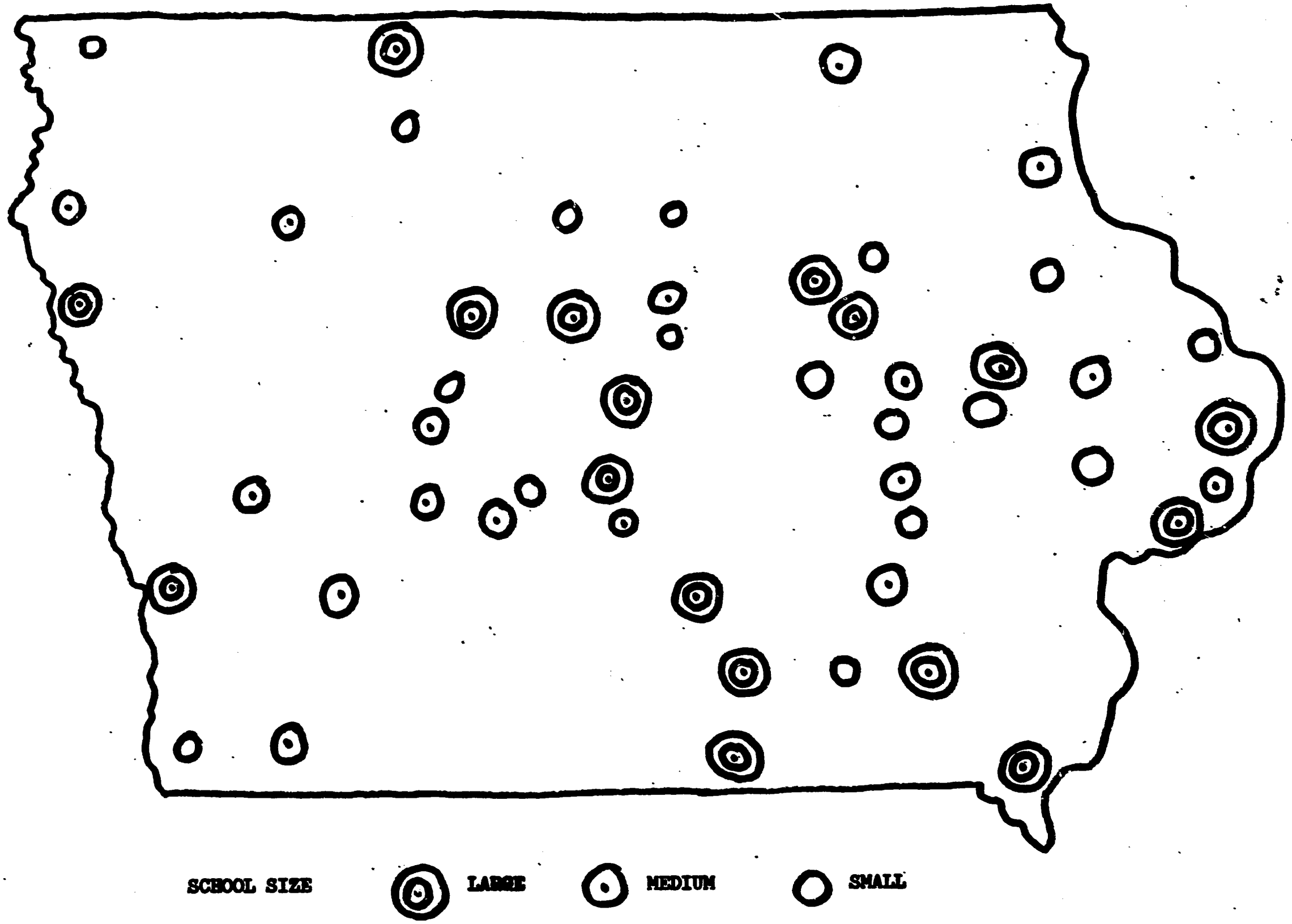
SCHOOLS SELECTED FOR SCIENCE SURVEY AND THEIR GEOGRAPHICAL DISTRIBUTION

APPENDIX A

SCHOOLS SELECTED FOR SCIENCE SURVEY

	Name of District	County	High School Enrollment (1963	
LARGE SCHOOLS	Des Moines	Polk	10,775	600 +
	Cedar Rapids	Linn	4,868	
	Davenport	Scott	4,665	
	Waterloo	Black Hawk	4,202	
	Sioux City	Woodbury	3,894	
	Council Bluffs	Pottawattamie	3,537	
	Fort Dodge	Webster	1,818	
	Clinton	Clinton	1,728	
	Ames	Story	1,321	
	Cedar Falls	Black Hawk	1,185	
	Keokuk	Lee	1,031	
	Fairfield	Jefferson	887	
	Webster City	Hamilton	822	
	Centerville	Appanoose	687	
	Esterville	Emmet	664	
	Albia	Monroe	655	
	Knoxville	Marion	645	
MEDIUM SCHOOLS	Le Mars	Plymouth	571	300 - 599
	North Scott	Scott	557	
	Iowa Falls	Hardin	533	
	Perry	Dallas	519	
	Storm Lake	Buena Vista	499	
	Jefferson	Greene	474	
	Clarinda	Page	446	
	Vinton	Benton	426	
	Monticello	Jones	403	
	Harlan	Shelby	390	
	Johnston Cons	Polk	368	
	Griswold	Cass	347	
	Williamsburg	Iowa	338	
	Central Comm	Clayton	335	
	Sigourney	Keokuk	322	
	Guthrie Center	Guthrie	313	
	Riceville	Howard	307	
SMALL SCHOOLS	West Lyon	Lyon	265	100 - 299
	Traer-Clutier	Tama	250	
	Edgewood-Colesburg	Delaware	237	
	H L V	Iowa	223	
	Eddyville	Wapello	210	
	CAL	Franklin	195	
	Dunkerton	Black Hawk	186	
	Lincoln Comm	Cedar	177	
	Farragut	Fremont	170	
	Churdan	Greene	161	
	Alden	Hardin	152	
	Norway	Benton	142	
	Lisbon	Linn	134	
	Woodward	Dallas	124	
	Ruthven	Palo Alto	118	
	Miles	Jackson	107	
	Goldfield	Wright	101	

GEOGRAPHICAL DISTRIBUTION OF SCHOOLS SELECTED FOR SCIENCE SURVEY



APPENDIX B

SCHOOL PERSONNEL COLLECTING DATA FOR THIS STUDY

APPENDIX B

SCHOOL PERSONNEL COLLECTING DATA FOR THIS STUDY

1. Richard Peterson - Le Mars - Physics Instructor
2. Melvin E. Heiler - North Scott - Junior and Senior High Principal
3. Kenneth Harfst - Iowa Falls - Science Instructor
4. Thomas Drake - Perry - Junior High Principal
5. Richard Kearney - Storm Lake - Chemistry Instructor
6. Anthony A. Andrusyk - Jefferson - Biology Instructor
7. Jerald Blasi - Clarinda - Senior High Principal
8. Donald DePrenger - Vinton - Chemistry Instructor
9. Dale Greenawald - Monticello - Junior and Senior High Principal
10. Glen Kuiper - Harlan - Chemistry & General Science Instructor
11. Richard Seveeney - Johnston - Chemistry and Biology Instructor
12. V. A. Chadwick - Griswold - Denior High Principal
13. Roland Chapman - Williamsburg - Biology Instructor
14. Harold Ebel - Central - Senior High Principal
15. Harrison Seip - Sigourney - Head, Science Department
16. Ted K. Hansen - Guthrie Center - Elementary Principal
17. Dale C. Guldberg - Riceville - Senior High Principal

APPENDIX C

DATA COLLECTED FROM SUPERVISORS

Schools by Size	Planned Curriculum		Year Curriculum Planned							Curriculum Prepared by		Plans for Curriculum Development	
	YES	NO	Before 58	58	59	60	61	62	63	Teachers	Teachers and Adminstrators	YES	NO
Large	11	5					4	3	2	6	4	4	1
Medium	8	9		1		2	2	1	1	4	2	6	3
Small	9	7				4	1	3	1	4	3	2	4
Totals	28	21		1		6	7	7	4	14	9	12	9
%	57.2	42.8	0.0	4.0	0.0	24.0	28.0	28.0	16.0	60.9	39.1	57.2	42.8

Table C-1. Supervisors' evaluation of school curriculum.

School Size	State Curriculum					
	Do Teachers know about State Curriculum?		Do Teachers plan to use State Curriculum?		Adopt as is	Serve as Pattern
	Yes	No	Yes	No		
Large	12	4	10	6	3	8
Medium	13	2	14	1	1	13
Small	9	7	12	3	1	13
Totals	34	13	46	10	5	34
%	72.3	27.7	82.2	17.8	12.8	87.2

Table C-2. Supervisors' statements concerning state curriculum.

SCHOOL SIZE	Science		Mathematics		Both	
	Yes	No	Yes	No	Yes	No
Large	4	11	1	11	4	10
Medium	0	16	1	15	0	15
Small	2	14	1	15	0	13
Totals	6	41	3	41	4	38
%	12.8	81.2	6.8	93.2	9.5	90.5

Table C-3. Supervisors' statements concerning concerning special consultants.

Schools by Size	Science Workshops							In-Service Science Courses							Science Fairs						
	Conducted		Years					Conducted		Years					Conducted		Years				
	Yes	No	60	61	62	63	64	Yes	No	60	61	62	63	64	Yes	No	60	61	62	63	64
Large	6	10		1	3	2		5	13	1		3	1		10	9			1	8	
Medium	5	11	2		2			1	10						9	2		1	4	4	
Small	0	16						1	15			1			5	17			2	3	
Totals	11	37						7	38						24	28					
%	22.9	7.1						15.6	84.4						46.2	53.8					

Table C-4. Status of programs for the improvement of science.

School Size	Departmentalization and Facilities					
	Departmentalization in Science		Departmentalization in other areas		Special Rooms	
	Yes	No	Yes	No	Yes	No
Large	16	0	15	1	16	0
Medium	17	0	17	0	17	0
Small	15	1	12	2	14	0
Totals	48	1	44	3	47	0
%	97.9	2.1	93.6	6.4	100.0	0.0

Table C-5. Supervisors' report on departmentalization.

School Size	Special Programs for Science Students					
	Remedial Program in Science		Honors Course for Advanced Students		Special Councel in Science Careers	
	Yes	No	Yes	No	Yes	No
Large	5	11	9	7	14	2
Medium	3	14	3	14	16	1
Small	2	14	1	15	13	3
Totals	10	39	13	36	43	6
%	20.4	79.6	26.5	73.5	87.8	12.2

Table C-6. Summary of reports from Supervisors on special programs in science.

School Size	Coordination of Science Program with other areas					
	Mathematics		Social Studies		English (reading, themes	
	Yes	No	Yes	No	Yes	No
Large	12	4	4	12	6	9
Medium	13	4	6	11	5	11
Small	11	5	5	8	6	8
Totals	36	13	15	31	18	28
%	73.5	26.5	32.6	67.4	39.2	60.8

Table C-7. Summary of Supervisors' reports on coordination of science with other subject matter fields.

Size of School	General Science offered				Terminal Course?		Required of all Students?		Prerequisite for advanced science	
	7th	8th	9th	10th	YES	NO	YES	NO	YES	NO
Large	1	1	12	0	3	8	6	6	4	5
Medium	0	0	15	0	3	8	9	6	4	7
Small	0	0	12	1	6	7	11	3	5	4
Totals	1	1	39	1	15	23	26	15	13	16
%	2.4	2.4	92.8	2.4	60.5	39.5	63.4	36.6	44.9	55.1

Table C-8. Supervisors' report on the status of General Science.

SCHOOLS BY SIZE	COURSES	Numbers of Sections																												Totals	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Sections / School	Mean
LARGE	Biology	1					1	3	1		1		1	1	1			1													1	132/12	11.0
	Chemistry		2	2	4	1		1						1																	51/11	4.6
	Physics	2	4	4			1																									28/11	2.5
MEDIUM	Biology			5	2	3																										41/10	4.1
	Chemistry	3	5	2																												19/10	1.9
	Physics	10																														10/10	1.0
SMALL	Biology	3	7																													17/10	1.7
	Chemistry	10	1																													12/11	1.1
	Physics	10																														10/10	1.0

Table C-9. Summary of Supervisors' reports on the numbers of sections offered in the three basic courses in science.

Courses \ Schools by Size	Large							Medium							Small							Totals			
# of Section	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	Large	Medium	Small	Totals
B.S.C.S. (Yellow)																						0	0	0	0
B.S.C.S. (Blue)	1	3																				6	0	0	6
B.S.C.S. (Green)								1														0	1	0	1
CHEMS	1				1	1																12	0	0	12
C.B.A.	2	1																				2	0	0	2
P.S.S.C.	1	3				1																13	0	0	13
TOTALS																						33	1	0	34
%																						97	3	0	

Table C-10. Supervisors' report on the number of schools offering sections of various national courses of study.

Courses	% of National Courses of Studies Incorporated into Conventional Courses																																			
	Large Schools % Incorporated												Medium Schools % Incorporated												Small Schools % Incorporated											
	0	5	10	15	20	25	30	35	40	45	50		0	5	10	15	20	25	30	35	40	45	50		0	5	10	15	20	25	30	35	40	45	50	
Biology				1		2									1	1	1		1																	
Chemistry		1	3	1		1			1		1			1	1		1	1								1										
Physics		1		2		1		1							2		1	1								1						1				

Table C-11. Supervisors' report on the number of schools incorporating certain percentages of national courses of study into their existing science programs.

APPENDIX D

DATA COLLECTED FROM TEACHERS

Degree / Size of School	B.A.	B.S.	M.A.	M.S.	Ph.D.
LARGE	17	22	21	12	1
MEDIUM	12	12	13	10	0
SMALL	10	15	2	0	0
Totals	39	49	36	22	1
%	26.5	33.4	24.5	14.9	0.7

Table D-1. Numbers of teachers holding particular degrees as reported by the teachers.

School Size	Years of	Numbers of teachers having years of experience and years in science																																					TOTALS	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	39	38	39	40	41	42	Sums	Mean
Large	Exp	1		6	9	9	5	5	5	2	1	3	3	2	2	1	2													1	2		3	1	1	1	2		3	1		1	1	1008/71	14.1
	Sci	3	1	7	10	5	2	5	4	3	1	6	3		2	2	2				2					1						2	3			1	1		3	1		1	1	898/71	12.6
Medium	Exp	3	6	6	3	6	2	3	1		3	2	3	1	2	2				1				1					1							1							381/47	8.1
	Sci	6	5	5	3	6	4	2	1		4	2	2	1	2				1					1					1							1							370/47	7.4
Small	Exp	2	5	2	7	1	2	3	2						1	1					1																						149/27	5.5
	Sci	3	6	3	6	1	2	1	2						1	2																											133/27	4.9
Totals	Exp	6	11	14	19	14	8	11	8	2	4	5	6	3	5	4	2			1	2			1					1	1	2		3	1	1	1	3		3	1		1	1	1532/145	10.5
	Sci	12	12	15	19	12	8	8	7	3	5	8	5	1	5	4	2	1			2			1		1			1			1	3			1	2		3	1		1	1	1380/145	9.5

Table B-2. Total number of years of teaching experience and years of experience in teaching science. Quantities in boxes indicate the numbers of teachers having experience for the number of years indicated.

Background Academic Training of Senior High School Teachers

University and College Courses	School Size	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Astronomy	Large			3	5	1	1	1												
	Medium			5	5															
	Small			2		2														
Biology	Large			1	3	5	3			3	3	1		2	2	1	3	2		1
	Medium			1	2	4	3	5		1			1	3		1		2		1
	Small			1		1		4	1		1	2		1			2			
Botany	Large				5	5	4	1	3	7	3	5	1	1			1	2		1
	Medium			1	1	4	3	3		2		5		3	1	1	1			
	Small				3	4		2		1	2		1	1	1					1
Chemistry	Large					2		1	3	12		4	2	3			1	1	3	2
	Medium				2	1	1			3	1	3		4		[illegible]	[illegible]	2	2	
	Small				1		2	1		3		2		1	1					
Earth Science	Large			4	3	3			1	4		1								
	Medium		1	1	1					4						1	1			
	Small			1	4	1		2												
Geology	Large			4	4	7	1	3		6							1			
	Medium			3	1			1	1							1				
	Small			1	1	1	1	2		1										
Meteorology	Large			3	4	2														
	Medium			2	4															
	Small			1	2															
Physics	Large				2	2	1	2	1	12	2	3	5	1	2	2	1			1
	Medium			2	2	2	2	1		5	3	4	1		1		3	2		
	Small			1	2			2		3	1	3	1	1		2	1		1	
Zoology	Large				4	3	3	1	1	7	1	4		2		1		1	2	3
	Medium				1	3	1	3		6		3	1	1			1			
	Small				3	5	1	3	1	2	3			1						
Science Methods	Large		1	12	12	10	1	9		4		1		2			3			
	Medium		1	5	7	1	2	3		2		4			1		1			
	Small		1	4	5	2	1	1	1											
Mathematics	Large			2	5	1		6		6	2	3	2		2	2	4	3	1	2
	Medium				5	2	3	1	1	4		5			1	1		3		
	Small			1		1	1			1		2	1	3			1			3

University and College Courses	School Size	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Astronomy	Large																		
	Medium																		
	Small																		
Biology	Large	1	2				1				1		2		3	1	1	1	
	Medium								1			1	2						2
	Small			1	1			1							1				
Botany	Large	1	4				1						2						1
	Medium		1	1						1						1			
	Small					1							1						
Chemistry	Large		5	2	1		2		2			2	1				3	1	1
	Medium	1			4	2	2		1				2			1	1		1
	Small	1	3	2			1		1										
Earth Science	Large							1			1								
	Medium																		
	Small																		
Geology	Large																		
	Medium																		
	Small																		
Meteorology	Large																		
	Medium																		
	Small																		
Physics	Large			2	1			1		1	1					2		2	
	Medium	1			1	1					1	1						1	
	Small							1							1				
Zoology	Large		3		1	1			2		1		1	1					1
	Medium		3	1						1	1		1						
	Small						1												
Science Methods	Large																		
	Medium																		
	Small																		
Mathematics	Large		2			2	1	1		1	1		1			1		1	1
	Medium	1		2	1				1	1			1	1	1	1			
	Small		1		1			1	1					1					

University and College Courses	School Size	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	over 66
Astronomy	Large																															
	Medium																															
	Small																															
Biology	Large				2										1						1		1		3							1
	Medium											1			1											1						
	Small																															
Botany	Large										1									1												
	Medium																															
	Small																															
Chemistry	Large				1	1			1	1			1		1																	2
	Medium									1				1																		
	Small		1													1																
Earth Science	Large																															
	Medium																															
	Small																															
Geology	Large																															
	Medium																															
	Small																															
Meteorology	Large																															
	Medium																															
	Small																															
Physics	Large		1										1		1			1	1													
	Medium	1			1			1							1																	
	Small																															
Zoology	Large				1		1								2											1			1			3
	Medium												1															1				
	Small																															
Science Methods	Large																															
	Medium																															
	Small																															
Mathematics	Large								1																							1
	Medium		1	1								1																				
	Small																															

University and College Courses	School Size	Totals: Semester Hours		Totals: Number of Teachers	
Astronomy	Large	36	73	11	25
	Medium	25		10	
	Small	12		4	
Biology	Large	1175	1909	103	103
	Medium	533		33	
	Small	219		18	
Botany	Large	623	1092	50	97
	Medium	299		29	
	Small	170		18	
Chemistry	Large	1261	2348	61	123
	Medium	734		40	
	Small	353		22	
Earth Science	Large	131	228	18	35
	Medium	67		9	
	Small	30		8	
Geology	Large	134	204	26	40
	Medium	36		7	
	Small	34		7	
Meteorology	Large	23	47	9	18
	Medium	16		6	
	Small	8		3	
Physics	Large	883	1674	54	112
	Medium	568		38	
	Small	223		20	
Zoology	Large	1142	1711	53	102
	Medium	451		29	
	Small	138		20	
Science Methods	Large	271	478	55	98
	Medium	157		28	
	Small	50		15	
Mathematics	Large	843	1685	55	113
	Medium	563		39	
	Small	279		19	

Table D-3. Total semester hours of credit completed by teachers in specific subject matter areas. The quantities in the boxes indicate the numbers of teachers having the given number of hours in that specific subject.

Average time in teaching science in minutes per week					
Large Schools		Medium Schools		Small Schools	
minutes/week	Teachers	minutes/week	Teachers	minutes/week	Teachers
25	1	260	1	55	1
220	1	275	4	90	1
250	2	280	1	225	1
275	5	285	2	275	1
285	1	570	1	300	2
300	1	600	1	550	2
322	1	775	1	600	2
550	5	825	2	725	1
600	3	855	2	775	1
825	1	891	1	1100	4
840	1	900	2	1200	2
900	3	1050	1	1250	3
988	1	1100	3	1300	1
1100	8	1140	3	1500	2
1200	3	1200	1	1680	1
1250	2	1250	1	1800	1
1260	1	1275	2		
1312	1	1320	1		
1320	1	1375	5		
1325	1	1425	1		
1350	1	1450	2		
1375	7	1500	2		
1385	1	1525	1		
1400	1	1550	2		
1425	2	1650	1		
1500	12	1800	1		
1575	2				
1650	2				
Mean	1044	1035	899		
Median	1200	1140	1100		
Mode	1500	1375	1100		

Table D-4. Average numbers of minutes per week taught in science. The quantities under the column headed "Teachers" indicate numbers of teachers.

School Size	Availability of Equipment					Availability of Supplies				
	Excellent	Very Good	Good	Poor	Very Poor	Excellent	Very Good	Good	Poor	Very Poor
Large	21	28	19	3	1	18	31	21	3	0
Medium	2	22	18	5	0	5	20	18	4	0
Small	5	9	8	4	0	6	9	10	2	0
Totals	28	59	45	12	1	29	60	49	9	0
%	19.3	40.7	31.0	8.2	0.8	19.8	40.8	33.3	6.1	0.0

Table D-5. Teachers' report on the status of equipment and supplies.

YEARLY AVERAGE BUDGET FOR EQUIPMENT IN DOLLARS					
Large Schools		Medium Schools		Small Schools	
Amount	# of Schools	Amount	# of Schools	Amount	# of Schools
$150	1	$100	2	$150	3
185	1	150	2	200	3
200	8	200	1	250	1
250	4	250	3	300	2
300	4	300	4	400	1
400	2	400	3	500	3
425	1	500	3	1000	2
500	2	600	1	2000	1
600	2	700	2	3000	1
750	3	800	1	3850	1
800	1	1000	2		
1000	4	1500	3		
1500	1	1800	4		
1680	4				
2000	3				
7000	1				
8000	1				
Mean	$1019	$705		$814	
Median	$500	$500		$350	
Mode	$200	$300 $1800		$150 $200	$500

Table D-6. Teachers' report on yearly average budget for equipment for high school science.

YEARLY AVERAGE BUDGET FOR SUPPLIES IN DOLLARS					
Large Schools		Medium Schools		Small Schools	
Amount	# of Schools	Amount	# of Schools	Amount	# of Schools
$10	1	$50	1	$100	5
15	1	100	4	150	1
50	1	150	4	200	3
100	2	200	6	220	1
125	2	300	5	300	2
150	1	350	1	350	2
165	4	400	2	400	1
175	1	800	1	500	3
200	6	1000	1	700	1
300	1			1000	1
325	1				
360	1				
400	1				
425	1				
500	8				
600	2				
1300	2				
1302	2				
2000	3				
3500	3				
Mean	$714.20	$268.00	$318.50		
Median	$380.00	$200.00	$260.00		
Mode	$500.00	$300.00	$100.00		

Table D-7. Teachers' report on yearly average budget for supplies for high school science.

School Size	Textbook Approach		Adequacy and up-to-dateness of textbooks					Adequacy and up-to-dateness of references				
	Single Text	Multiple Text	E	VG	G	P	VP	E	VG	G	P	VP
Large	57	15	15	36	20	4	3	13	29	25	6	0
Medium	44	7	11	16	13	6	1	1	14	22	8	1
Small	26	1	4	10	9	3	0	0	9	7	10	1
Totals	127	23	30	62	42	13	4	14	52	54	24	2
%	84.7	15.3	19.9	41.0	27.8	8.6	2.7	9.6	35.6	37.0	16.4	1.4

Table D-8. Status of texts and references and reported by teachers. In the column headings E for excellent, VG for very good, G for good, P for poor, and VP for very poor.

CLASSROOM METHODS	Large Schools											Medium Schools											Small Schools											Ranking			
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	Large	Medium	Small	Totals
Text Reading & Discussion	56	7	5		2					1		36	8		1		1	1					21	4	1									1	1	1	1
Teacher Demonstrations	7	32	17	6	6	2		1				6	18	14	5	2	1						2	12	9	1	3							2	2	2	2
Pupil Demonstrations		2	9	23	6	13	3	3	1			1	2	5	18	9	6	2		2		1		1	3	7	5	3	3	1				5	5	6	5
Pupil Experiments	6	23	18	10	6	2		1				1	15	20	3	3	1	2					3	7	6	5	3		2					2	3	3	3
Field Trips & Excursions			1	1	7	1	13	8	6	4	1		1	1	3	2	8	11	6	2	3			1	2	1	1	3	3	3	4	1		9	6	8	7
Outdoor Education		1			4	2	2	3	4	15	4						1	4	4	6	18	2						1		2	3	10		7	10	10	9
Directed Observations	4	7	13	12	9	5	5	1				1	2	3	10	12	5	6	2					1	4	3	5	7	2					4	4	4	4
Research Reading		4	7	11	17	17	3	1						4	5	13	10	4	6	2				1	2	7	4	4	3	1				6	7	5	6
Resource People			2	1	2	4	6	12	10	3						1	4	6	11	9	5	1					2	6	5	1	1			7	8	7	8
Visiting Scientists			2	2	3	8	11	7	9	7						2	5	4	6	14	7					1		1		4	7	3		10	9	9	10

Table D-9. Numbers of teachers ranking classroom methods used. For example, 56 teachers ranked "Text Reading & Discussion" as the primary method used in their classrooms, 7 ranked it as the second most used method, etc..

Visual Aids / Ranking	Large Schools							Medium Schools							Small Schools							Ranking			
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	Large	Medium	Small	Totals
Films	16	15	17	9	11	1	3	5	9	7	7	7	5	4	7	4	2	3	2	5		2	2	3	3
Filmstrips	1	4	8	6	6	19	8	2	6	2	5	5	9	9	3	5	1	3	3	6	1	5	5	4	5
Bulletin Boards	2		4	17	7	12	13		2	4	7	11	12	14				3	4	6	7	7	7	7	7
Live Materials	10	9	4	9	6	8	12	2	3	5	3	6	4	17	1	2	2	3	5	1	6	4	6	6	6
Diagrams	28	14	8	9	7		1	23	7	6	3	3	2		11	4	7	1	1		2	1	1	1	1
Charts	10	23	15	6	12	3	2	6	12	12	6	5	4	1	4	9	5	6	2			3	3	2	2
Models	5	10	17	13	14	11	1	7	8	8	13	4	3	3	1	3	9	4	3	2	2	6	4	5	4

Table D-10. Number of teachers ranking visual aids used. For example, 16 teachers from Large Schools reported that they used "Films" more than any other visual aid, 15 ranked "Films" second, etc..

SPECIAL TRAINING OF SENIOR HIGH SCHOOL TEACHERS

(Large Schools)

AREA	INSTITUTES	WORKSHOPS	NONE
Biology	24	6	14
Chemistry	6	3	5
Physics	9	1	1
Combinations	11	-	2
Totals	50	10	22
(Medium Schools)			
Biology	2	2	8
Chemistry Physics	15	2	7
Combinations	5	1	1
Totals	22	5	16
(Small Schools)			
Biology	2	-	6
Chemistry Physics	5	2	5
Combinations	3	-	2
Totals	10	2	13

Table D-11. Report from teachers indicating the numbers who have had special training in science and science teaching.

MEMBERSHIP IN VARIOUS PROFESSIONAL ORGANIZATIONS

(Numbers of High School Science Teachers)

SCHOOL SIZE	AREA	ISEA	NEA	Local	County	NSTA	Ia Acad Sci	None
LARGE	Biology	38	30	21	5	3	8	1
	Chemistry	8	6	6	-	3	2	1
	Physics	11	9	8	1	4	3	1
	Combinations	14	11	7	3	7	3	-
	Totals	71	56	42	9	17	16	3
MEDIUM	Biology	12	7	4	1	2	1	1
	Chemistry Physics	25	21	6	1	5	2	-
	Combinations	6	6	2	-	3	2	-
	Totals	43	34	12	2	10	5	1
SMALL	Biology	8	7	-	2	1	-	-
	Chemistry Physics	12	11	2	-	2	-	2
	Combinations	6	6	1	2	-	1	-
	Totals	26	24	3	4	3	1	2
Grand Total		140	114	57	15	30	22	6

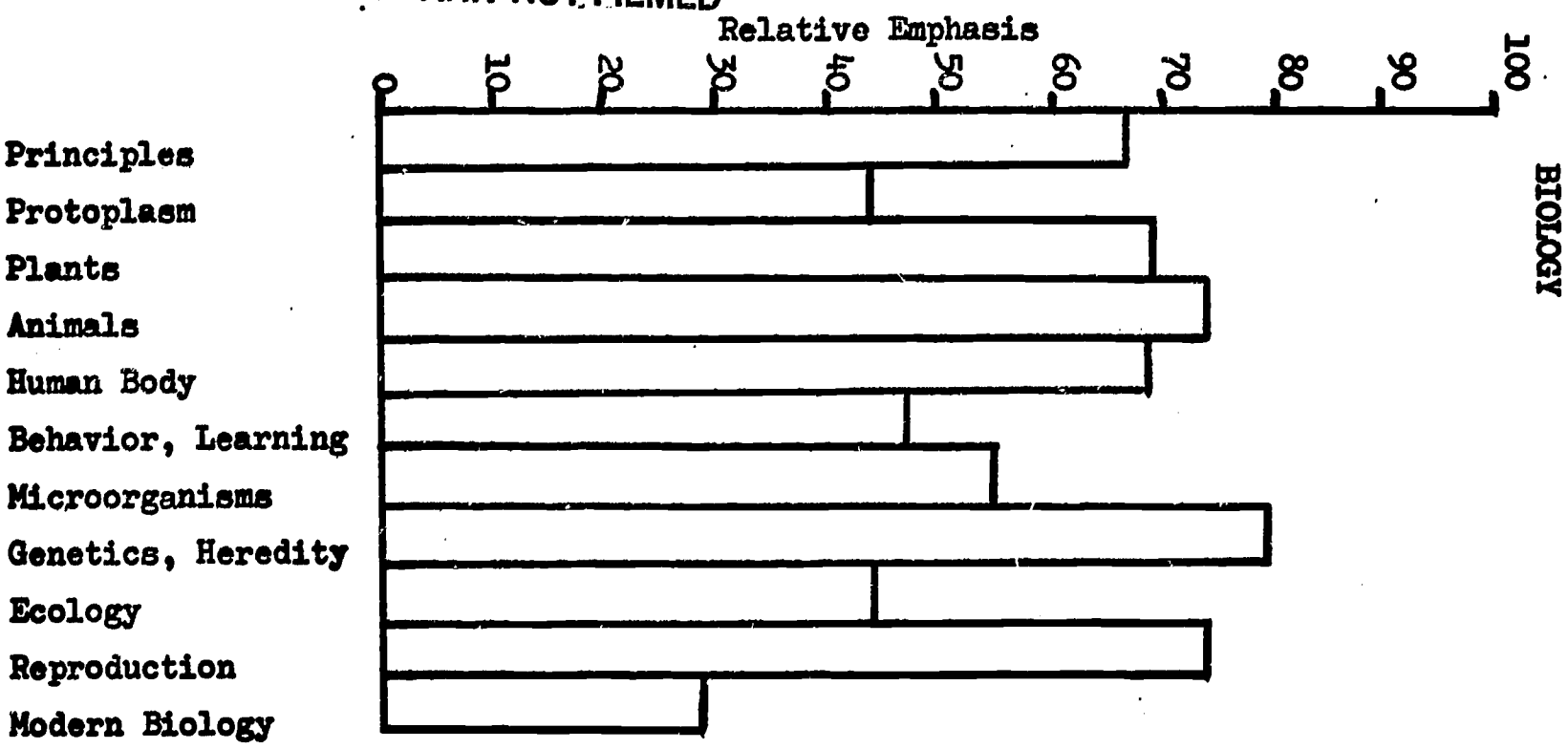
Table D-12. Membership in professional organizations as reported by the teachers. For example, 38 biology teachers from Large schools belonged to the ISEA, 30 to the NEA, etc..

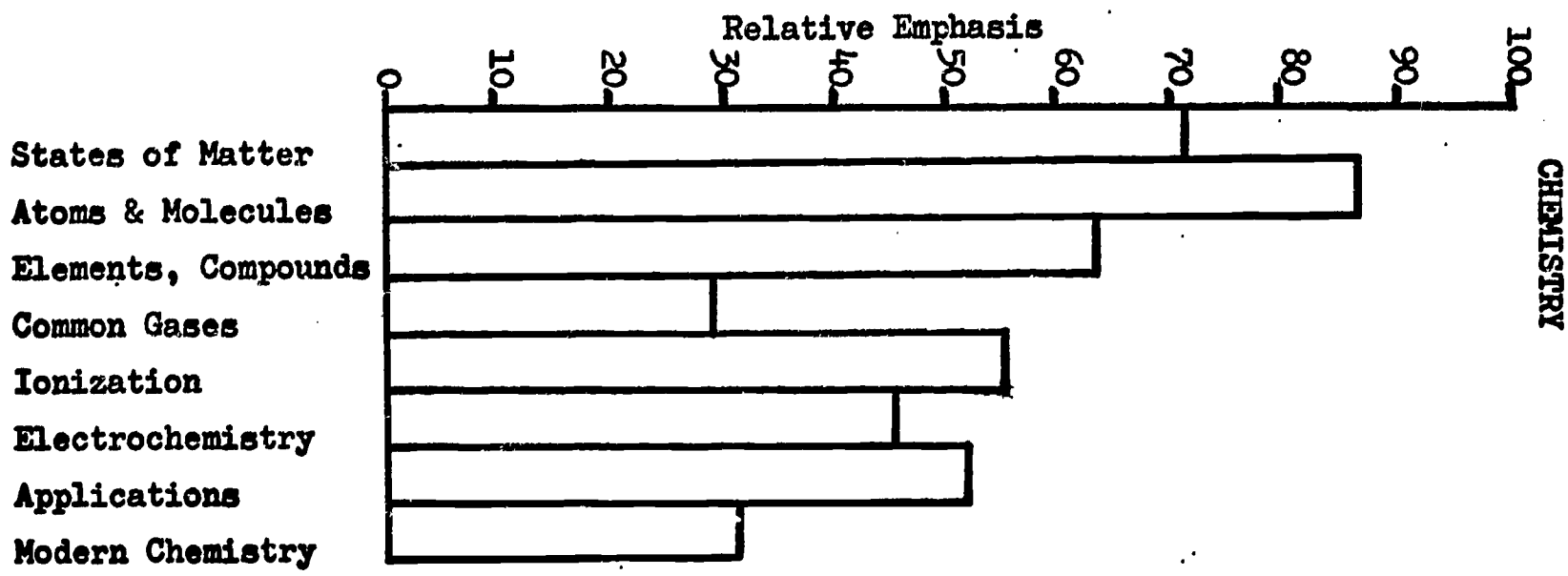
APPENDIX E

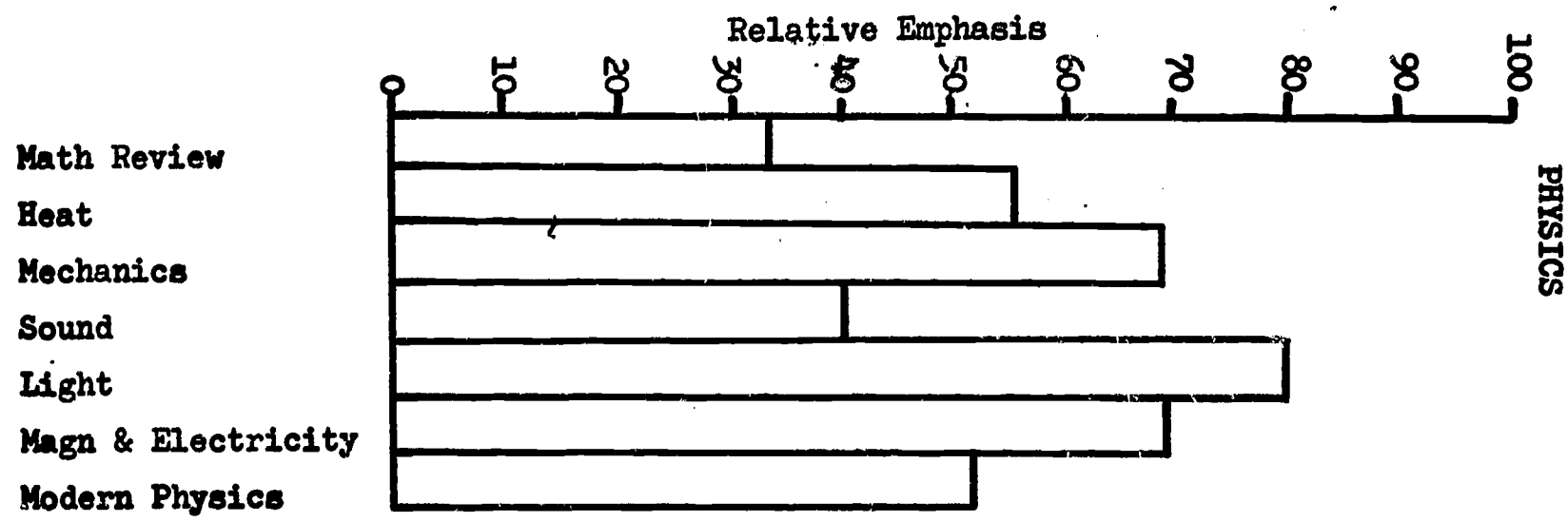
INFORMATION CONCERNING TOPIC EMPHASIS IN SCIENCE

CURRICULUM EMPHASIS BY TOPIC

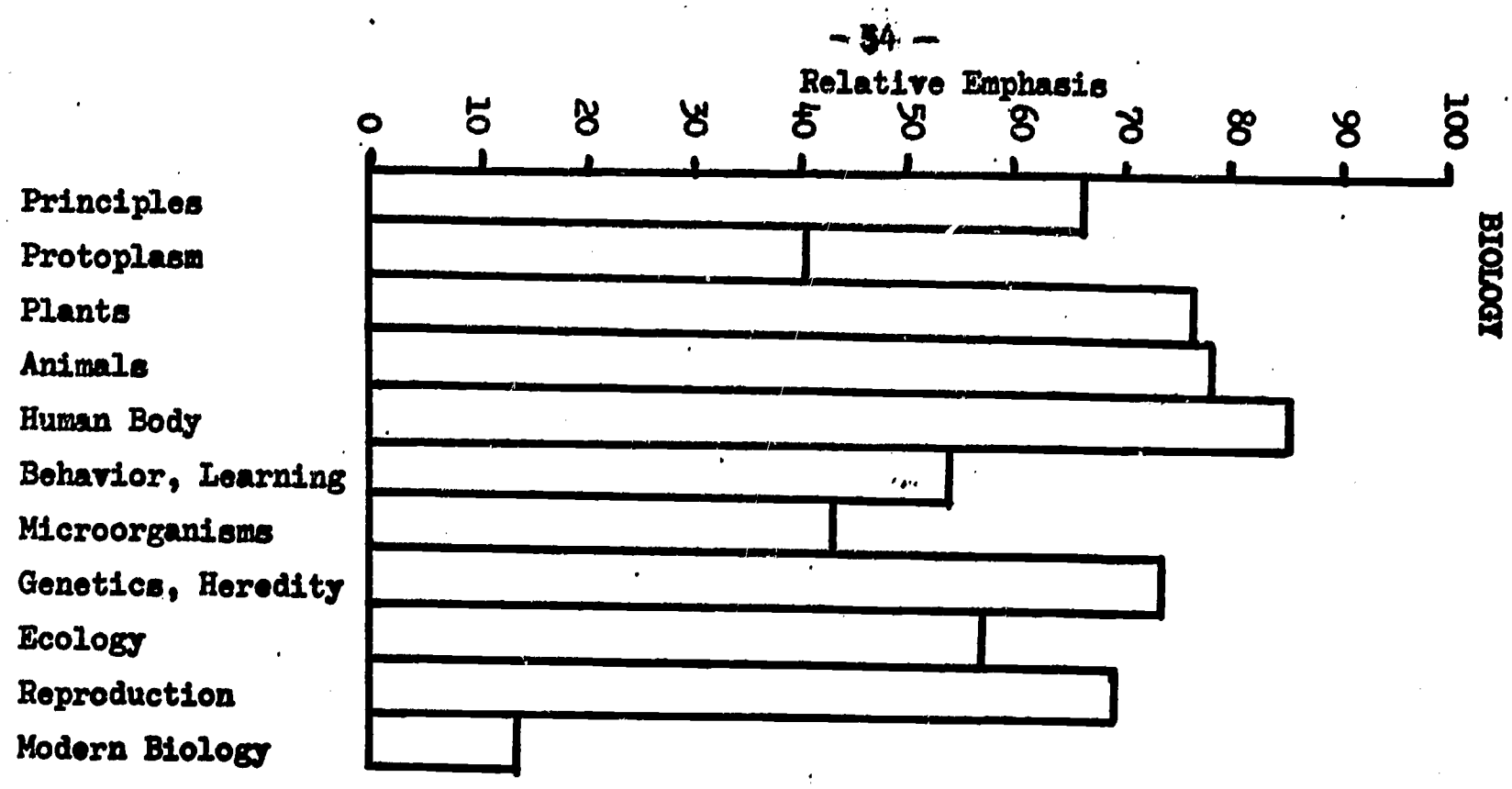
(Large Schools)

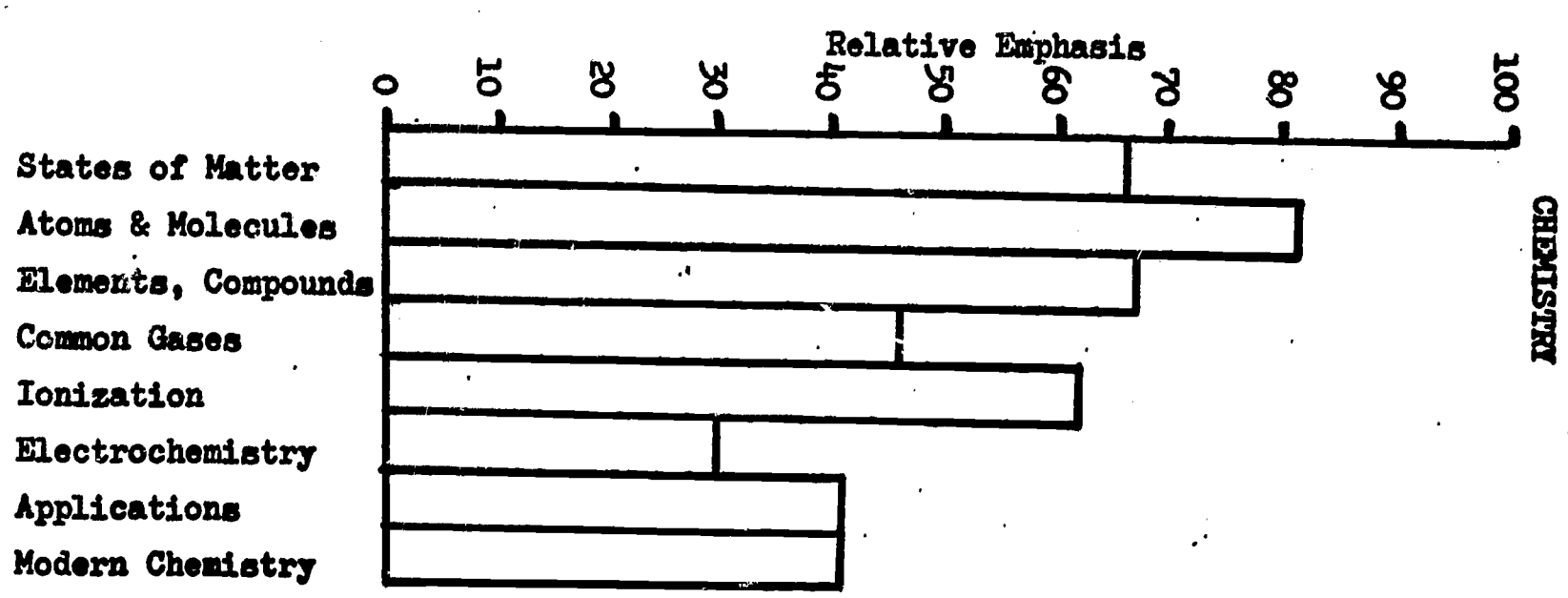


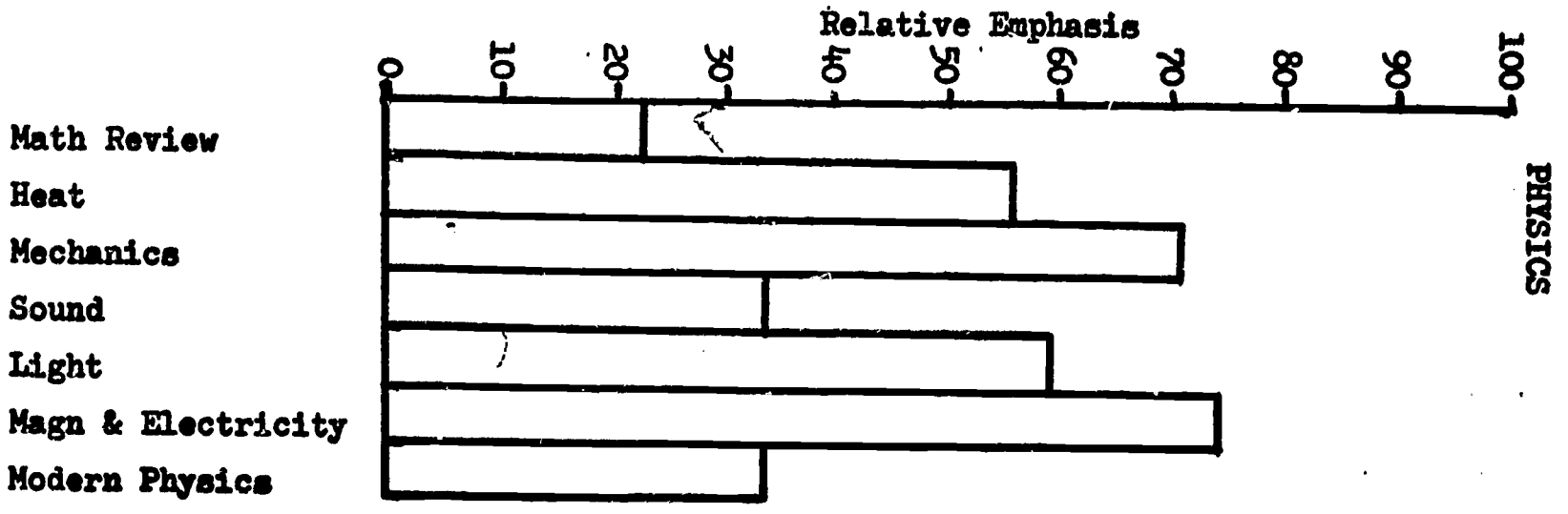




Graphs E-1. Three graphs indicating the relative emphasis placed on various topics in biology, chemistry, and physics respectively in the "Large" high schools. For example, 72 of 100 or 72 % of the chemistry teachers strongly emphasize "States of Matter" in their chemistry courses.

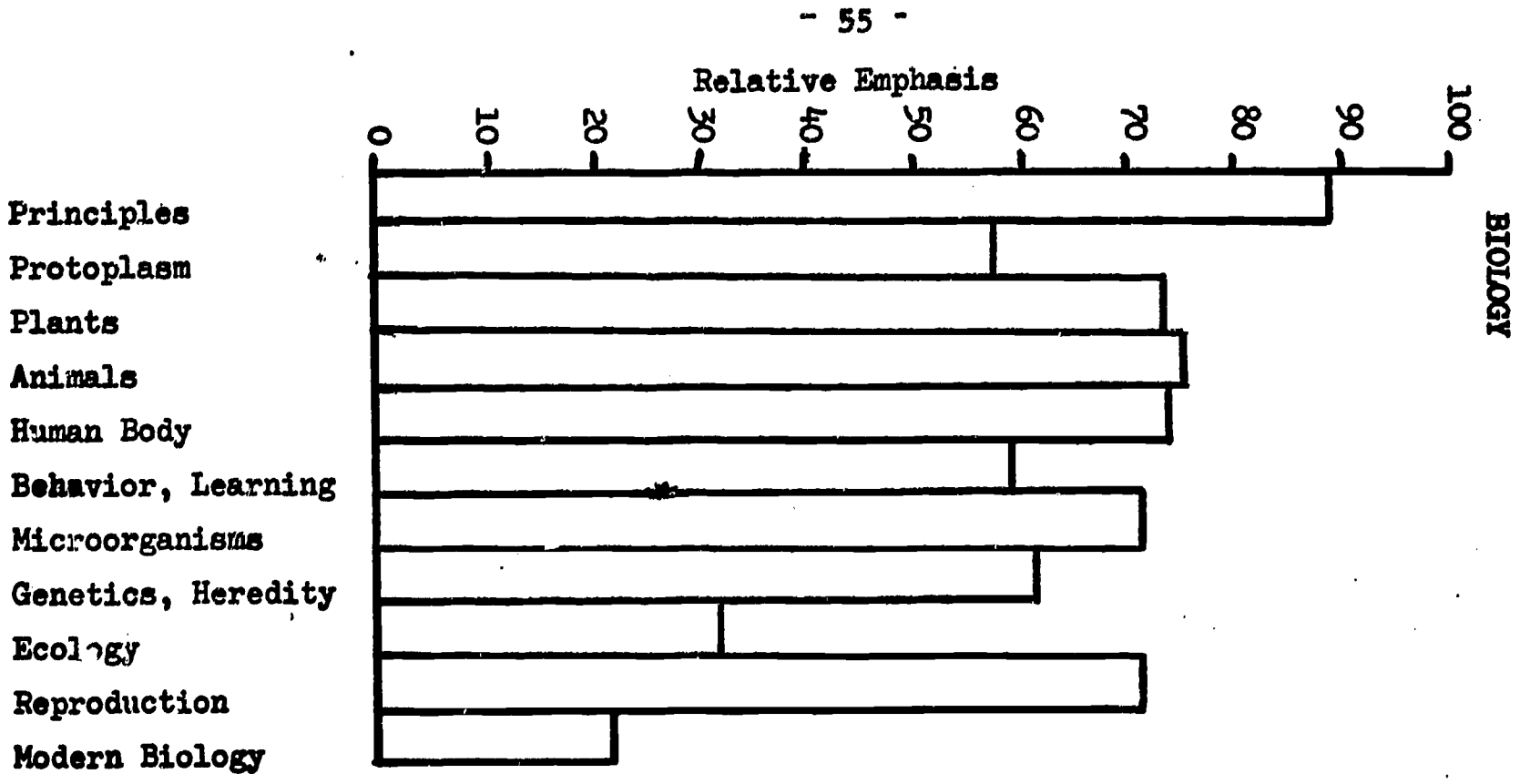


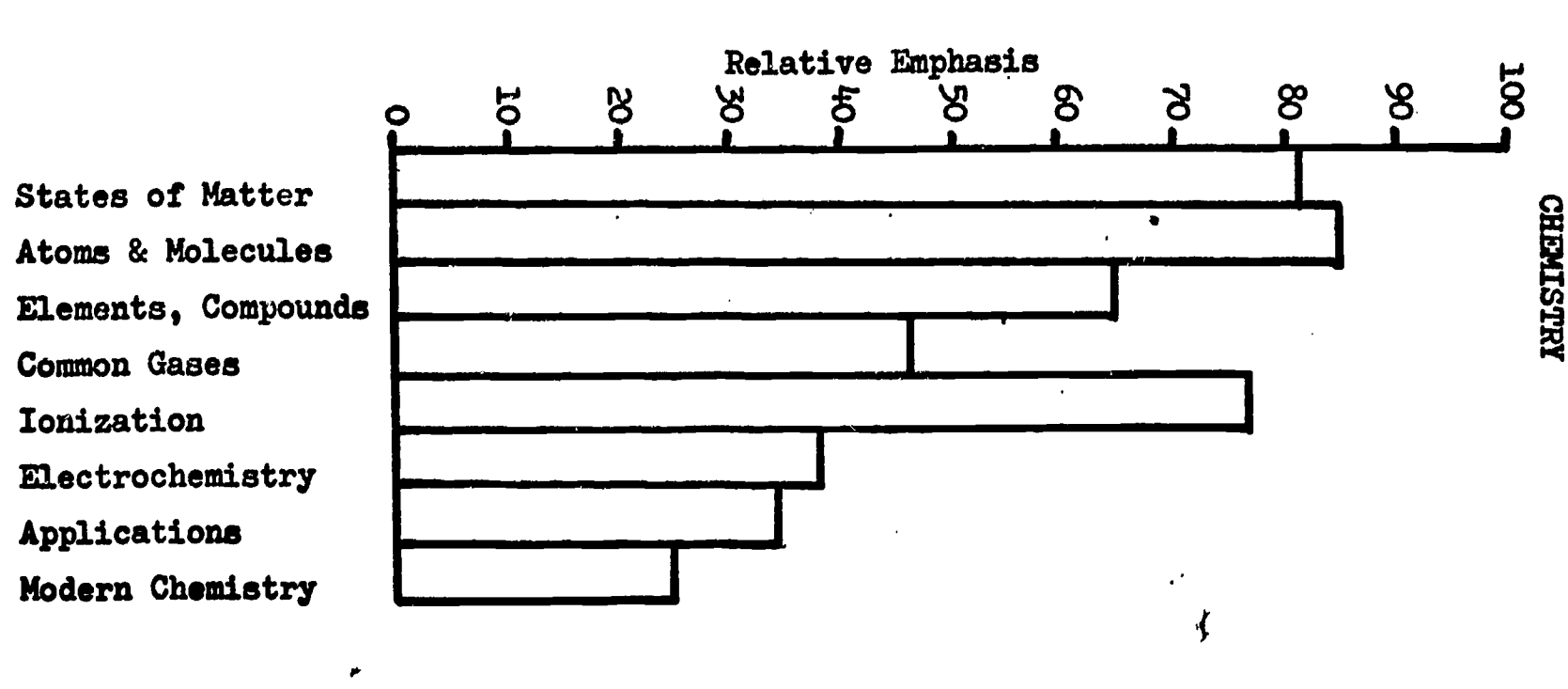


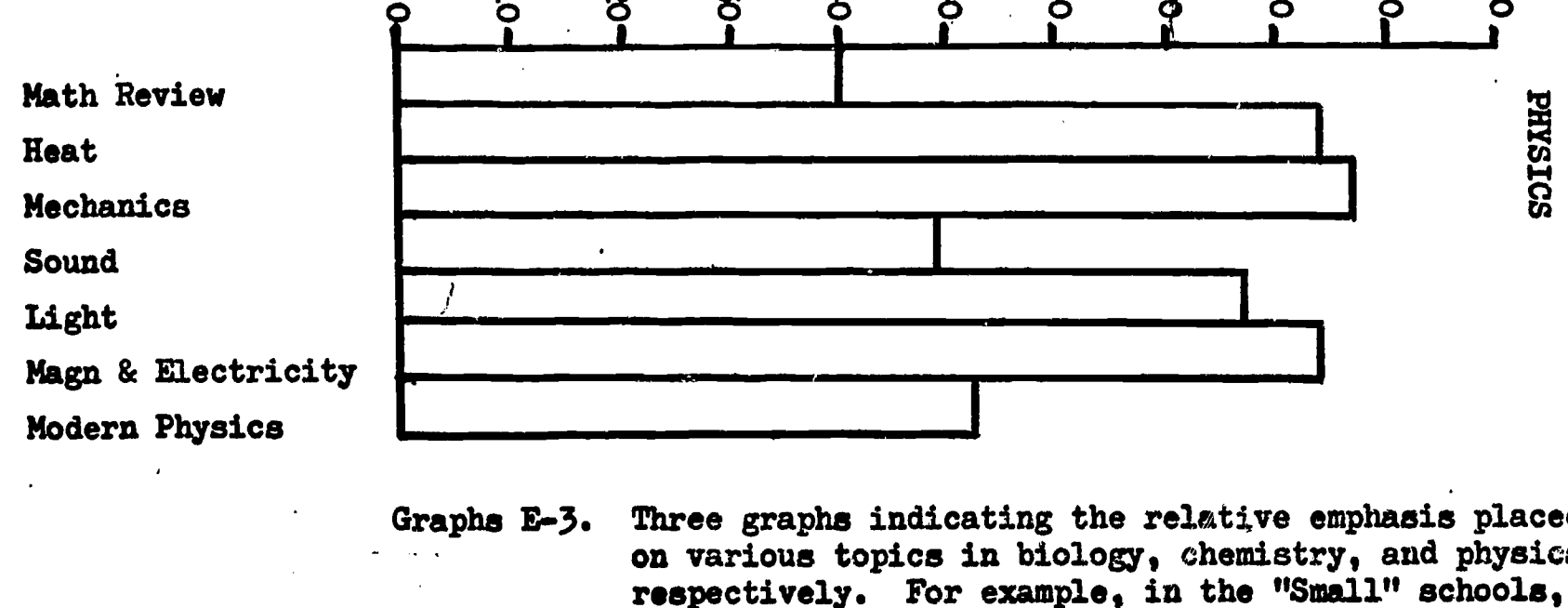


CURRICULUM EMPHASIS BY TOPIC
(Medium Schools)

Graphs E-2. Three graphs indicating the relative emphasis placed on various topics in biology, chemistry, and physics respectively in the "Medium" high schools. For example, 67 of 100 or 67 % of the chemistry teachers strongly emphasize "States of Matter" in their chemistry courses.

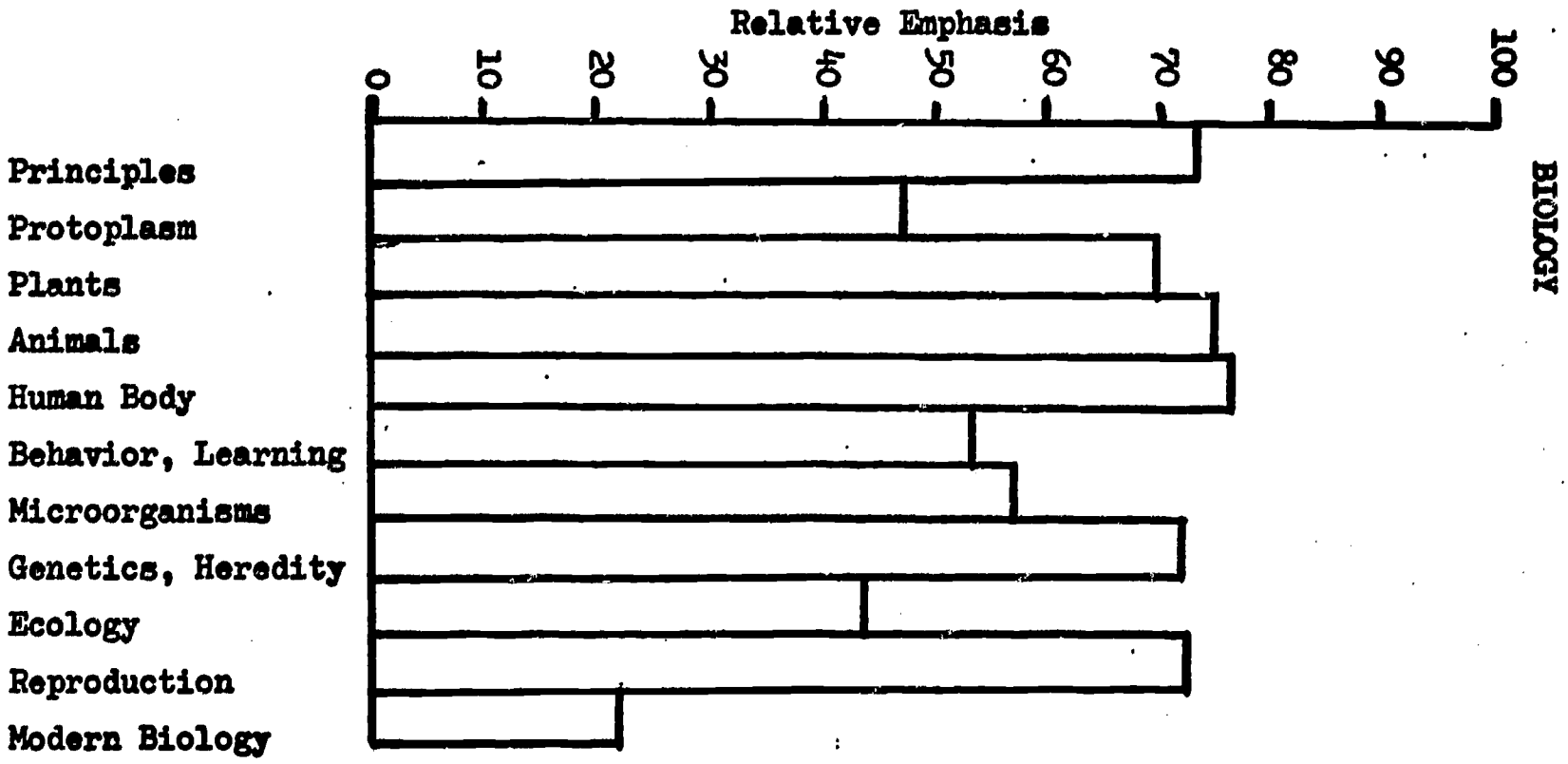


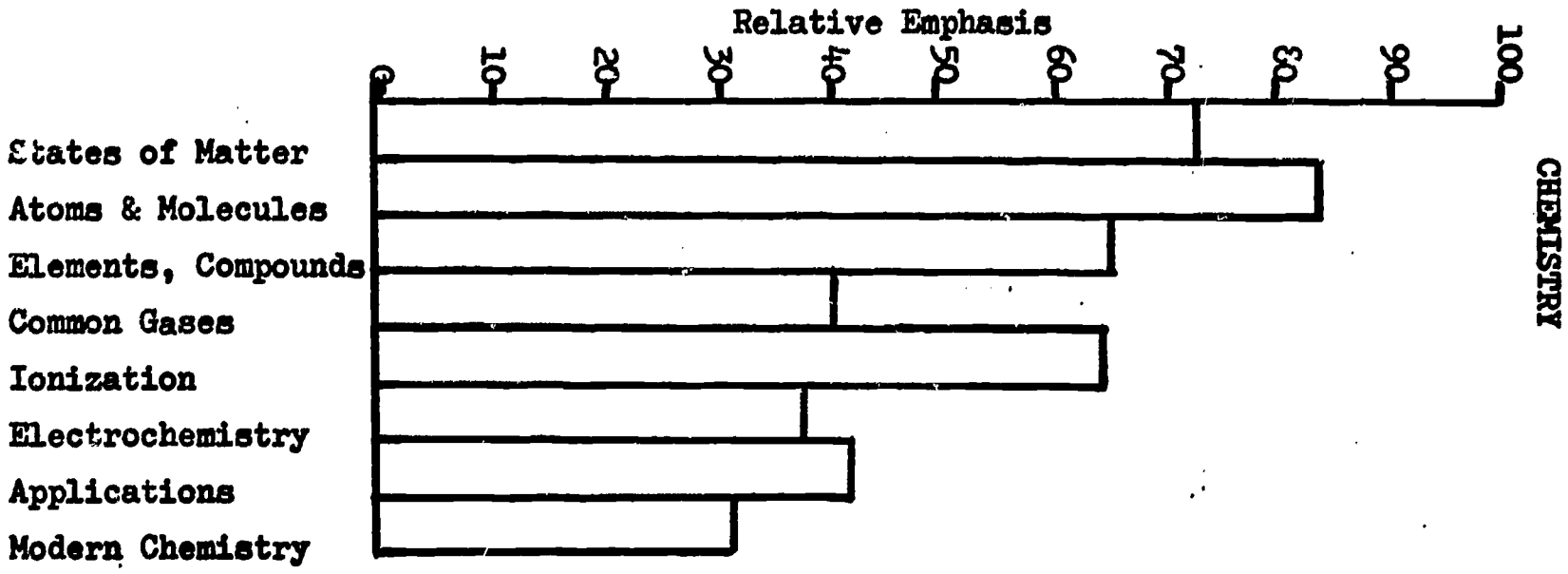


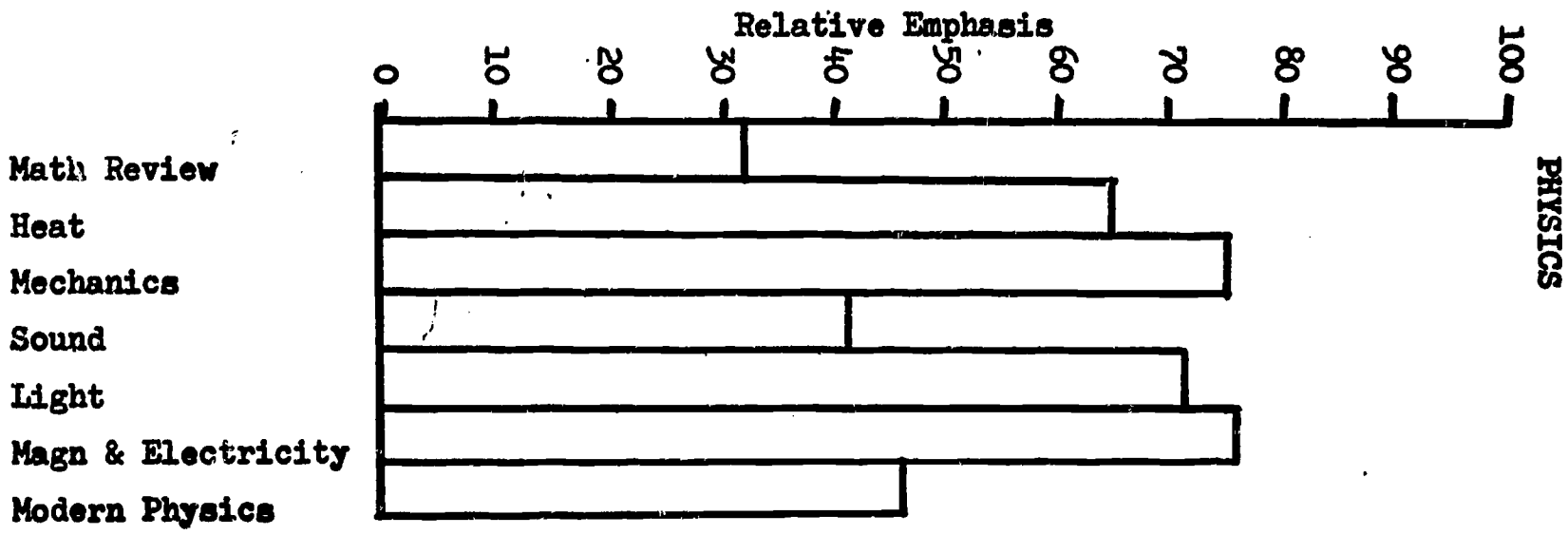


CURRICULUM EMPHASIS BY TOPIC

Graphs E-3. Three graphs indicating the relative emphasis placed on various topics in biology, chemistry, and physics, respectively. For example, in the "Small" schools, 82 of 100 or 82 % of the chemistry teachers strongly emphasize "States of Matter" in their chemistry courses.







CURRICULUM EMPHASIS BY TOPIC

Composite for Large, Medium, and Small Schools

Graphs E-4. Three graphs indicating the relative emphasis placed on various topics in biology, chemistry, and physics, respectively. These graphs are composites of those appearing on the three previous pages.