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SCIENCE EDUCATION RESEARCH STUDIES -- 1951.

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SUMMARIES OF 24 STUDIES IN SCIENCE EDUCATION COMPLETED DURING 1951 ARE TREATED IN THIS LISTING. THE STUDIES LISTED REPRESENT THE RESPONSE TO A NATIONWIDE QUESTIONNAIRE REQUESTING COPIES OF RESEARCH REPORTS. FOR EACH ENTRY IN THE LISTING THERE ARE INCLUDED--(1) THE AUTHOR'S NAME, (2) THE TITLE OF THE STUDY, (3) WHETHER OR NOT IT IS A THESIS OR DEGREE ITEM, (4) THE YEAR THE STUDY WAS COMPLETED, (5) THE INSTITUTION WHERE THE STUDY WAS CONDUCTED, (6) THE NUMBER OF PAGES IN THE COMPLETE REPORT, (7) THE SOURCE FROM WHICH THE COMPLETE STUDY MAY BE OBTAINED, (8) A STATEMENT OF THE PROBLEM, (9) THE SOURCES OF DATA, (10) THE KIND OF STATISTICAL TREATMENT USED, AND (11) THE MAJOR FINDINGS. ENTRIES ARE LISTED ALPHABETICALLY BY THE AUTHOR'S LAST NAME. (RS)

SELECTED SCIENCE SERVICES

U S DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Office of Education Washington 25 D C

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SCIENCE EDUCATION RESEARCH STUDIES -- 1951

Prepared by
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This summary of research studies in science education is the second annual listing which has grown out of a cooperative project involving the National Association for Research in Science Teaching and the Office of Education. Twenty-four studies are reported in this summary.

Report forms for pertinent research studies were mailed to research leaders throughout the Nation in November 1951. As reports were received the summaries were prepared from the data given. No attempts were made to evaluate the quality of the research studies. All studies of science teaching received up to February 6 are included in this summary.

Persons who know of related studies which were completed during 1951 but which are not included in this listing are urged to bring them to the attention of the Office of Education. These studies will then be included when this listing is revised.

The information given concerning each study includes, wherever possible, the following items in the order given: author (surname first), title of study, "non-thesis" or degree if a thesis, year study was completed, institution where study was carried out, pages in the complete report, and source from which copy of the complete study may be obtained. This is followed by a statement of the problem or problems, sources of data, statistical treatment used, and major findings. Certain additional information is available from the Office of Education but full information can be obtained best from the source given in the summary.

Since this cooperative project is in its developmental stages, suggestions concerning ways to make the summaries of increased help will be appreciated.

The members of the Research Committee of the National Association for Research in Science Teaching who are assisting in the development of this project are: Dr. Charlotte L. Grant, Oak Park High School; Dr. Guybert P. Cahoon, Ohio State University; and Dr. Francis D. Curtis (Chairman), University of Michigan.

BLACKBURN, ROBERT TAYLOR. The Use of Textbook Analysis in Determining Course Content for Physical Science General Education Courses. Nonthesis, 1951, Chico State College. Author, George Williams College, Chicago, Illinois.

Problem or Problems.--Major problem: Can we objectively determine what scientific principles, which an educated non-science citizen should know about the physical world, are of higher and lesser importance? Minor problems: (1) Can it be done by textbook analysis? (2) can it be done by questionnaires from educated public? and (3) can it be done by analysis of student questions?

Sources of Data.--Reference books, periodicals, experimental groups, interviews, questionnaires and dissertations.

Statistical Treatment.--Mean, standard deviation and coefficient of correlation.

Major Findings.--Present methods, especially the procedure of textbook analysis, are not valid for determining what principles of science should be taught in physical science general education courses. Although the results of this investigation were primarily negative, there is no justification for the conclusion that the order of importance of principles of science which an educated non-science citizen should know cannot be objectively ascertained. However, it is borne out by the evidence that the methods of textbook analysis, questionnaire, and student opinion are not valid procedures.

BROMBERICK, LAWRENCE EDWARD. A Study of Procedures in Teaching High School Chemistry (An Experimental Study). Ed. D., 1951, University of Pittsburgh. 165 p. Library, University of Pittsburgh, Pittsburgh, Pennsylvania.

Problem or Problems.--An experimental study comparing the relative educational outcomes when courses in high school chemistry are taught with emphasis on applied chemistry versus courses taught with emphasis on pure chemistry. Areas compared were: (1) general chemistry; (2) technical vocabulary; (3) problems and equations, (4) chemistry in home living; (5) chemistry for the Pittsburgher; (6) chemistry in Pittsburgh newspapers; and (7) attitude toward the study of chemistry.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, median, standard deviation, critical ratio, Fisher's "t" and comparison of frequencies.

Major Findings.--When courses in high school chemistry are taught with emphasis on the applied (every day) aspects, the pupils' achievement in pure (technical) chemistry is at least equal to their achievement when the course is taught in the conventional manner, i.e., with emphasis on pure (logical) chemistry. Furthermore, their achievement in the applied aspects of chemistry is significantly greater. (The findings upheld those of the eight-year study and of Wrightstone's study.)

BROWN, CLYDE MOSELEY. Science Interests of Junior College Girls as Determined by Their Readings in Current Science. Ed. D., 1951, University of Missouri. Library, University of Missouri, Columbia.

Problem or Problems.—(1) To determine the areas of science interests of junior college girls; (2) to determine the sources from which they read; and (3) to determine the nature of a science course built upon the interests as expressed in the readings of the girls.

Sources of Data.—Experimental group.

Statistical Treatment.—Mean.

Major Findings.—(1) The science interests of junior college girls are largely biological; (2) the interests of the girls are not concerned with the biological field as a whole but are primarily concerned with "homocentric biology;" (3) the interests of the girls are not in technical science but in non-technical science; (4) the interests of the girls are low in many of the science areas which are commonly assumed as necessary for general education; (5) there are few interests of the students with high marks that are not shared by those girls with low marks; and (6) the junior college girls depend more upon the current news type magazines devoted to "Science" and "Medicine" for their science reading than upon any other type of magazine.

BROWN, STANLEY B. Science Information and Attitude Possessed by California Elementary School Pupils. Ed. D., 1951, Stanford University. 210 p. College of Education Library, Stanford University, California.

Problem or Problems.—(1) Can adequate criteria be found for testing science information and attitudes of California elementary pupils; (2) if such criteria have been established, is it possible to construct paper and pencil test items to these criteria; (3) if it is possible to construct an elementary school science information and attitude test and to administer that test under uniform conditions to California elementary school pupils (selected in terms of quantity, geographical distribution and location), can the following questions be answered: (a) how do the 5th and 8th grade pupils compare in total overall achievement on both the science information and attitude test findings? (b) what is the effect of geographical location in total overall achievement on the science information and attitude test findings? and (c) what is the correlation between the science information and attitude test findings?

Sources of Data.—Experimental groups, control groups, expert judgments and questionnaires.

Statistical Treatment.—Mean, median, standard deviation, coefficient of correlation, critical ratio, chi square, and comparison of frequencies.

Major Findings.—(1) The boys in both the 5th and 8th grade groups obtained some-

what higher scores on the science information test than did the girls; (2) the 5th and 8th grade girls achieved slightly higher scores than did the boys on the science attitude test; however, the difference was unreliable from a statistical viewpoint; (3) eighth grade pupils, irrespective of sex, were found to make significantly better scores on the science information test than did the 5th grade pupils; (4) the increment between the 5th and 8th grade pupils' attainment of science attitudes is somewhat less than for the science information test section although the improvement that does exist is statistically significant as determined by the critical ratio; (5) with reference to geographical location, there was found to be no appreciable difference between the urban and suburban pupils' level of achievement on the science information test. The differences between urban vs. the rural and suburban vs. the rural pupils respectively indicated a slight gain in favor of the rural pupils (approximately three points higher). These differences were found to be reliable as proven by the critical ratio; (6) the science attitude test findings indicate that there is little significant difference between the urban and suburban groups, while the rural pupils are somewhat superior (approximately three points); (7) the average correlation between the science information and attitude tests was found to be .47, indicating a moderate relationship between the two tests. The range of the correlation for the several groups extended from .34 for the 5th grade suburban girls to .67 for the 8th grade suburban girls; and (8) on the twenty item test of science attitudes considered by validating judges to be attitudes which elementary school pupils should acquire, the response on the average was undesirable for more than one-half of the cases, or more than half of the pupils gave an undesirable response to the test items.

BUCK, JACQUELINE VELLA. A Study of the Relationship Between Social Acceptance by Classmates and Achievement in a General Science Class. M. A., 1951, University of Michigan. 70 p. Graduate School, Ann Arbor.

Problem or Problems.--Recognizing the importance of science instruction in education and realizing that there are many factors influencing effective learning, among them being the social climate of the classroom, it is the purpose of this study to determine the relationship between social acceptance by classmates, as determined by the sociometric test, and achievement in an eighth grade general science class.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, standard deviation and Fisher's "t".

Major Findings.--There was no significant gain in the achievement of the experimental group which could be attributed to sociometric methods of teaching; however, there was an improvement in the social status of the class. It is recommended that the study be repeated with larger groups over a longer period of time; and with the use of more sociometric teaching methods, and a different standardized science achievement test.

EDWARDS, T. BENTLEY and LOFGREN, NORMAN L. A "Problem" Approach to the Teaching of College Chemistry. Nonthesis, 1951, Chico State College. Norman L. Lofgren, Chico State College, Chico, California.

Problem or Problems.--The relative effectiveness of two different programs in the teaching of general chemistry are determined. The two programs are as follows: (1) a laboratory course employing a manual and text was conducted over two semesters; and (2) by use of available reference materials students organized studies within restricted areas of problems chosen by themselves. This, also, was a two semester program.

Sources of Data.--Experimental groups.

Statistical Treatment.--Mean, median, standard deviation and coefficient of correlation.

Major Findings.--By use of the problems approach, Program (2), we observed a greater gain in subject matter learned, in addition to improvements in other factors such as interest and the amount of reading done.

FELLOWS, MURIEL H. Preparing Readable Anthropological Material. Ed. D., 1951, University of Pennsylvania. Penniman Library, University of Pennsylvania, Philadelphia.

Problem or Problems.--The Land of Egypt is the first of a series of readable anthropological books to be sponsored by the University Museum (Philadelphia), and published by a commercial publisher. When the manuscript was finished, it was submitted to various libraries, children, and teachers for criticism and testing as to its readability. The book should be readable to anyone who has completed five grades of school.

Sources of Data.--Experimental groups and expert judgments.

Statistical Treatment.--Mean, standard deviation and coefficient of correlation.

Major Findings.--Procedures for preparing reading material are described.

GRANT, CHARLOTTE. Meeting Student Needs by Integration. Nonthesis, 1951, Oak Park High School. 6 p. Author, Oak Park High School, Oak Park, Illinois.

Problem or Problems.--Methods of integration: curricula, departmental courses, extra-curricular activities, school-community projects, pupil-teacher cooperation and interviews.

Sources of Data.--Courses of study, experimental groups, interviews and questionnaires.

Statistical Treatment.---None.

Major Findings.---Integration is possible between departments and between class and extra-class activities. Integration is necessary to overcome too much compartmentalization and consequently prejudices and ignorances. Only by working together can we know what is being done to meet student needs, where the omissions and over-lappings occur, and what students actually think about our curriculums.

HARRIS, SARAH BLACKWELL. Sex Education in the Elementary School With Special Reference to a Program Integrated With Sixth Grade Science. M. S., 1951, State Teachers College. 126 p. State Teachers College, Trenton 5, New Jersey.

Problem or Problems.---This problem consisted of (1) an examination of courses of study in science and health and a survey of writings of authorities in the field of sex education to find out what is being done in the elementary school; (2) a study of sex interests of boys and girls of the sixth grade level to discover their needs; (3) a determination of how the science course of study in Princeton can be geared to meet these needs; (4) a gathering of biological facts necessary for the teacher; and (5) finally planning a program in sex education to correlate with the sixth grade course of study for the Witherspoon School in Princeton, New Jersey.

Sources of Data.---Textbooks, courses of study, reference books, periodicals and expert judgments.

Statistical Treatment.---None.

Major Findings.---Despite the crying need for sex education, the schools are not prepared to handle it. Thousands of children still get their information about sex in undesirable and unwholesome ways. This study should assist elementary school teachers in attacking the problem and in enriching their curriculum in order to train youth for a full and wholesome adult life.

HAUPT, GEORGE WEBSTER. Concepts of Magnetism Held by Elementary School Children. Nonthesis, 1951, State Teachers College. Author, State Teachers College, Glassboro, New Jersey.

Problem or Problems.---Do children's concepts of magnetism parallel the historical development of man's knowledge? What experiences with magnetism have children encountered? How do children explain phenomena of magnetism? In what contexts are association cast? What grade and age differences in experiences and explanations?

Sources of Data.---Experimental groups and interviews.

Statistical Treatment.---None.

Major Findings.--Children's concepts of magnetism developed along similar stages as those of the race. Children from lower grade levels are more accurate in their statements concerning laws of magnetism than theories of magnetism.

HERTZ, G. C., and MEINICKE, MERLE. Study and Report of Using a Fused Course in Physics and Chemistry in Watertown, South Dakota High School in Year 1950-51. M. S., 1951, South Dakota State College. Library, South Dakota State College, Brookings.

Problem or Problems.--A year try-out of a fused physics-chemistry course with two sections taught for the full year by the authors. Considerable testing to check results. They devised their own outline and sought to adjust the content to rather low-ability students in 11th or 12th grades. The superior students took the regular separate physics or chemistry course taught in the school by the same teachers.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, standard deviation and coefficient of correlation.

Major Findings.--Authors maintain such a course is much more worthwhile to juniors and seniors who do not take regular year-courses in physics and chemistry than a previously used so-called "consumers" science for the similar group. They suggest that in smaller high school a so-called "fused" course (one year) of physics and chemistry would be somewhat better than for such small school to teach but one of physics or chemistry or to teach same in alternate years. Under such alternate scheme students often miss entirely any physics or any chemistry. Authors conclude that even duller students can, with careful teaching, grasp principles of physics and chemistry in such courses. Previous experience for similar group with so-called "consumer" science course was not nearly so successful.

KROHN, MILBERT H. Evaluating Ability to Distinguish Between Opinion and Scientific Fact at Different Grade Levels. M. A., 1951, Colorado State College of Education. 71 p. Library, Colorado State College of Education, Greeley.

Problem or Problems.--This study was undertaken to ascertain the abilities of students at different grade levels to distinguish between scientific fact and opinion. The problem necessitated the construction of an instrument to measure this ability. The problem also included an attempt to determine what background factors were conducive or detrimental to the formation of this ability.

Sources of Data.--Expert judgments and tests.

Statistical Treatment.--Mean, coefficient of correlation and Spearman-Brown prophecy formula.

Major Findings.--(1) As the individual's amount of education increases, that is, as he progresses in his academic career, he has more experiences which prepare him to distinguish between opinion and scientific fact; (2) science education effects one's ability to distinguish between opinion and scientific fact in a positive way; (3) the general achievement on the test could have been much better for all grades; (4) evidence indicates that the experiences one has in fields other than science act to increase the score; (5) the type of statement missed most often indicates that students are less critical than they should be. The students at the higher grade levels probably missed the neither items more often because they read too much into them; and (6) the ability to distinguish between opinion and scientific fact can be measured and there are certain background factors, previously mentioned, that do effect the scores gained.

KRUGLAK, HAYM. Experimental Outcomes of Laboratory Instruction in Elementary College Physics. Ph. D., 1951, University of Minnesota. 165 p. Library, University of Minnesota, Minneapolis.

Problem or Problems.--(1)Are there any significant differences between the individual and the demonstration methods of teaching elementary physics at the college level? (2) are there any significant differences between the laboratory instructors, e.g., can the difference in the outcomes be attributed to the effects of the individual instructors? and (3) are there any significant differences between the instructors and the methods, e.g., does one method work better for one instructor than for another?

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, Fisher's "t" and analysis of variance and covariance.

Major Findings.--(1) The experimental evidence supports the conclusion that the individual method as now used in elementary college physics laboratories is superior to the demonstration method in teaching simple manipulatory skills and techniques, the understanding of instrumental set ups, and the skills in solving simple problems using apparatus and materials of the elementary mechanics laboratory. No statistically significant differences on this criterion could be traced to the differences in the instructors or to the instructor-method interaction; and (2) no statistically significant differences were traceable to the two teaching methods, to the four instructors, or to the interactions between instructors and interactions between instructors and methods on the laboratory written test, on the mechanics theory test, and on a performance test involving complex instrumental situations.

LEE, LOUISE. A Study of Science Interests of Third Grade Children at Longfellow School As Revealed Through Science Experiences in Animal and Plant Life. M. A., 1951, University of New Mexico. College of Education, University of New Mexico, Albuquerque.

Problem or Problems.—It was the purpose of this study to attempt to determine children's interests in animal and plant life as revealed through science experiences of a group of third grade children.

Sources of Data.—Reference books, periodicals, experimental groups and children's comments.

Statistical Treatment.—None.

Major Findings.—(1) It was found that interest in animal life was much greater than interest in plant life; (2) the greatest interest in animals was found to be in the study of insects. The majority of interest in insects seemed to be in how the insects lived and how they secure their food; (3) the children's main interest seemed to be in finding out the characteristics of the animals, in caring for the animals that were brought into the classroom, and in finding out how the animals secure their food; (4) in the study of animals first-hand experiences created the most interest; (5) in the study of plant life the greatest interest was in cultivated plants. Trees were second in interest; and (6) data from the study seemed to warrant the conclusions that through the children's science experience, their natural interests are broadened.

MATTHEWS, UNA MAE. A Technique for Evaluating Third Grade Children's Understanding of Terms and Principles in Science. M. Ed., 1951, University of Texas. Library, University of Texas, Austin.

Problem or Problems.—To measure the levels of understanding of selected terms and principles in science by third grade children.

Sources of Data.—Interviews.

Statistical Treatment.—Comparison of frequencies.

Major Findings.—Not reported.

McCARTHY, FRANCIS WADSWORTH. Age Placement of Selected Science Subject Matter. Ed. D., 1951, Harvard Graduate School of Education. Education Library, Harvard University, Cambridge, Massachusetts.

Problem or Problems.—The purpose of this study is to attempt to determine at what age a certain science concept can be presented to young children with the anticipation that a significant proportion of the children will be able to demonstrate their understanding of the concept. Out of the great number of concepts which are found in science, a concept was selected which would be relatively simple in its expression, which could be demonstrated by simple experiments and could be grasped by observation plus a minimum of required reasoning on the part of the child. The concept was that of "work" as applied to simple machines in physics.

Sources of Data.--Experimental groups.

Statistical Treatment.--Mean.

Major Findings.--At chronological age about 6.7 years, 50% of children could demonstrate operational understanding of the principles involved (simple first-class lever, pulley system, inclined plane). All three sets of ideas were of approximately equal difficulty. Below chronological age 5.0 years essentially none were successful; above 9.0 years all were successful. Mental age (Kuhlmann-Anderson) gave same spread as chronological age.

PEACHER, FLEM P. Superstitions and Misconceptions Believed by College Freshmen. B. S., 1951, Tenn. A. and I. State University. 22 p. Martha Brown Memorial Library, Tenn. A. and I. State University, Nashville.

Problem or Problems.--The problem of the study is to measure the extent of belief in superstitions and misconceptions among a group of 1951 freshmen at the Tenn. A. and I. State University. The purpose of the study was "to see how they stood with respect to these unfounded beliefs in order that subsequent science courses might contribute to their elimination."

Sources of Data.--Questionnaires and expert judgments.

Statistical Treatment.--Mean and comparison of frequencies.

Major Findings.--(1) The most prevalent of the unfounded beliefs concerned health; (2) these beliefs point to the existence of an insufficient fund of scientific knowledge of ordinary phenomena and inability to do critical thinking on the part of a majority of the respondents; and (3) these beliefs seem to indicate an apparent failure to some secondary school science programs to develop proficiency in the use of the scientific method among their students.

RICH, BARNETT. Variation, Its Extension and Application to Problem Solving. Ph. D., 1951, Columbia University. 153 p. Author, Richmond Hill High School, Richmond Hill, Queens 18, New York.

Problem or Problems.--(1) The place of functionality in secondary school mathematics; and (2) the correlation of both mathematics and science instruction in the secondary schools. The crux of both problems: the determination of what constitutes the subject matter of functionality.

Sources of Data.--Reference books, periodicals, textbooks, courses of study and expert judgments.

Statistical Treatment.--None.

Major Findings.--(1) The correlation of mathematics and science instruction is dependent on the solution of the problem involved in the determination of the content

of the mathematics taught in connection with variables, variable changes, and variable relationships. This is so-called mathematics of functionality; (2) the study advocates the use of a new symbol for the ratio of any two ordered values of a variable; the use of "two-set" equations, the more adequate treatment in mathematics classrooms and science classrooms of the fields of variation and sense change; the study of formulas in terms of three basic equations of three variables; to wit, $x \neq y = z$, $xy = z$, and $x^y = z$; and (3) the study advocates the need for continuity in mathematics instruction in the teaching of variable-relations.

ROSS, PHILIP. Nature Recreation in Resort Hotels. M. S., 1951, University of Massachusetts. 105 p. Goodell Library, University of Massachusetts, Amherst.

Problem or Problems.--The reasons for people going to resort hotels. People have a native hunger for the simple life and seek this when vacationing. How does this idea of "going back to nature" affect the management of resort hotels. The aim of this study is to analyze the problem and to present a picture of how the out-door needs of people may be better met at the resort hotel.

Sources of Data.--Interviews, questionnaires and observation.

Statistical Treatment.--None.

Major Findings.--Nature recreation is an up-and-coming movement. Nature recreation will be one of the important leisure sports. Vacation parks have established an excellent example. Every resort hotel has local natural resources that can be more fully utilized. Hotel managers must have a nature study philosophy. The science may be called human ecology. Tradition is a part of the environment.

SMITH, HERBERT FREDERICK A. A Determination of Principles and Experiments Desirable for a Course of General Science at the Junior High School Level. Ph. D., 1951. University of Michigan. Library, University of Michigan, Ann Arbor.

Problem or Problems.--To determine the relative importance of the principles of science which are desirable for inclusion in a general science course at the junior high school level, and to determine the relative values of some experiments which are desirable for inclusion in such a course, and whether each of those experiments would more appropriately be performed as a laboratory experiment or as a demonstration.

Sources of Data.--Expert judgments and textbooks.

Statistical Treatment.--None.

Major Findings.--(1) There is an abundance (253) of principles suitable for such a course (general science at junior high school level); (2) of the 253 principles, 141 were principles of physical science and 112 were principles of biological science; (3) the use of the inductive method of teaching was found to be

appropriate in the teaching of general science; (4) a laboratory course in general science is practicable in schools possessing only meagre equipment; and (5) not only is the individual laboratory method appropriate for use in general science courses, but also it is worthy of much wider use than is customarily made of it.

TOBEY, ELEANOR E. Pupils' Questions as a Factor in Selecting Science Experiences in Grades Four Through Nine. M. A., 1951, Colorado State College of Education. 36 p. Library, Colorado State College of Education, Greeley.

Problem or Problems.--This investigation is an attempt to gather pupils' questions about certain science experiments demonstrated in grades four through nine to learn at what grade level the experiments may be most successfully used. The study is not concerned with the few differences in the science backgrounds of the pupils or with the ages and intelligent quotients of the individuals used.

Sources of Data.--Experimental groups and free response questions of children.

Statistical Treatment.--None.

Major Findings.--Analysis of the data secured in the survey showed that (1) the kinds of questions asked by the pupils about the experiments were of five classifications - purpose, materials, procedure, results and miscellaneous; (2) students in all grade levels asked questions, with the fifth grade asking the most and the ninth grade the least number of questions; (3) very few questions asked included social concepts; (4) from the results of this study the grade level may be a factor in determining the type of questions asked; (5) the study suggests that there are sex differences in the types of questions asked by the pupils as well as the number asked about the various experiments; (6) the teacher must have a "pointing-out" of the social significance of an experiment in order to elicit questions involving social concepts; and (7) the study shows that in this particular investigation grade placement of science experiments may not be determined by the questions asked by the pupils.

WARD, BARBARA ANN (KINNEY). An Annotated Bibliography of Nature Study Aids for Grades One Through Six. M. A., 1951, San Jose State College. 168 p. Library, San Jose State College, San Jose, California.

Problem or Problems.--The purpose of the study was to present a briefly annotated bibliography of nature study materials for grades one through six organized by topics: astronomy, birds, fish and amphibia, geology, insects and spiders, mammals, meteorology, plants, reptiles and trees. The purpose was to include selected books, pamphlets and audio-visual aids for each subject.

Sources of Data.--Original material (primary sources), reference books, periodicals and courses of study.

Statistical Treatment.—None.

Major Findings.—The value of this study lies in the fact it presents in compact form annotated listings of available materials together with sources from which the materials may be obtained. It is of use to anyone working with children (grades one through six) who is concerned with combining education, interest, and entertainment. The material listed is meant to be used to supplement texts or other factual information.

WILSON, GEORGE M. Course Offerings, Enrollments and Scheduling Practices in Science in Nebraska High Schools. M. A., 1951, University of Nebraska. 156 p. Love Memorial Library, University of Nebraska, Lincoln.

Problem or Problems.—Specifically stated the problems of this study are: (1) to determine trends in science course offerings; (2) to determine over a twenty-year period enrollments and scheduling practices in the science curriculum in the secondary schools of Nebraska; and (3) to determine the number of units of science taught.

Sources of Data.—Records of the State Department of Public Instruction.

Statistical Treatment.—Mean.

Major Findings.—(1) In the face of increased competition from broader offerings in the secondary school curriculum, science course offerings and enrollments have been maintained better than might have been expected. Although the science enrollment has declined on the basis of percent of total enrollment, the actual number of students enrolled in science courses has increased. Trends in Nebraska, with the exception of chemistry, have tended to keep pace with national trends. On the basis of percent of total enrollment, general science, biology, and physics enrollments do not differ materially from national trends but the percent of students enrolled in chemistry was less than half that found for the nation as a whole. Specialized sciences, such as botany, physiology, non-vocational agriculture and others, have either declined or disappeared from the science curriculum with preference being given to the more generalized science courses such as general science, biology and senior science. (2) The scheduling of general science in grade nine and biology in grade ten paralleled the findings of earlier studies. However, scheduling of physics and chemistry in a combination of grades eleven and twelve did not conform to the national trend. The double laboratory period has practically disappeared from the science curriculum in favor of the single laboratory period. The tendency to devote an increased length of time to the class period and to confine both the recitation and laboratory to five periods per week follows the national trend.

WILSON, LELAND LESLIE. General Education Science in Southern Association Junior and Senior Colleges. Ph. D., 1951, Peabody College. Library, George Peabody

College for Teachers, Nashville, Tennessee.

Problem or Problems.—This study of general education science courses in the Southern Association of colleges will include all junior and senior college holding membership in this Association. The major purposes of this study are: (1) to determine the present status of general education science courses in the colleges of the Southern Association; (2) to determine, insofar as possible, the probable future trends in general education science courses in this Association; (3) to compare the junior college programs in general education science with those of the four year colleges; and (4) to compare the status of general education science courses in the colleges of the Southern Association with that in other colleges for which data are available.

Sources of Data.—Questionnaires, interviews, textbooks, reference books, periodicals, and courses of study.

Statistical Treatment.—Mean, median and rank order correlations.

Major Findings.—General education science courses are being taught in 47.8 percent of all Southern Association colleges. Seventy-six percent of the teachers colleges have such courses while only 40 percent of the junior colleges have them. About 85 percent of the Southern Association colleges will accept credits for general education science without question when transferred from an accredited college. Only about 50 percent of the senior colleges and 66 percent of the junior colleges will allow these credits to count toward minimum science requirements for graduation. The general survey is the most common type of course organization for the general education science courses. The "block-and-gap" organization and the historical study are used relatively little. Only 36 percent of teachers furnishing data have had as much as eleven semester hours of course work in four or more sciences and 58 percent of them have had twenty or more hours of course work in only one or two sciences. Most of the teachers in this group were not employed primarily for general education science work and very few are devoting full time to it. The great majority of the courses are taught by a single teacher. Lecture is the most frequently used teaching procedure and individual laboratory work is used in less than half of the courses.

The three major objectives in the junior colleges are: (1) to develop appreciation of the social implications of science; (2) to promote a full personal life through a more complete understanding of the natural environment; and (3) to develop an understanding of the leading laws and concepts of science that affect the daily life of the individual. The senior college teachers say that their three major objectives are: (1) to develop an understanding of the leading laws and concepts of science that affect the daily life of the individual; (2) to promote a full personal life through a more complete understanding of the natural environment; and (3) to develop the ability to think critically.

The principal problems of these general education science courses, as listed by teachers, center around the lack of time to develop a real understanding of science in students with poor backgrounds for, little interest in, and often a positive fear of science.

Supplement to Circular No. 334-III

SCIENCE EDUCATION RESEARCH STUDIES -- 1951

Prepared by
PHILIP G. JOHNSON
Specialist for Science (Secondary Schools)

This Supplement reports additional studies completed during the calendar year 1951.

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AXELROD, AARON. A Course of Study in Applied Science for Machinist Apprentices. Ed. D., 1951, New York University. New York University Library, Washington Square, New York City.

Problem or Problems.--The problem in this document is that of developing a course of study in applied science which will be directly related to the usual jobs performed by apprentices in machine shops during their term of apprenticeship.

Sources of Data.--Trade analyses, courses of study, textbooks, interviews, expert judgments and questionnaires.

Statistical Treatment.--None.

Major Findings.--(1) This course of study can provide a definite program of science instruction as related to machine-shop procedures; (2) this course of study can be used by both the applied-science teacher and the shop teacher. The shop teacher can use this outline as he teaches the practical jobs of the shop curriculum. He can point out the science implications whenever he meets them in shop practice. In addition to this method, the course can be taught by the regular science teacher and insures good integration of his work with the machine-shop jobs; (3) the science course of study has been divided into main topics to facilitate teaching and to give aid from an organizational standpoint. A topic can be taught separately as needed in a certain part of the course without interfering with any other part of the course. In such cases where the applied science is taught by different teachers, close working agreements between these teachers will prevent undue duplication of effort on the part of both; (4) this applied science course can be used either in the actual instructional shop or in a separate classroom, and does not require a laboratory in order to carry out demonstrations or procedures; (5) it provides the pure science teacher with a practical course of science directly tied in with actual working and machine-shop procedures; (6) all science principles necessary and related to machine-shop practice have been included; (7) this

course, of course, will eliminate vagaries in instructional practice ordinarily due to differences in course content, and this factor is valuable to both the experienced and inexperienced teacher; and (8) the science content of this course of study is that needed by both the schools and industry and is based on the needs of modern industrial conditions. Apprentice programs today are in a state of flux as far as science content is concerned. There is no uniformity among teachers of science in industry or schools in the teaching of content.

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BLANC, SAM S. Audio-Visual Resources for the Teaching of Science. Ed. D., 1951, University of Denver. 500 p. Library, University Campus, University of Denver, Denver 10, Colorado.

Problem or Problems.--To develop an integrated resource guide to materials for teacher use on the junior high school level in science. These were tied to pupil interests, and audio-visual materials suggested for each area were based on extensive criteria for selection developed as a part of the study.

Sources of Data.--Reference books, periodicals, textbooks, courses of study, interviews, expert judgments, and questionnaires.

Statistical Treatment.--Critical ratio.

Major Findings.--It was found that pupils were interested in science topics at the junior high school level. There was a specific difference of interests between boys and girls and between the three grade levels in a number of the topics included on the questionnaire. Audio-visual materials were available in any number for each of the topics of major interest.

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BOILEAU, ALMERIAN ROBINSON. Interferometry and Its Uses. M. A., 1951, San Diego State College. 100 p. Library, San Diego State College, San Diego, California.

Problem or Problems.--The purpose of this thesis is to present a brief overview of interferometry and its relationship to the teaching of general science or physics at the secondary school level.

Sources of Data.--Reference books, periodicals, textbooks, and experiments.

Statistical Treatment.--None.

Major Findings.--The operation of the Michelson interferometer is covered in detail. This complete treatment is considered desirable since no such treatment has been found. In this chapter are colored photographic transparencies showing the actual appearance of white light fringes. The two chapters, "Industrial Applications of Interferometry" and "Scientific Applications of Interferometry," are compiled from many sources. They show the many and varied interferometric applications. This material is resource material for the teacher. The chapter entitled "Interferometry in the Secondary School" contains suggestions for the use of this material.

BURMESTER, MARY ALICE. Construction and Validation of a Test to Measure Some of the Inductive Aspects of Scientific Thinking. Ed. D., 1951, Michigan State College. 405 p. Library, Michigan State College, East Lansing.

Problem or Problems.--To devise a test to measure some of the inductive aspects of the ability to think scientifically.

Sources of Data.--Experimental groups and expert judgments.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, critical ratio, and chi square.

Major Findings.--(1) Test was fairly reliable (.90) and (2) validity coefficient .72 - .77.

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COLE, MARTHA DARNEAL. What Are the Educational Resources for the Study of General Science in Kanawha Valley. M. A., 1951, West Virginia University. 62 p. University Library, West Virginia University, Morgantown.

Problem or Problems.--The object of the problem was twofold: (1) to determine the educational resources for the study of general science in Kanawha Valley; and (2) to determine the use already being made of the resources available by the science teachers of Kanawha County.

Sources of Data.---Questionnaires.

Statistical Treatment.---None.

Major Findings.--(1) The modern educational trend toward using community resources has proved to be of great value to the science classes of Kanawha County; (2) the businesses and industries of Kanawha Valley have become vitally aware of the needs of the schools, concerning community resources and have made considerable progress toward supplying these needs; (3) the teachers of general science in Kanawha Valley, though recognizing the great benefits derived from using community resources, have failed to take the fullest advantage of them. This was found to be due to three major reasons: (a) lack of pertinent information concerning available resources, (b) lack of school time in which to take advantage of these resources, and (c) lack of suitable transportation facilities; (4) of the resources available, the field trip has been used most often by the science teachers, followed by films, publications, and special services; and (5) finally, using community resources in the study of general science can do much to enrich the general science program; create and maintain interest; be broadening and motivating to the teacher; and aid in creating a deeper sense of responsibility toward community welfare and understanding on the part of the students.

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DIAMOND, SHELDON. A Study of the Relative Effectiveness of the Laboratory and Demonstration Methods of Instruction in Imparting Factual Knowledge of Chemistry to Certain Students at Brooklyn Technical High School. Nonthesis, 1951, City College. 26 p. Seminar in Educational Research, City College, New York 31, N.Y.

Problem or Problems.--Many of the students at this particular high school seemed uninterested in the work in elementary courses in chemistry. The apparent waste of laboratory time posed the question: Do students gain anything from their experiences in the laboratory? This question may be divided into several subsidiary parts: (1) Do they gain specific information? (2) Do they gain laboratory technique? (3) Do they gain the elements of logical or scientific thinking? (4) Do they gain an understanding of the principles underlying the phenomena they observe? The question also arises as to whether some other method of instruction, more specifically, the demonstration method, would be more or less effective in achieving these ends.

Sources of Data.--Reference books, periodicals, and control groups.

Statistical Treatment.--Mean, standard deviation, and critical ratio.

Major Findings.--There was found to be little difference if any between the laboratory and demonstration methods as far as learning and retention of chemical facts are concerned. However, this is one of the points on which former investigators disagree. Ten found the demonstration method to be superior, while eleven found the laboratory method to be superior. Three found, as did the present investigator, that there is no significant difference between the two. The variety of the results suggest that the methods used to examine the factor studied in this paper and others have not gotten to the fundamental natures of the two methods. They have failed to recognize the points common to both of them, and the real differences.

The findings by the investigators of such factors as resourcefulness, technique, and manipulative ability agree that the laboratory method is the better one to use. Those who have studied the time necessary for performing the exercises, the factor of immediate recall, and the acquisition of the ability to think logically agree that the demonstration method is superior. It is indicated that a combination of the two methods should be used.

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FESSENDEN, DELMORE LYLE. The Adequacy of Chemistry Laboratories of Indiana High Schools. Nonthesis, 1951, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The purpose of this study is to determine how extensively chemistry is being offered in Indiana high schools and to determine how adequately these schools are equipped for teaching chemistry.

Sources of Data.--Questionnaires.

Statistical Treatment.--None.

Major Findings.--The over-all conditions may be summarized by stating that the larger Indiana high schools (over 700 enrollment) are in most all cases offering chemistry with adequate laboratory facilities. Schools in Indiana with less than 700 enrollment are in most cases not offering chemistry, and those that do, have inadequate laboratory facilities.

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JACOBSON, WILLARD JAMES. Science Education and the Development of Abilities to Cope with Problematic Life Situations. Ed. D., 1951, Teachers College, Columbia University, 194 p. Library, Teachers College, 525 West 120 Street, New York City.

Problem or Problems.--How can science teachers help young people to develop their abilities to cope with their everyday problems of life? To develop suggestions and proposals for dealing with this question, an investigation was made of (1) previous proposals for the development of these abilities in science education; (2) analyses of the act of solving problems; and (3) the role of values and value judgments in problem solving.

Sources of Data.--Reference books, periodicals, courses of study, interviews, and textbooks.

Statistical Treatment.--None.

Major Findings.--The major finding was that if we wish to develop student abilities to deal with problems, we should actually study and deal with the problems that are recognized by the students in our classes. Extensive suggestions were made for implementing such a program of science education.

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JOHNSON, EDDIE. The Relationship Between Scientific Background and Attitudes Toward Teaching Science in the Public Elementary School. Nonthesis, 1951, City College. 42 p. Seminar in Educational Research, City College, New York 31, New York.

Problem or Problems.--The study was conducted in order to ascertain the reasons for the present deficiencies existing in the scientific training of elementary school teachers, what suggestions the teachers have for improving future training programs in the college methods courses, what methods and means the teachers can suggest for improving the present role of science in the elementary school, and what type of in-service science course would be most practical.

Sources of Data.--Questionnaires.

Statistical Treatment.--Mean and comparison of frequencies.

Major Findings.--(1) The majority of teachers in this project have average science knowledge. (2) Teachers have a greater knowledge of general science than any other natural science. (3) The score made on an objective science test is related to: (a) the amount of time the teacher has studied science formally, (b) the amount of time she teaches science in her class. (4) The score in any area will indicate roughly how much training the teacher has had in that area. (5) Teachers need and want a practical in-service science course. (6) The science curriculum must be revised to suit the needs of the elementary school child. (7) The length of time for the science methods course in college should be increased to a minimum of one semester. The content of this course must be more practical and less theoretical. (8) The License Examination questions should be made to cover more general science knowledge than the technical knowledge derived from the other sciences.

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KIELY, LAWRENCE JOHN. An Experimental Investigation of the Effectiveness of Student-Made Drawings and Photomicrographs in Microscopic Work in Pre-Professional Biology. Ed. D., 1951, Teachers College, Columbia University. 90 p. Library of Teachers College, Columbia University, New York City.

Problem or Problems.--The problem of the study reported here was to determine the relative values with respect to the acquisition and retention of factual knowledge of two methods of laboratory procedure: (1) having the students make the drawings from their observations of the specimen under the microscope; and (2) having the students record their observations on photomicrographs of the specimen under the microscope.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, and critical ratio.

Major Findings.--(1) Students learned and retained more factual information, in terms of total combined results for all units by the use of photomicrographs; (2) students learned significantly more factual information on both halves of the examination (the multiple-choice and the identification of structures) by the use of photomicrographs; and (3) students of both high and low I.Q. levels learned more by the use of the photomicrographs. It is recommended that photomicrographs replace the student-made drawings, or be used in conjunction with student-made drawings, under conditions similar to those in this study, in teaching elementary histology to pre-professional biology students.

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KLINE, ARTHUR IVAN. Trends in the Teaching of High School Chemistry. Nonthesis, 1951, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--It was the purpose of this investigation to attempt to determine some of the trends in the teaching of high school chemistry. Since chemistry is a profession in which opportunities for employment are continually expanding, the writer felt that this investigation might serve to indicate where the teachers have succeeded and where they have failed in this one area - the teaching of chemistry in the high school.

Sources of Data.--Questionnaires.

Statistical Treatment.--None.

Major Findings.--If nothing else has been done to make a course in chemistry functional, the adoption of the contract method in the classroom and individual experimentation in the laboratory as mentioned by a large number of the teachers is very worthwhile. Students are showing more interest in chemistry as a career or as a prerequisite for some other career than they did ten years ago, but it is still difficult to hold students' interest in the basic facts of chemistry.

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KNAPMAN, FRED W. Science Education and Forest Resource-Use in Northwestern Washington. Ed. D., 1951, Teachers College, Columbia University. 180 p. Library, Teachers College, Columbia University, New York City.

Problem or Problems.--The project was prepared to help teachers work with young people in the identification and investigation of problems of forest resource-use.

Sources of Data.--Reference books, periodicals, the forest resources and their uses.

Statistical Treatment.--None.

Major Findings.--One problem area is analyzed in answer to the question, "How can the forests be managed to continue to supply the forest products industries?" A second problem area develops from the question, "How can forest resources now wasted be profitably used?" The parts of the project which deal with methods of teaching emphasize the use of group procedures as teachers and students plan and work together.

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KOSS, KENNETH WILLIAM. The Use of Instructional Resources in Teaching a Science Unit. Nonthesis, 1951, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The problem in this research report was to point out the significance of instructional resources in science teaching. The importance of the major instructional resources for science teaching and their availability was stressed.

Sources of Data.--Textbooks, reference books, and periodicals.

Statistical Treatment.--None.

Major Findings.--The findings illustrated how major instructional resources may be utilized in making teaching more effective. The major instructional resources discussed are as follows: field trips, preserved materials and specimen exhibits, models, microscopic slides, charts, demonstrations, still pictures, slides, film-strips, motion pictures, visual and verbal symbols, radio, television and free and inexpensive materials. The findings point out that science teaching has been made more effective through sensory contact with instructional resources.

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MACY, RICHARD ALLEN. A Survey of the Subject Matter Taught in Biology in the Public High Schools of the State of Indiana. Nonthesis, 1951, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The purpose of this study was to determine the subject matter presented in the biology classes of the public high schools in the State of Indiana. An attempt was also made to determine the number of periods or days spent on the various units of subject matter as well as the season or seasons in which they were taught.

Sources of Data.--None.

Statistical Treatment.--None.

Major Findings.--It was quite evident from the data received that there tended to be little uniformity in the instruction of biology in the public high schools in the State of Indiana. A great variance as to what subject matter was taught during the year, the number of days spent on the various units, and the season or seasons in which the units were presented, was reported.

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MASON, JOHN MURRYN. An Experimental Study in the Teaching of Scientific Thinking in Biological Science at the College Level. Ph. D., 1951, Michigan State College. 321 p. Library, Michigan State College, East Lansing.

Problem or Problems.--The main purpose of this investigation was to compare the relative effectiveness of two different methods of teaching biological science at the college level. The two methods compared were arbitrarily designated the scientific thinking method and the descriptive method. These two methods were compared with respect to their effectiveness in teaching factual information, overall objectives in the course, ability to think scientifically, and scientific attitudes in lecture, in laboratory, and in lecture and laboratory. The scientific thinking method was an attempt to directly teach for the development of the methods and attitudes of science. The descriptive method stressed only the factual information of the course.

In addition to this main purpose, the study was also concerned with the changes resulting from the instructional methods with respect to the acquisition of factual information and scientific attitudes after one, two, and three term's instruction.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Critical ratio and analysis of variance and covariance.

Major Findings.--The descriptive method of lecture was more effective in teaching factual information after one and also after two terms' instruction than the scientific thinking method. After three term's instruction, the two methods of lecture were equally effective in teaching factual information. The two methods of lecture were equally effective in teaching the overall objectives of the course and in teaching certain abilities associated with scientific thinking. The scientific thinking method as used in lecture was more effective in teaching scientific attitudes than the descriptive method.

The two methods were equally effective in laboratory instruction with respect to the acquisition of factual information, of the overall objectives of the course, and of scientific attitudes. The scientific thinking method as used in laboratory instruction was more effective in developing certain abilities associated with scientific thinking than the descriptive method.

In the situation in which the instructional method was the same in lecture and laboratory, the two methods were equally effective in teaching factual information and the overall objectives of the course. The scientific thinking method

was more effective in teaching certain of the abilities inherent in scientific thinking and in teaching scientific attitudes than the descriptive method.

Students taught by either method made significant gains in scientific attitudes during the school year.

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MILLER, JOHN RUSSELL. An Analysis of Various Factors Associated with Achievement in General Science. Nonthesis, 1951, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The problem of this study was to determine the influence which out-of-school science activities may have upon knowledge of subject matter in the field of general science, and also to compare the out-of-school science activities of boys and girls.

Sources of Data.--Control groups.

Statistical Treatment.--Fisher's "t."

Major Findings.--From the findings one can conclude that on the average (1) students who travel widely, belong to several organizations, have immediate access to magazines and reference books, and engage in many out-of-school science activities possess more factual science knowledge than those students of few activities where the factor of intelligence is eliminated as a contributing factor; (2) those students who have built, collected, used, and made various things have a measurably higher achievement in general science; (3) girls tend to engage in fewer outside science activities than boys--especially those activities of a manipulative and building nature; and (4) increased use of experiments and equipment that can be built and used by students may contribute toward increased knowledge in general science.

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NELSON, MERCEDES L. A Study to Determine Practices of High School Girls as They Relate to Self-Medication and the Preparation of a Health Unit of Self-Medication. Ed.D., 1951, New York University. 199 p. New York University Library, Washington Square, New York City.

Problem or Problems.--The problem is to determine the part that patented and home remedies play in the everyday health practices of tenth, eleventh, and twelfth-grade girls; and to construct a unit on self-medication within a health course of study which will give information on these remedies. Sub-problems: (1) To determine types of remedies ordinarily used by high school girls; frequency of the use of such remedies; and the reasons suggested for their usage. The relationships, if any, between the frequency of the use of each type of self-prescribed remedy, and the factors of age, grade, race, religion, nationality, socio-economic status, and intelligence quotient will be analyzed; (2) to establish criteria of good health practices related to self-medication for high school girls; (3) to evaluate the practices of self-medication in light of established criteria of good health practices; and (4) to construct a unit on patented and home remedies to be incorporated within the health course of study or manual.

Sources of Data.--Questionnaires, reference books, periodicals, expert judgments, textbooks, and courses of study.

Statistical Treatment.--Comparison of frequencies and percentages.

Major Findings.--(1) The use of home and patented remedies by the high school girls of Minneapolis is high; (2) the medication used is largely self-prescribed; (3) age is not a significant factor in the use of remedies, although there may be a slight increase of use by older girls; (4) the grade in which the girl is enrolled is not a factor; (5) religious beliefs, as such, do not influence the use of remedies; (6) no significant differences exist in use of remedies by girls from different nationality backgrounds; (7) economic status is not a determining factor in the use of remedies although there may be a very slight tendency for greater use in the low income groups; (8) intelligence is not a strong factor in the use of remedies, although there may be slightly less use in the upper brackets; (9) the frequency of the use will vary with the remedy; (10) high school girls tend to choose remedies that are used by the family; (11) high school girls frequently use remedies that have been prescribed for some other member of the family; (12) girls accept suggestions for remedies from druggists and from friends; (13) advertising is a strong factor in the choice of remedy even though high school girls may not always be aware of its influence; (14) high school girls have little knowledge or understanding of their body processes; and (15) high school girls exercise very little critical judgment in evaluating claims made for remedies and tend to be very gullible.

The conclusions drawn from the study would indicate a need for a unit in a high school curriculum which will stimulate appreciation of the importance of good health practices as they relate to self-medication and point out the many dangers inherent in the self-prescribed use of remedies.

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RAISNER, ARNOLD. An Evaluation of a New Method of Teaching Science to Elementary School Children as Related to the Aims of the New York Board of Education. 1951, City College. 34 p. Seminar in Educational Research, City College, 138th Street and Amsterdam Avenue, New York 31, New York.

Problem or Problems.--The purpose of the study was to determine through experimental teaching whether teaching techniques employing toys in elementary school science education detract from or add to the final desired aims as promulgated by the New York City Board of Education.

Sources of Data.--Reference books, periodicals, experimental groups, and interviews.

Statistical Treatment.--Mean.

Major Findings.--(1) When using toys in a science presentation in preference to a formalized science experiment, it is generally more difficult for a pupil of average intelligence to get at the principle involved and the reapplication thereof. (2) Once the child has derived an understanding of the science principle through the use of a toy demonstration, he is more likely to be able to re-apply and understand the implications of the experiment. (3) If a child

finally achieves an understanding of a principle, he is more likely to retain that knowledge for a longer period of time if he learned it through the use of a toy demonstration. (4) Children within all normal intelligence ranges show a greater avidity in the partaking of class discussions and activity. Interest is much more easily motivated and retained when a toy is the centerpoint of attention. When the bizarre attraction of the toy wears off there nevertheless remains the investigating spirit that is so vital to the aims of science teaching.

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SCHWARTZ, HERBERT. The World Food Problem: A Teachers' Source Book of Information and Issues in the Feeding of Mankind. Ed. D., 1951, Teachers College, Columbia University. 249 p. Library, Teachers College, Columbia University, New York City.

Problem or Problems.--This report was undertaken in an attempt at demonstrating facts, principles, and issues that when separated from the irrelevancies that now becloud them become truly fundamental in the problem of the optimum feeding of all the world's peoples. That this is a problem not just of people, but also of the education of people, derives from the fact that if criteria are to be universally reoriented in a democratic social order that is based upon independence of decision on the part of the individuals who make up that order, it presupposes also that each one must be made capable, must be educated, to do so.

Sources of Data.--Reference books, periodicals, reports, lectures, addresses and other information from people and organizations working in the area.

Statistical Treatment.--Validity of data extant interpreted and criticized.

Major Findings.--Food supply still lags one step behind the growth of numbers of humans ready to consume it. Individual needs for optimum feeding in terms of complete living are well known, but only as specialized knowledge among few, and not yet as common knowledge of all that exists for its sustenance on and in the earth and its seas. The problem of total feeding of all is unnecessarily confused by complex social factors, acting upon processes that should be entirely separate from such restraints. Freedom from want implies freedom from ignorance, inhibiting social factors and from the competition of increasing populations. Elimination of current malpractice in dealing with food would itself multiply the effectiveness of the existing supply. Education must become functional, reach all of the people at the lowest levels and militantly treating undernourishment as a virulent disease.

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STAFFORD, WAYNE ARTHUR. The Effect of the Use of a Textbook as Compared with Supplemental Material in Teaching Biology. M. A., 1951, University of Michigan. 69 p. Education Library, University of Michigan, 5th Floor University High School, Ann Arbor, Michigan.

Problem or Problems.--The purpose is to investigate the effectiveness of teaching biology in one class with a textbook and in a second with supplemental materials only.

Sources of Data.--Reference books, periodicals, textbooks, experimental groups, and control groups.

Statistical Treatment.--Fisher's "t".

Major Findings.--(1) Much supplemental material may be found and also organized into subject matter form. (2) Students grew under both systems both semesters. (3) It is more feasible to start with a text and supplement it as much as necessary.

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VESTAL, DONALD A. The Relative Effectiveness in the Teaching of High School Physics of Two Photographic Techniques Utilized by the Sound Motion Picture. Ph. D., 1951, University of Nebraska. 123 p. Love Memorial Library, University of Nebraska, Lincoln.

Problem or Problems.--The problem of this study was to determine the relative effectiveness of two photographic techniques utilized by the sound motion picture. Specifically, the effectiveness in terms of learning resulting from motion picture sequences utilizing animation was compared with the learning resulting from film sequences presented by direct photography.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, critical ratio, Fisher's "t", and analysis of variance and covariance.

Major Findings.--(1) On the basis of comparisons of the attainment of a representative sampling of students in high school physics, there appears to be no significant difference in the effectiveness, as aids to learning of the techniques of animation and of direct photography when utilized in the film sequences of sound motion pictures used as supplemental teaching aids during the study of electricity; and (2) on the basis of a comparison of the attainments of students on different levels of accomplishment, there is evidence that the use of direct photography in the sequences of sound motion pictures, used to supplement instruction, results in significantly greater gains in learning than does the use of the technique of animation for those students who rank in the upper quarter of the experimental group on a measure of general progress during the study of electricity.

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VOLLENDORF, MARGARET LUCIA. The Combined Compared to the Independent Courses in Eighth Grade General Science and Mathematics. M. A., 1951, University of Minnesota. 48 p. Library, University of Minnesota, Minneapolis.

Problem or Problems.--(1) Does the integration of mathematics and science at the eighth grade level lead to better understanding and application of mathematical skills and principles than would be obtained in separate courses? (2) does the integration of mathematics and science at the eighth grade level lead to better understanding and knowledge of scientific facts and principles? and (3) should the integrated course be continued at the University High School?

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, median, standard deviation, analysis of variance and covariance, analysis of variance and covariance involving F ratio and Tests of Normality.

Major Findings.--In mathematics there was no significant difference in outcomes in teaching a course integrating mathematics and science and in teaching the two courses separately at the eighth grade level at the University of Minnesota High School. In the science the gain in understanding and the knowledge of facts and principles was significantly better for the separate courses than for the integrated course.

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WALTER, MURRAY GEORGE. Developing an Experimental Program in Science Elective for Grades 11 and 12 at the Garden City High School, Garden City, New York. Ed. D., 1951, Teachers College, Columbia University. 131 p. Teachers College Library, Columbia University, New York City.

Problem or Problems.--This project report deals with the developing of an experimental program in science to supplement the existing traditional science courses in the Garden City High School, Garden City, New York. This report describes the goals, pupil-teacher planning and procedures, some illustrative teaching methods and materials, the evaluation and the significance of the project.

Sources of Data.--Experimental groups, control groups, reference books, periodicals, expert judgments, courses of study, interviews, and textbooks.

Statistical Treatment.--None.

Major Findings.--For the general education of the boys and girls in the high school the cooperative planning and carrying out of learning experiences concerned with the various needs and interests of the members of each class, and with the problems of the locality, should be continued and developed further. This method gives the flexibility and the adaptability necessary to provide the best learning experiences each succeeding year of the program.

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WASHTON, NATHAN SEYMOUR. Teaching Biology for General Education. Nonthesis, 1951, Queens College. 4 p. Author, Queens College, Flushing 67, New York.

Problem or Problems.--How can we teach biology for general education? What are the purposes of teaching specific principles of biology for general education?

Sources of Data.--Reference books, periodicals, textbooks, courses of study, interviews, expert judgments, and questionnaires.

Statistical Treatment.--None.

Major Findings.--(1) Teach biological principles pertaining to behavior, reproduction, heredity, and evolution in order that students may be provided with the

necessary knowledge, skills, and attitudes to (a) attain an emotionally stable personality and make a worthy social adjustment; (b) be better fit for successful family and marital relationships. (2) Teach the principles pertaining to heredity and evolution in order that students (a) understand the social, economic, and spiritual forces at work in society and develop a sense of social responsibility; (b) participate more effectively in solving problems of contemporary society; (c) recognize the interdependence of the different peoples of the world. (3) Teach the principles pertaining to nutrition in order that students (a) understand the place of the consumer in society and learn to become intelligent consumers of goods, services and time; (b) participate more effectively in solving problems of contemporary society. (4) All of the principles of biology should be emphasized to students in terms of the following objectives of general education: (a) gain a better understanding of the meaning and purpose of life and a truer sense of values; (b) maintain and improve their health and share in the responsibility for protecting the health of the community; (c) utilize a scientific approach in solving problems dealing with society and human welfare.

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WEISLOGEL, MARY H. and PROJECT STAFF. The Development of Tests for Evaluating Research Proficiency in Physics and Chemistry -- The fourth in a series of reports prepared under the sponsorship of the Manpower Branch, Human Resources Division, Office of Naval Research. Nonthesis, 1951, American Institute for Research. 36 p. American Institute for Research, Pittsburgh, Pennsylvania.

Problem or Problems.--The development of tests to measure proficiency in specific areas of scientific work. Measures were desired for use in the selection and evaluation of advanced research personnel in the fields of physics and chemistry.

Sources of Data.--Expert judgments.

Statistical Treatment.--None.

Major Findings.--Separate tests were developed for physics and chemistry including a group of non-technical items common to both tests. The technical items were designed to measure proficiency in formulating problems and hypotheses, planning and designing the investigation, conducting the investigation, and interpreting research results. The non-technical items were designed to sample proficiency in administering research projects and accepting organizational and personal responsibility. The tests are intended for individuals at the doctorate level of training or its equivalent in experience. Test items are based on specific types of job performance which an earlier study had shown to be crucial to successful performance in research work. It is believed that the tests will be of value in selecting and evaluating research personnel in the intended fields. A bibliography of twenty-one references is included. The tests were not given preliminary trial to establish optimum administration conditions and suitability for various fields of specialization within physics and chemistry. A comprehensive validation program was recommended.

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WINIER, LEONARD PHILIP. The Biological Sciences in the General Education Program at Iowa State Teachers College. Ed. D., 1951, Teachers College, Columbia University. Library, Teachers College, Columbia University, New York City.

Problem or Problems.--To conduct an experimental study for purposes of gaining useful ideas and reliable evidence for constructing a biological science course in the general education program at Iowa State Teachers College.

Sources of Data.--Reference books, periodicals, experimental groups, control groups, interviews, questionnaires, expert judgments and committee work.

Statistical Treatment.--Analysis of variance and covariance.

Major Findings.--(1) In terms of the established goals of general education at Iowa State Teachers College, it was easier to justify an emphasis upon personal-social needs in the experimental study than to defend the strictly subject-matter approach to classified fields of knowledge common in most conventional biology courses; (2) in the experimental study, it was necessary to go beyond the ordinary limits of subject matter in the biological field in order to achieve some degree of success in attaining the broad, over-all goals of general education; (3) a major emphasis in the experimental study centered upon personal-social needs of the students that stem in large measure from the controversial social issues of the day. Such issues included the study of conservation, regional planning, human origin and development, quality of population, sex education, and racial problems. The basic methodology in experimental classes was the group process; (4) evidence from interviews and comments of students both in and out of the classroom, indicated that the areas of study in the experimental course related closely to the conversational topics that the students discussed among classmates, friends, and parents in out-of-school life. This evidence suggested that the concerns and problems of young people were dealt with in the experimental classes; (5) the evaluation phase of the experimental study indicated student growth in the development of desirable social attitudes with respect to certain controversial social issues; and (6) the experimental study proved effective in providing the committee charged with constructing the biological science course for the general education program with a basic approach to the selection of instructional materials.

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ZIPPER, JOSEPH HENRY. Development of an Introductory Biology Course for Gannon College. Ed. D., 1951, Teachers College, Columbia University. 132 p. Library, Teachers College, Columbia University, New York City.

Problem or Problems.--The project involves the development and evaluation of an introductory biology course designed to implement the program of general education, to the extent that young people may learn to use applicable knowledge in group action centered upon personal and community problems. It is a plan of action research planned to improve the educational practices in which Gannon College is engaging.

Sources of Data.--Experimental groups.

Statistical Treatment.--None.

Major Findings.—The significance of this project lies in the promise that group process used by general biology students in the solution of personal and community problems shows in improved student-instructor relationships, wide use of community resources, economy of time, ease in cooperative planning of curriculum, smoother transition from secondary to higher education, provision for a wide variety of educational experiences, and consideration of individual differences.

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NOTE: The statements in the foregoing summaries of research studies were, except in a few instances, as reported by the author. The reports were sent to the Office of Education for the purpose of bringing research studies to the attention of those who seek such information.