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An evaluation of courses of study in mathematics for grades 9 to 12

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Boston University

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Boston University
BOSTON UNIVERSITY
GRADUATE SCHOOL

Thesis
AN EVALUATION OF COURSES OF STUDY IN
MATHEMATICS FOR GRADES 9-12

by
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(A. B., Emmanuel, 1947)

Submitted in partial fulfilment of the
requirements for the degree of
Master of Arts
1950
Approved

by

First Reader: [Signature]
[Name and Title]

Second Reader: [Signature]
[Name and Title]
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CHAPTER I
INTRODUCTION

The purpose of this study is to evaluate courses of study in mathematics for grades 9 - 12. This evaluation is to determine, "What makes a good course of study?" and, "Are there many good courses of study existing at the present time that are available for reference?" The answers to these questions should make it possible to build better courses of study and to effectively revise present obsolete courses.

LIMITATIONS OF THIS STUDY

To evaluate the courses of study in mathematics from grades 1 - 12 would be well beyond the range of an ordinary thesis paper. Therefore, the author chose grades 9 - 12 for evaluation. There is a logical division here because, ordinarily, formal teaching of arithmetic ends with grade 8 and specialized mathematics begins with grade 9. In the first 8 grades, the student is taught the fundamentals of arithmetic which makes him able to cope with the formulae and theories he will meet in grades 9 - 12.

In many instances, teachers and educators wishing to procure a course of study from another school system find it impossible to do so. Reasons for this may vary. Some of the reasons given are: 1. the course of study cannot be adapted readily to some other system; or, 2. the supply far
exceeds the demand; or 3. a course of study is not put down in black and white. In the latter case, the teachers agree on the material to be covered in class, or the head of the mathematics department assigns an outline for the teachers to follow. Since some courses of study are not distributed outside of the school system in which they originated, an evaluation of these would profit only the system itself. Consequently, this study will be limited only to those courses of study which can be obtained upon request.

Business arithmetic differs considerably from specialized mathematics and is taught only in "commercial" courses. Therefore, these courses will not be taken up in this study.

NEED FOR COURSE OF STUDY EVALUATION

Why is such a study as this necessary at the present time? A letter was sent by the author to all the State Departments of Education. The answers to this inquiry revealed a lack of courses of study in mathematics in many school systems. In some schools where courses of study exist, they are considered obsolete; and, therefore, either not used at all, or used only for reference purposes. Most of these school systems did not care to forward a copy of their course outline since it did not give a true picture of the mathematics courses then being taught. A great number of these schools are interested in constructing a new course of study, while others merely wish to revise courses of study that have been previ-
ously used. A study such as this would help in carrying out curriculum revision much more effectively.

At the present time, there also exists a great deal of disparity among the courses of study being used in the schools. This will become more evident during the treatment of each course of study. This inequality may be found in the construction, objectives, treatment of material, and other necessary data used in the outlines. Because such a disparity exists, does it also follow that one course of study must necessarily be better than the other?

A study of former research in the field shows that courses of study are being evaluated almost continuously. But a further and closer check reveals the fact that mathematics high school courses of study are not being evaluated. Guide sheets, rating scales, and criteria have been set up in some cases, but the actual evaluation is left to the reader. All previous studies based on high school courses of study in mathematics were found to be outdated.

This study, therefore, is an appraisal of the present courses of study in mathematics for grades 9 - 12. Only those courses of study in use in the high schools and which are available on request will be treated. This attempt is made with the hope that it will aid curriculum construction in the future.
CHAPTER II
REVIEW OF RESEARCH

Although a great deal of material has been written on current trends in curriculum construction and revision, no apparent evaluation of courses of study has been conducted to determine if the current courses meet these trends. Research has been conducted on a general plan to cover all courses and all grades. Mathematics has increased in importance and value recently because of World War II. Therefore, a great deal of research has been concentrated in this field in the past few years. But courses of study have not been evaluated within recent years to determine if the demands of current educators have been met.

An attempt shall be made to determine: first, just exactly when and where evaluations have been conducted; and secondly, what the current tendencies in high school mathematics are.

PREVIOUS EVALUATIONS

One of the earliest evaluation of courses of study dealt with state and rural elementary curriculum. This was made by C. M. Reinoehl in 1922.1 The findings are unimportant at this time for two reasons: first, they are outdated by this time

and have no connection with today's methods; and, second, they
do not concern high school mathematics.

Nine thousand elementary school courses found in 498
bulletins were rated on criteria set up at Teachers' College,
Columbia University, in 1924. From these the 200 courses
considered best were selected and score cards were developed.
These score cards were not rated. This study, however, was
limited to the elementary level.

A critical study of all public school courses of study
published 1929-1931 was made in 1932 by Henry Harap and A. J.
Bayne then of the Cleveland School of Education. All types
of courses of study were taken from grades 1 - 12. The most
revealing conclusion at that time was the important role the
classroom teacher played in curriculum construction. Since
this survey was not limited to high school but covered all
fields, other findings and statistical references are irrele-
vant to this particular study.

The earliest study limited to mathematics in the high
school was conducted under the U. S. Department of Education.
It was a national survey of secondary education and it covered

2. Florence B. Stratemeyer and H. B. Bruner, Rating Eleme-
   ntry School Courses of Study: A Report of the Results Secured
   from Rating Nine Thousand Elementary School Courses of Study,
   Bureau of Publications, Teachers' College, Columbia University,
   1926.

   School Courses of Study Published 1929-1931," Journal of Ed-
   ucational Research, 26: 46-55, 105-9, September, 1932.
Junior and Senior High School mathematics. Perhaps a statement made at that time is just as true to-day,

...The fact that a school publishes a course of study and releases it for analysis is indicative of efforts to produce a better course of study than obtained in the average school.

This report presented practices in a selected group of schools in the United States. Analyses are based on courses of study submitted and visits to a few of the schools that were considered outstanding at the time. The general and specific characteristics of the Junior and Senior High School and the influences affecting the production and use of courses of study were studied.

The summaries and conclusions, in reference to the Senior High Schools only, are the following:

1. Mimeographed often.
2. Objectives show influence of National Committee formulation.
3. Less detail and less care in construction than Junior High.
4. Materials of instruction are organized logically rather than psychologically.

5. Teaching procedures not connected with specific materials—rather are of a general nature.

6. Objectives—more emphasis on disciplinary and cultural values rather than on practical needs.

7. Total offerings—most of the courses are for those who are going to college.

8. Most teachers were made familiar with the course of study through assignments incident to production or through training in the use of the outline.

9. Correlation among the various grades or divisions were lacking.

10. Test measurement definitely weak.

11. In most cases a textbook is adapted.6

In 1937 evaluation criteria was set up by a group of graduate students at Columbia.7 This was done in the belief that an analysis of courses of study would give a picture of teaching in the United States. This criteria, however, was limited only to the elementary grades and it was not intended to be objective or specific.

In 1937, also, a survey of courses of study and other curriculum materials published since 1934 was conducted by the

6. Ibid.

United States Office of Education. The findings covered all courses of study but the dominant characteristics in each field also were given.

Of the more important points noted, the following are worth mentioning:

1. Very few courses present definite plans of revision, but most of them reflect the current point of view that the curriculum must meet the needs of a constantly changing social order.

2. The teacher played a major role in curriculum work as teacher participation was found in 63% of the courses.

3. Very little evidence of research was found.

4. General objectives were found in 76% of the courses while specific objectives were found in only 42%.

5. Only 31% listed objectives as pupil goals.

6. Parallel columns appeared in 22% of the mathematics courses.

7. Few courses in mathematics suggested creative activities.

8. Standards of attainment were inferred in many of the courses but only 22% contained definite statements.

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9. Evaluation of pupil progress was found in very few courses of study.

In mathematics, the tendency seemed to be a notable decline in the functional character of mathematics. In some school systems this function was discovered in general courses but in the traditional courses this was left to the ingenuity of the teacher.

Perhaps the nearest thing that can be found to an evaluation of a mathematics course of study is a criteria set up by S. E. Boselly, Jr., of the Lincoln High School, Seattle, Washington; and, Harriet Holbrook, Girls' Six Year High School, Portland, Oregon. No attempt, however, was made to analyze a course of study with this criteria. This set of criteria, set up around 1939, is very comprehensive and with very few changes could be used to-day. It covers in detail the major topics of philosophy, objectives, content, methods, testing, and bibliography content. The standards of judgment used for the present study were based a great deal upon this set of criteria.

All of the literature read and the fact that such a set of criteria was built, indicates the need for a course of study evaluation in mathematics. Research shows none within the past five years to guide curriculum workers.

CURRENT TRENDS IN MATHEMATICS

What are the current tendencies in high school mathematics? Before this question can be answered, we must learn more about high school pupils who are taking mathematics. According to J. H. Zant, three groups of pupils exist:10

1. Those who need only functional competence in the mathematics used by the average citizen. This group includes not only the average student but also the brighter student who does not wish to go to college.

2. Those who are going to specialize and need a background of specialized mathematics. These students can follow the "sequential courses in mathematics".

3. Those who are going to be future mathematics teachers. They should take "as much as they can get".

Zant makes three groups, but the second and third group can be classified as one, in-so-far as high school courses in mathematics are concerned. This leaves two major divisions of mathematics students: 1) those who do not intend to specialize and, therefore, are not interested in the sequential type of mathematics; and 2) those who do intend to specialize.

It is evident from the literature that educators are attempting to meet the needs of both classes. In any case, it is the student that must be considered and not the teacher.

or the course. The course must meet the needs of the student. Therefore, the more progressive school, in order to meet the demands of both classes of students would have a program of study planned along a double track. Current literature, in regard to offerings of courses, emphasizes this a great deal.

H. R. Douglass states that of approximately 18% of high school students who will go to college,

... perhaps a third of them do not have the ability to learn enough algebra, geometry, or trigonometry to be able to use it. Perhaps another 20% cannot be interested enough in its study to learn enough to be able to use it.11

Therefore, he suggests that there should be another series of offerings for the majority of pupils. This series should contain arithmetic and its application to all phases of life, considerable geometry of construction and measurement of surfaces and volumes, and six or seven months of algebra correlated with arithmetic and geometry with a variety of applications.

E. R. Breslich feels, also, that more than one plan or type of curriculum should be carried out in the high schools to meet the needs of ALL the students.12


Whether Douglass' suggestions should be followed or not is not to be considered at the present time. What should be considered is the provision for the study of mathematics by the average student, that is, something other than the sequential series.

Current literature not only reveals a few new trends in curriculum construction but also emphasizes the important trends of the past.

Educators in the field of mathematics have included in the general objectives for mathematics courses: understanding, attitudes and appreciations, as well as facts. However, it is frequently found that the stress is laid on facts and skills. In many cases where this dual object of mathematics does exist, the courses tend to assume that understandings, attitudes and appreciations are brought about either through the instructor or just through the course itself. As Herrick points out,

Facts alone about any common learning are not sufficient to make the learning valuable and lasting in everyday living. Attitudes without the facts are dangerous. Skill without the proper attitudes can lead to difficulty. Appreciation is based upon understanding experiences. Therefore, every common learning should involve all these phases of learning.13

There has always been felt a need for correlation among the various subjects. This correlation can usually be brought

without too much difficulty in the social sciences. The fact can also be established that mathematics is many times correlated with physics or chemistry, but the reverse is not always true. A successful plan has been worked out in this connection in the Pasadena Junior College.\textsuperscript{14} New topics in mathematics are brought up just before they are needed in physics or chemistry. This supplies the need of motivation for the new topic. Concepts in reasoning are taken up, also, before the study of geometry is begun. This plan can also be adapted successfully in the high schools and help to make mathematics more meaningful.

A study of subject-matter material in the schools and its relative importance either in future courses or for vocations has shown that many changes should be made. Much of the content included should be omitted and some additions should be made. W. D. Reeves has made up a list of the changes that should be made in Algebra, Geometry, and Trigonometry.\textsuperscript{15}

From the list given,

There seem to be two types of changes for the coming curriculum in mathematics:
1. Revisions of mathematics and science content to provide illustrations and applications.


2. A new drive toward a more complete mastery and sane ability to transfer mathematical and scientific learnings to practical situations.

Perhaps the best recent contribution to curriculum development was made in 1949 by J. Betzner and others. This series of articles is concerned with the complexities involved whenever a curriculum is to undergo a change. According to this article the number one goal of educators is to meet the needs and interests of the pupils. Then and only then can effective education be carried out. But if an individualized program is carried out, then isn't the socialized program neglected? Curriculum construction and revision "is an inclusive process of inventorying, understanding, and planning a highly interwoven, complex shift not only in myriads of practices but in general purposes."17

If a vital and significant program of education is to be brought about in the school, educators and laymen feel that parents and other citizens must participate in curriculum development.

Children should learn how to think, not what to think; in other words, to solve problems. This is a necessity for all learning activities conducted. The problem-solving activities

17. Ibid, Page 293.
must be significant. But,

..., significance does not lie entirely in the internal or intrinsic attributes of an experience in the particular facts, events, skills, or feelings that may be involved, or even in methodology.... It is always necessary to ask 'significant for what' and 'significant to whom'.

According to this article there are three errors to avoid, which are the following:

1. To assume that significance lies only in the here and now.

2. To give exclusive or undue emphasis to either the general welfare values or the individual values of the youth in judging the significance of an actual or possible experience.

3. To assume that children or youth of any particular age differ one from another only in an intellectual sense, and that intellectual differences are the only ones that matter.

Another necessity for effective learning is a good learning environment. A course of study can and should list materials and suggestions to help achieve this goal. The physical setting of the classroom must be conducive to learning. It must contain the proper equipment which should be available when needed. The pupils must also have access to instructional materials and to community resources. The more materials that are available, the easier it is for the

pupils to learn. Community resources, in many cases adaptable to the course of study, are too often neglected.

If a school or college assumes the responsibility of helping learners obtain a more effective education, it is involved in a continuous curriculum development. Such a staff can achieve this through re-educating itself. Some of the suggestions made for study are: to study learners; to study broad social trends; to experiment with methods and materials, and to select a basic plan of organization. If the faculty make it a point to undertake such studies, then a foundation is laid upon which a good course of study can be built.

The professional personnel should give particular attention to their responsibilities. The teacher must "give particular attention to the problem of selecting and evaluating learning experience." The administrator, supervisor, and resource director's responsibilities lie as "stimulators, co-ordinators, and general aides."¹⁹ They must also be facilitators since they have an over-all view of the needs and resources available.

Very little has been done in course of study evaluation in the past few years. Although some aids have recently been given for the evaluation of courses of study, no actual evaluation is evident.

¹⁹. Ibid, Page 325.
CHAPTER III
PROCEDURES

In order to evaluate the courses of study, three things are necessary. These may seem obvious, nevertheless they are essential if the study is to be conducted. First, the courses of study must be obtained; second, evaluation criteria must be set up; and third, the assembled material must be organized into presentable units.

OBTAINING THE COURSES OF STUDY

Obtaining the courses of study was more difficult than the author had at first presumed. At the time, only a very small number (approximately six courses of study) could be obtained in the Resources library at Boston University. It was necessary, in order to obtain a more accurate picture of the courses in high school mathematics, to secure a larger number of curriculum guides. In order to get a list of the curriculum guides available, the author wrote to the people who were connected with curriculum material since they would be able to supply the information desired. Letters asking for a list of high school courses of mathematics were written to:

1. Mr. Gordon McKenzie, Curriculum Laboratory, Teachers' College, Columbia University.
2. Director of Curriculum Laboratory, George Peabody
College for Teachers, Nashville, Tennessee.

3. Dr. Philip G. Johnson, Office of Education, Washington, D. C.

However, the results were not as expected. A reference to a list of courses was sent from Columbia University. George Peabody Teachers' College also sent the same reference, with a notation that although a considerable number of courses are on their shelves, no attempt has been made to evaluate them. Since a ready-made list of courses on hand was not available at the time, titles of courses were not sent. The reference made by both of the Teachers' Colleges was not followed up because it was very brief.

Although the Federal Office of Education stated that they had a substantial number of courses on hand, they did not send a listing of them. The author's request at the time was for the more desirable ones. According to the letter, no attempt was made to classify the courses; therefore, no list was sent.

Since this method of approach for receiving a list of courses was not successful, another plan had to be developed. It was then decided to write to the State Department of Education in each one of the forty-eight states. If information as to the situation of existing curriculum material was available, the State Department of Education would be the most logical place to secure it. Therefore, a form letter was sent to each state. The letter requested a list of the available
courses of study that had been prepared for cities, towns, counties, schools, or any other locality that might use a course of study. In some cases a follow-up letter was necessary, but a reply of some form was received from each State Department of Education. Replies came in the form of state courses of study, letters and postcards, school directories and manuals (some of them annotated). Letters varied from "no information available" in a few cases to a good suggested list of places to write for courses.

From the replies to this form letter, it was possible to determine approximately how many states publish a state course of study for mathematics. Eleven states publish a state course of study and seven states are either revising or printing a new course of study. Seven of the states sent a high school course of study. Table I gives a summary of the information received together with the suggestions of places to send for curriculum material.

Exactly one hundred names of places to write for a course of study were received. After the list was made up, the director of the Boston University Resources Library sent for the curriculum material to be evaluated. This material has since been placed in the library for reference. Up to June 15, 1950, eleven courses of study were received and thirty-two replies as to the unavailability of curriculum material. It was presumed that the majority of the others did not have material to send.
Five other courses were obtained from various other sources. Some of them are not complete, but they give an indication of the type of mathematics curriculum in the high schools. In all, twenty-three courses of study were obtained.

THE EVALUATION CRITERIA

Now that the courses of study had been received, a suitable criteria had to be set up in order to evaluate them. In order to get proper comparison among the courses, consistency was desired. Identical information about each one would be sought.

After thorough review of the research presented in the literature, and careful consideration, it was decided to evaluate the courses under the following main headings: general information, objectives, organization, materials and activities, method, flexibility, measurement, content, references, and conclusions.

As previously mentioned, criteria for the evaluation of a high school mathematics course of study was built by S. E. Boselly and H. Holbrook.¹

¹ S. E. Boselly, Jr., and H. Holbrook, loc. cit.
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<td>Alabama, Montgomery</td>
<td>No State course of study--Program of studies only.</td>
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<td>Arizona, Phoenix</td>
<td>Eleven high schools suggested.</td>
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<td>Arkansas, Little Rock</td>
<td>Eleven towns suggested.</td>
</tr>
<tr>
<td>California, Sacramento</td>
<td>San Francisco and Los Angeles suggested.</td>
</tr>
<tr>
<td>Colorado, Denver</td>
<td>No State course of study.</td>
</tr>
<tr>
<td>Connecticut, Hartford</td>
<td>No State course of study--Text selected by schools.</td>
</tr>
<tr>
<td>Delaware, Dover</td>
<td>No State course of study--No other information.</td>
</tr>
<tr>
<td>Florida, Tallahassee</td>
<td>New State guide soon available.</td>
</tr>
<tr>
<td>Georgia, Atlanta</td>
<td>School leaders manual, only, sent.</td>
</tr>
<tr>
<td>Idaho, Boise</td>
<td>New State guide soon available--No other information.</td>
</tr>
<tr>
<td>Illinois, Springfield</td>
<td>School directory, only, sent.</td>
</tr>
<tr>
<td>Indiana, Indianapolis</td>
<td>Writing new State course of study.</td>
</tr>
<tr>
<td>Iowa, Des Moines</td>
<td>State course of study sent--No other information.</td>
</tr>
<tr>
<td>Kansas, Topeka</td>
<td>Information not included in list of materials.</td>
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<tr>
<td>Kentucky, Frankfort</td>
<td>No information as to State course of study.</td>
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<td>Louisiana, Baton Rouge</td>
<td>New Orleans suggested.</td>
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<td>State, Capital City</td>
<td>Details</td>
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<tr>
<td>Maine, Augusta</td>
<td>No State course of study.</td>
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<tr>
<td>Maryland, Annapolis</td>
<td>No State course of study available.</td>
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<tr>
<td>Massachusetts, Boston</td>
<td>Four information as State course of study.</td>
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<tr>
<td>Michigan, Lansing</td>
<td>No information as to State course of study.</td>
</tr>
<tr>
<td>Minnesota, St. Paul</td>
<td>State course of study, only, available.</td>
</tr>
<tr>
<td>Mississippi, Jackson</td>
<td>No State course of study--State required textbooks.</td>
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<tr>
<td>Missouri, Jefferson City</td>
<td>State course of study available.</td>
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<td>Montana, Helena</td>
<td>State course of study sent--No other information.</td>
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<tr>
<td>Nebraska, Lincoln</td>
<td>Omaha and Lincoln suggested.</td>
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<tr>
<td>Nevada, Carson City</td>
<td>No schools publish course of study--Use State's.</td>
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<tr>
<td>New Hampshire, Concord</td>
<td>Revising State course of study.</td>
</tr>
<tr>
<td>New Jersey, Trenton</td>
<td>No information as to State course of study.</td>
</tr>
<tr>
<td>New Mexico, Santa Fe</td>
<td>No schools publish course of study.</td>
</tr>
<tr>
<td>New York, Albany</td>
<td>State course of study sent.</td>
</tr>
<tr>
<td>North Carolina, Raleigh</td>
<td>Grade 7-12 plan--all courses approved by the State.</td>
</tr>
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<td>North Dakota, Bismarck</td>
<td>Tentative course of study--not available.</td>
</tr>
<tr>
<td>Ohio, Columbus</td>
<td>No information available on districts.</td>
</tr>
<tr>
<td></td>
<td>State course of study at printer's.</td>
</tr>
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<td></td>
<td>State course of study sent--No other information.</td>
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<td>Cincinnati and Cleveland suggested.</td>
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<td>State, Capital City</td>
<td>State course of study sent—No other information.</td>
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<td>Oklahoma, Oklahoma City</td>
<td>Portland and Medford suggested.</td>
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<td>Oregon, Salem</td>
<td>No State course of study available at present.</td>
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<tr>
<td>Pennsylvania, Harrisburg</td>
<td>Write to University of Pennsylvania—no reply received.</td>
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<tr>
<td>Rhode Island, Providence</td>
<td>No State course of study.</td>
</tr>
<tr>
<td>South Carolina, Columbia</td>
<td>Six schools suggested.</td>
</tr>
<tr>
<td>South Dakota, Pierre</td>
<td>Directory of schools sent.</td>
</tr>
<tr>
<td>Tennessee, Nashville</td>
<td>No State course of study.</td>
</tr>
<tr>
<td>Texas, Austin</td>
<td>Three high schools suggested.</td>
</tr>
<tr>
<td>Utah, Salt Lake City</td>
<td>No State course of study on senior high level.</td>
</tr>
<tr>
<td>Vermont, Montpelier</td>
<td>State course of study also sent.</td>
</tr>
<tr>
<td>Virginia, Richmond</td>
<td>Two counties and four cities suggested.</td>
</tr>
<tr>
<td>Washington, Olympia</td>
<td>Two suggestions given.</td>
</tr>
<tr>
<td>West Virginia, Charleston</td>
<td>State course of study sent—No other information.</td>
</tr>
<tr>
<td>Wisconsin, Madison</td>
<td>No State course of study.</td>
</tr>
<tr>
<td>Wyoming, Cheyenne</td>
<td>Four suggestions given.</td>
</tr>
</tbody>
</table>
A good part of the criteria for this present study was based upon their work. Some additions and further explanations were needed to make it more complete. These were obtained from other criteria found, and from the literature used in the research.

**General information.** This will include such items as method of construction of course, provisions for revising, year of publication, mechanical makeup, and manner of treating major phases. It will also include any special or unusual features worth mentioning.

**Objectives.** Under this classification there are two types of objectives, general and specific. General objectives are usually constructed for high school mathematics in general, or for a specific course. Specific objectives are usually limited to units or to a particular section within the course.

It is the objectives, both general and specific, that provide the purpose for which the course is necessary. This is aptly stated in a government survey, "The importance of aims or objectives in a course of study lies in the directive influence which they exert upon the selection of content, activities, and experiences." Therefore, a course of study, in order to be developed along the desired path, must have

general objectives to guide the remainder of the curriculum. Specific objectives, of course, make it even more valuable and should be a part of every course of study.

The broad aims of mathematics come under three classifications: 1) practical, 2) disciplinary, and 3) cultural. These have stemmed from the Report of the National Committee on Mathematics Requirements and still have influence in the construction of mathematics courses. The better courses of study would naturally include provisions for all three.

The objectives should also recognize not only the students' needs, interests, and capacities, but also his activities, needs and interests in his future life whether it be for vocational purposes or for further study.

What are the reasons for the selection of the objectives? Is the selection based on opinions of the committee, report of national committee, scientific investigation or experimentation? It is necessary to know this in order to be able to determine how much value should be placed on the objectives. The cause or causes for selection ought to be known also for the same reason.

The objectives form a necessary part of a course of study. Without them it is not complete.

Organization. The course of study must have some type of organization, otherwise it would be very difficult to understand and use. From this, it will be determined if a time allotment is included for the course. If there is, is there a time allotment within the course for the materials and topics? Is there also a maximum and minimum time allotment? If there is a time allotment within the course, the amount of content within the period of time will also be ascertained. Another point that would come under this classification is the information as to whether it prescribes the material according to grade placement.

Materials and Activities. An important item which should be included in a course of study is a list of the materials required for the mathematics classroom. These are an essential part of the mathematics course, but too often this information is not included. The materials would serve the purpose of stimulating valuable research. One main classification under this topic is reading material. Reading for the course may be conducted according to more than one method. Either a textbook may be assigned for the course, or a book-list of references may be given. A book-list for reference is more superior because it would give the student much more valuable material from which to learn.

The better course of study would also include professional literature for teachers to provide background for the
course and suggestions for classroom adaptations.

Other types of materials also come under this classification. These include drill cards, visual aids, maps, radio, constructive materials and community resources. Community resources are too often neglected. If used properly, they could provide rich experiences for learning. A great deal of valuable knowledge could be obtained from museums, industrial plants, community services, and well-chosen lectures.

A course of study should not only include materials that could be used effectively but should also provide suggestions for their use by the teacher.

Classroom and extra-curricular activities should be closely allied with materials, since the activities depend upon the materials available. Activities should be such as to provide for individual differences, to involve creative and intellectual effort, to involve doing and experiencing, etc. These activities would help to accomplish the aims or objectives. But without the proper equipment or materials, the activities are not possible.

**Method.** A description of the content will be included under this topic. The following points will be considered in the description. Does it give type lessons or suggested units? Does it suggest correlation with community life? Does it provide for the diagnosis and correction of individual difficulties?
The better course of study would also suggest a variety of procedures for attacking each new problem or unit. Then it would also list the better methods under given circumstances. Procedures for realizing the specific objectives, if any, should also be suggested. A good course of study should help the teacher plan the work beforehand.

**Flexibility.** A course of study should not be fixed but flexible to meet the varying conditions under which the course might exist. There should be provisions for adapting the course to 1) communities or schools, 2) classes or groups, and 3) individual pupils. No two courses are conducted under identical circumstances, therefore, there is a need for flexibility.

The flexibility may be achieved in more than one way. It can be done by varying the content of the course, time-requirements, the method for presentation, or the procedures followed.

**Measurement.** In order to know what the student has learned, some provisions for measurement must be carried out. Yet, too often, provisions for measurement are left out. Perhaps this is left to the ingenuity of the teacher.

What should be included under the topic of measurement? The first thing that must be known is the standard of attainment. This may be defined either in terms of course-objectives or standard norms. The definitions would naturally depend upon the course.

Evaluation of pupil progress may be conducted according
to more than one method. Testing may be considered as a part of each unit or under a periodic schedule.

Testing material can be obtained under various plans. If the school is fortunate enough, local tests may be supplied. Otherwise, standard tests may be suggested; sample tests may be included, or directions for making the tests may be given. At any rate, the tests should be based on the original objectives and be representative of the subject matter to be tested.

Regardless of how the tests may be obtained, proper use of them must be made. Otherwise, testing is a waste of time and effort. These tests may be used for pupil placement, for promotion, or for remedial work.

Content. The first point under consideration is the courses offered. These must meet the mathematics needs of all the students. For those students not following the traditional sequence of courses, provisions must be made for them to acquire the essential mathematical knowledge. The courses must also appeal to the students, either for their intrinsic value or for future needs.

The organization of the subject matter must be such as to be readily understood by the teacher. There should be a wide range of subject matter as well as suggested topics which could be included for individual differences or if the required material is mastered before the end of the term.

Proper emphasis must be laid upon drill material, know-
ledge, applications, skills, modes of thinking, attitudes, and appreciations. This is especially necessary for the inexperienced teacher, as these points very often, are not discernible from the material itself.

Mathematics, because of its nature, is most often presented according to traditional and logical form, rather than according to difficulty.

Another point of necessity in the content is that of correlation and integration. Correlation, particularly with physics and chemistry, can be brought about easily. This correlation also helps to develop an appreciation of mathematics as well as to give practical application. Integration in mathematics helps to develop an overall picture of the subject.

If the material is organized into units, some points must be observed here also. First, it must be presented so as to appeal to the pupil and appear interesting. There also must be objectives for the units and they must be so stated that both teacher and pupil can understand them and work for their realization. The unit must begin with and reproduce life situations, and proceed to generalizations by the pupil. Provisions for individual differences must also be made to challenge even the best of students.

References. These are a necessary part of each course. There must be a sufficient list to present an answer to almost
any question that may be posed by either teacher or student. References may include books, magazines, pamphlets or other printed literature. Suggestions for their acquisition and use should be provided. An annotated list, of course, would be very valuable.

**Conclusions.** For this heading an overall picture of the course will be presented and general information necessary for completion of the course will be included.

**PRESENTATION OF EVALUATIONS**

The third point under consideration in this chapter is the presentation of the evaluated material. Since each State in the Union had been contacted regarding the availability of courses, it was decided to present the courses of study according to the States in alphabetical order. Any State not represented will not be mentioned. The State course of study, if any, will be presented first and then, in order, the courses of study for counties, cities, towns and high schools. If a high school course of study was sent as being representative of the town, it will be considered under the town rather than the high school.

The evaluations will be presented according to the main headings described. Omission of one or more of the topics will mean that it was not mentioned in the course.
MATHEMATICS IN THE ANNISTON CITY SCHOOLS

This course of study includes arithmetic and mathematics from grades 1-12. Grades 9-12, only, as defined in Chapter I, will be considered.

General information. The course of study was constructed by the Mathematics Committee of the Anniston Teachers' Association. There are no stated provisions that would allow for future revision. The date of construction or printing is not given. The course is mimeographed and stapled. The major phases of the course of study are in outline form.

Objectives. The general objectives of mathematics as a whole are included in the Forward. General objectives, listed as Achievement goals, are stated for each course. Emphasis is placed in the practical value of the subject. Skills, knowledge and habits are stressed. The course of study states, however, that it does not mean that all the older aims as discipline, pleasure, cultural and preparatory values are wholly ignored. It does mean that the emphasis has shifted. The following basic mathematical objectives are included:--

1) mathematics as a mode of thinking--in Ninth Grade Mathematics, 2) transfer of training may be secured--in Plane Geometry, 3) preparation for future courses, 4) increase computational skills, 5) practical usefulness, and 6) inter-
relation with other subjects—in Trigonometry and Plane Geometry.

**Organization.** The courses are organized according to a year's plan of work, with the exception of Plane Trigonometry and Solid Geometry. These are planned as semester courses. Each course is divided into three sections. The three sections are: I Achievement Goals, II Content, and III Materials. Correlation is mentioned in the objectives, but there is very little provision for it in the content. The courses are presented in organized outlines. There is no time allotment within the courses.

**Materials.** Although each course has a division labeled, "Materials", the only things listed are textbooks. There is at least one textbook suggested for each course, but some courses have two or three.

**Content.** The following courses are offered: Ninth Grade Algebra, Ninth Grade Arithmetic, Plane and Solid Geometry, Second Year Algebra, and Plane Trigonometry. They are well organized in outline form. The main topics to be taken up are listed. Under each main topic, the sub-divisions are given. A wide range of subject matter is included to complete the main topics. Ninth Grade Mathematics is presented so that it is functional in terms of human experience. Correlation is found in Trigonometry and Plane Geometry. Trigonometry is correlated with engineering, science,
and industry. Plane Geometry is correlated with shop work 
and engineering. Rather than units, the content is pre-

tented in the form of project-problems.

References. A bibliography, for the course of study only, 
is given. This includes courses of study.

Conclusions. Many necessary points that should be 
included in a course of study are omitted. Activities, 
methods, more materials and provision for flexibility should 
be included.
COURSE OF STUDY FOR THE TUCSON PUBLIC SCHOOLS

An outline, only was sent in plane geometry and in first year algebra. The complete course of study is being rewritten. Under consideration, also is a change in textbooks.

General information. The author or authors of this course of study are not given. A revision is definitely planned. This is mentioned in the letter enclosed with the outline. The course of study is mimeographed and loose leaf. Most of the material is presented in outline form. One unusual feature is presented in the geometry course. To maintain the skills in algebra and arithmetic, a section covering these subjects is presented for each six week unit.

Objectives. The general objectives, only, are given. The general objectives for algebra are divided into three groups. The objectives are classified as: 1) practical, 2) logical, or 3) cultural. They are not classified for geometry. The objectives are listed as pupil goals. They recognize pupil interests and needs, as well as adult needs and interests. The following basic mathematical objectives are recognized: 1) Transfer of training, if definitely taught — in Geometry, 2) preparation for taking college board entrance examinations, 3) character training in habits, attitudes, and appreciations, and 4) increase in computational
skills. The major emphasis is concentrated on acquiring skills.

**Organization.** The courses are organized on a year's basis. It is arranged in outline. The following main topics are included in the outline: 1) general objectives, 2) current and future needs, 3) proficiency to be expected, and 4) teaching units by six week periods. The course prescribes the time of year for the various materials, since the content is stated as, First Six Weeks, Second Six Weeks, etc.

**Materials.** A textbook is required for each course. A few other textbooks are also listed as references. The only other material suggested is a combination text and workbook. This is given for the geometry course to maintain the skills in algebra and arithmetic.

**Method.** The general content to be included in the teaching units per six week periods is the only material presented. No methods, as defined, are presented.

**Content.** The content is selected according to the textbook prescribed for each course. The chapters including the content are assigned. The course of study does not go into much detail into the content. No conclusions can be formed from the course of study since this topic depends upon the textbook used.

**References.** Four references are listed for each course. A brief annotation is also presented. One important item,
Conclusions. Since this is only an outline of the course of study being rewritten, definite conclusions cannot be made at this time.
A COURSE OF STUDY IN ESSENTIAL MATHEMATICS -
SEMESTER III

A COURSE OF STUDY IN ESSENTIAL MATHEMATICS -
SEMESTER IV

CHICAGO PUBLIC HIGH SCHOOLS

These are two separate courses of study for the
Chicago Public High Schools, but since they both take up the
same subject and are similar they will be taken up together.

General information. The courses of study were con-
structed by a general committee of principals and teachers
headed by a chairman. A revision or the content was carried
on during the construction of the course. The final form
of the courses, dated 1943, has been developed from the
tentative forms of the units with revisions and changes as
suggested by the teachers after actual classroom use and
personal evaluation. The courses of study are mimeographed
and bound. Most of the material is presented in units and
informal discussions.

Objectives. The general objectives are given for each
course. The specific objectives are referred to within the
courses of study. The major emphasis, in both courses, is
placed on understandings, ability to apply understandings,
and enriched living and social well-being. The objectives
are listed as teacher goals. They recognize the needs, desires, and wants of the student as well as general educational activities. The following mathematical objectives are included: 1) mathematics as a mode of thinking, particularly to apply facts to daily problems, 2) practical usefulness, and 3) preparation for vocations.

Organization. The material is organized into semesters. Each semester is broken down into four units. Rather than topical arrangements, the units are arranged under general headings. The time allotment presented is the time per unit. The units are scheduled from three to eight weeks with one unit of one week on the slide rule. The course states that the time limits are merely suggested. At the request of teachers, a maximum number of class periods has been suggested for each of the main sections of the units.

Materials and Activities. No specific textbook is required as the material is taken from a collection of books. Two book-lists for pupil use are included. One list is for regular class use, while the other list is for supplementary reading. Each unit gives the page references. Professional literature for teachers and materials to provide a background are given in the bibliography. For Semester III, other materials, such as measurement instruments, magnetic compass, slide rule, models of solids, and maps are suggested for classroom use. Semester IV classifies other materials as
aids. These materials are not given in the course of study. Rather, page references for these aids are given in "Aids for Teachers of Mathematics in Chicago Public High Schools".

Both courses suggest many varied activities to achieve the objectives. A great number of activities are included in each unit. The following are some of the activities listed in the unit, "Mathematics and Consumer Buying": checking bills, making and counting change, saving money, checking charge accounts, working with community service bills and installment buying. This is an example of the type of activities listed for just one unit.

Methods. The material is described as suggested units. Suggestions for correlating instruction with community life and for providing for individual differences are also given. A variety of procedures for starting the units are also presented. A section on suggestions and vocabulary precedes each unit.

Flexibility. Provisions for individual differences can be made by the varying activities.

Content. For Semester III, the following units are presented: 1) Direct Measurement, 2) Geometrical Relationships, 3) Surfaces and Volumes of Solids, and 4) Indirect Measurements. Semester IV presents: 1) Mathematics of Spending the Income, 2) Mathematics and Consumer Buying, 3) Mathematics of Investment, and 4) Mathematics in
Government. The material presented is made functional in terms of human experiences. The students do not memorize or learn the vocabulary of the new material. Rather, the vocabulary or the new material is taken up in activities.

In the units, the objectives are referred to in an informal paragraph. Pupil experiences are connected with future outcomes because they reproduce real life situations. The units are to be carried until finished or as long as interest is maintained.

References. Up-to-date lists of references are included. These are presented for each unit as well as the whole course of study. Periodical references for teachers are also included. These references are for the "Mathematics Teacher" and "School Science and Mathematics". The following classification of groups are made: reference textbooks, reading in mathematics, and supplementary textbooks. Semester IV includes another classification, trends in the mathematics curriculum.

Conclusion. These two courses, if carried out effectively, can provide excellent mathematics material to those students that are not taking the traditional courses.
This course of study includes programs of study only for grades 10-12. Grade 9 is considered as a Junior High grade, and therefore not included in this course of study.

**General information.** This course of study was constructed by production committees for each grade level. These committees were headed by a Mathematics Area Committee. No provisions are stated for future revision. The course of study was published by the State of Iowa in 1949. It is printed and bound, and it contains one hundred thirty eight pages.

**Objectives.** The general objectives for mathematics in the senior high school are proposed. These take into consideration functional competence, skill and knowledge, preparation for future work and study, appreciations, and habits. The objectives are based on the belief that mathematics should provide for the needs of general education and for the needs of the students going to college. Habits and skills acquired in mathematics are desirable in adult life. An understanding of the concepts and principles of mathematics are also necessary in adult life. The aims of each course are given in detail. Intermediate algebra puts the main emphasis on skills. Habits and knowledge are also emphasized, but to a lesser degree. The objectives for Plane and Solid Geometry
are presented from a pedagogical point of view and also from the standpoint of organization. Skills, knowledge, understanding of the nature of proof, and habits are emphasized in geometry. Fourth Semester Algebra and Trigonometry consider appreciation, understanding, skills, knowledge and habits. It is evident from the above that the practical and cultural aspects of mathematics are included. Only one objective is given for General Mathematics—"to teach students those applications of mathematics which are most likely to be used in everyday living". The objectives are listed mainly as teacher goals. However, the unit objectives of Geometry, and the objectives of Trigonometry are listed as pupil goals.

Organization. The courses are organized on a year's basis with the exception of one course in Algebra and Trigonometry. These are organized as semester courses. The courses are then broken down into units. Trigonometry and Plane and Solid Geometry contain five units each. Intermediate Algebra and Consumer Mathematics contain twelve units each. Only a brief topical outline is given for Fourth Semester Algebra. The units for Trigonometry and Consumer Mathematics are divided into three parts. These parts are: 1) aims, 2) information to be gained, and 3) suggested teaching procedure and pupil activity. Algebra and Geometry have a fourth division, evaluation of the unit. Trigonometry has a section on evaluation at the end of the course. The
material within the units is presented in outline form. No time allotment is included for the units.

Materials and Activities. No specific textbook is required for the courses. Textbook references are given for all of the courses. For Geometry, page references are given according to each main topic. Consumer Mathematics also includes a bibliography of teaching aids which would be helpful for all the courses. Places where reliable sources of information are available are listed. It includes agencies of the Federal, State and local governments; Federal Security Agency; Professional organizations and others. Professional magazines are also given for references. These include "The Mathematics Teacher" and "School Science and Mathematics". Materials are included only for the Geometry course. These include slides and films, sticks to develop triangles, and student-made models and instruments. A list of films and filmstrips for mathematics use is included in the Appendix.

Algebra and Trigonometry contain only subject matter activities. However, activities to gain greater experiences are included in Geometry and Consumer Mathematics. These activities include the following:- pupils locate source material in the library to prepare a report on outstanding mathematicians; individual field trips to make a list of the applications of geometry; collect data on
installment buying, purchasing, etc.; and solve problems on setting up a budget for a home.

**Method.** The content is presented in units for all the courses, except Fourth Semester Algebra. This course contains only a topical outline of the material to be covered. Each unit provides a variety of procedures to introduce the new topic. The course of study calls attention to the material that is to be emphasized, or is apt to cause difficulty to the student. Suggestions for oral and written work are also given.

**Flexibility.** Optional topics are presented in Geometry, Trigonometry, and Consumer Mathematics. Provisions for individual differences could be obtained in the other courses by giving the brighter students more of the problems listed.

**Measurement.** Standards of attainment in terms of the unit objectives are presented for each unit. These are presented under the title of "Evaluation of the Unit". The course of study does not state how the measurement is to be done. This is left to the teacher.

**Content.** All of the mathematics courses in the Senior High School are offered on an elective basis. The following are the sequential courses offered: Intermediate Algebra, Plane and Solid Geometry, Fourth Semester Algebra, and Trigonometry. Plane and Solid Geometry are fused together in the Geometry course. To meet the needs and abilities of
all high school students, Consumer Mathematics is offered. For each course, the subject matter outline is presented. Each main topic is then made up into a unit. The main topics are presented according to difficulty, but the material in each outline is presented according to logic.

References. As previously mentioned, references are included for each course. Fourth Semester Algebra and Trigonometry list the references according to textbook and supplementary materials. A general bibliography is also included in Appendix I. The references are grouped under the following headings: 1) Yearbooks of the National Council of Teachers of Mathematics, 2) mathematics magazines (in order of preference), 3) books for teachers, 4) books for Algebra, Geometry, and Arithmetic, 5) measuring, measuring instruments and tables, 6) historical books, and 7) general references.

Conclusions. The course of study is an invaluable aid to teachers of the courses offered. The material to be included in the courses is taken up in great detail. If the suggested time allotment for each unit was included, the course of study would help a great deal more.
This manual, Part II, is a guide for all courses given in the high schools of Maine. Part I contains the administration and supervisory details concerning the secondary schools of Maine. Mathematics, only, as defined in Chapter I, will be considered.

General information. This manual was written in part and edited by Mr. Harrison C. Lyseth, State Director of Secondary Education. It is only a temporary manual to be enlarged and rewritten at a later date. This manual is dated 1938. It is mimeographed and bound. The material is organized into paragraphs.

Objectives. According to the course of study, the aims include the ultimate objectives as stated in the "Cardinal Principles of Secondary Education". In addition to these, provisions for character training in accuracy and clear thinking are made. The future needs of certain student groups are also taken into consideration.

Organization. The subject of mathematics is written up in two pages. The material is divided into aims, procedures, methods, and bibliography. The procedures are then broken down into each grade level. There is no time allotment given.

Materials. Only one reference is made to this. The course states that mathematics requires special equipment in
order to be taught effectively.

Methods. The course does not make any attempt to go into detail in teaching methods.

Content. The course offerings are the only materials given for each grade. For grade 9, algebra and some kind of a general math course, not yet classified, are offered in the larger school systems. In the smaller schools only one course, usually general mathematics, is offered. For grade 10 in most schools, a second year of mathematics is offered. In the smaller schools, algebra is usually given depending on the ninth grade offerings. For grade 11, geometry is offered. For grade 12, solid geometry and trigonometry are offered in the larger schools. Nothing definite is stated about the course offerings in the smaller schools.

References. A bibliography is offered to aid the mathematics teacher to pursue correct methods. This list is also given so that the teacher may understand the needs of equipment in the classroom.

Conclusion. Since this is only a tentative edition and does not contain the materials necessary for a good course of study, definite conclusions can not be made at this time.
BROCKTON PUBLIC SCHOOLS COURSE OF STUDY FOR GRADES 7-9

As indicated this course of study is for the Junior High School. However, since it does include grade 9, it will be evaluated here.

General information. The course was constructed by a Curriculum Committee composed of the Superintendent of schools, two heads of Mathematics departments, and eight teachers from eight different schools, in 1947. There are no stated provisions that would allow for future revision. The course is mimeographed and bound. The course of study contains forty-five pages. Nineteen pages are given over to the ninth grade. The major phases are divided into eight units. One unusual and excellent feature of this course is that each unit lists the new vocabulary.

Objectives. General objectives for the course are given and also specific objectives for each unit. According to the general objectives, major emphasis is laid on skills and understanding. Knowledge and appreciation are mentioned, but not stressed. The general objectives are listed according to teacher goals, but most of the unit objectives are listed according to teacher goals, but most of the unit objectives are listed as pupil goals. For validity, it recognizes not only the children's needs but also the social needs of the
immediate community and society at large. The following basic mathematical objectives are included: 1) Mathematics as a mode of thinking to aid in collecting, understanding, and applying facts; 2) Mathematics as a means of increasing computational skills; 3) Power to apply mathematical concepts; 4) Practical usefulness; and 5) Cultural values.

**Organization.** The particular section under consideration is organized as a ninth grade course of study for general mathematics. The units are arranged according to topics within the subject matter and center about the child's interest. It is arranged in an organized outline form within the units. There is a suggested time allotment for each unit ranging from two to eight weeks. In a sense, it states the time of year for each unit because the units are organized in a logical order.

**Materials.** There is no specified textbook for the course, but for each unit there is a bibliography of about four books with page references. Informal drill cards made by students are suggested. Community services are taken into consideration when the pupils work with Brockton's budget and tax rates. The course also suggests excellent material and related activities both inside and outside the classroom which would help to stimulate valuable cultural and recreational studies. Such materials as the following are included: Advertisements for sized to height clothing;
Collection of newspaper clippings showing price reductions in per cent, bank advertisements, graphs, etc; and Brockton's budget plan. These are easily obtained and the teacher is helped by suggestions for presentation and adaptation.

The activities suggested to correspond with the materials involve creative and intellectual effort, and are related to the objectives. They also involve drill work and memorization, doing and experiencing.

**Method.** The content is constructed as suggested units, made to correlate the instruction with community life. The desirable outcomes for both teacher and pupil are listed in the aims for each unit. It also states that these aims should be achieved by each pupil. Provisions for individual differences can be made only with the related activities for each unit since the brighter student would accomplish more of the projects.

**Measurement.** Although diagnostic measurement is needed for this course and referred to, it does not state what methods or tests can be used to achieve this. It does mention that periodic testing to determine gains should be made and charted to register progress.

**Content.** In this course a wide range of subject matter exists. The following subjects are taken up as units: remedial and refresher work in the fundamentals, the formula, the simple equation, ratio and proportion, percentage and
interest, graphic representation, measurement and informal geometry, and indirect measurement. Good organization is evident within the units as they are broken down into 1) Aim, 2) Content—which is well specified and includes the new vocabulary, and 3) Related activities. More emphasis is laid on drill material, knowledge, applications and skills, rather than on attitudes and appreciations. The content should appeal to the pupils because of its intrinsic value and evident worth. Diagnostic, remedial, concrete and drill work are all covered in the material. It is definitely within the pupils' ability, but at times there is a question as to whether it presents enough of a challenge.

References. There are at least four references for each unit, and these are considered up to date. The references can be made useful for individual differences; however, this is not suggested. They are alphabetically arranged and can be easily revised.

Conclusion. This is a good up to date course for general mathematics in the ninth grade. It can also be used very effectively for a general mathematics course in a Senior High School. All points, with the exception of flexibility, considered essential in a course of study are given consideration. The unusual feature of including a new vocabulary for each unit makes it even more valuable.
Enclosed with the course of study was a notation stating that this was just a bare outline. It is the intention of the school to further expand the course of study into a more complete work.

**General information.** The author or authors of the course are not given. As stated in the letter, the course of study is to be revised and put into a more complete form. The course of study is made up of seven typewritten pages and stapled. The content is presented in lists.

**Objectives.** The general objectives of mathematics as a whole are given. They are based on the general objectives as given in the Fifteenth Yearbook of the National Council of Teachers of Mathematics. General objectives are also given for Plane Geometry, but not for any other course. The general objectives of mathematics include the following phases: skills, knowledge, concepts, desirable attitudes, interests and application. No stress is laid on any particular phase. The main emphasis of Plane Geometry is to lay the foundations for deductive reasoning. The objectives are listed as teacher goals. They recognize adult activities, needs and interests.

**Organization.** The courses are organized on a year's
basis. For Algebra I, Algebra II, and Trigonometry, a list of the content that is to be covered each month of the school year is presented. This is not done for Plane Geometry. For Geometry, the content is presented but without any time allotment.

Content. Algebra I, Plane Geometry, Algebra II, Trigonometry and Elementary Analysis are offered in Weston High School. No grade placements are assigned. The general topics to be covered for each course are given. The material is not given in great detail. It is to be taken up in a logical form, rather than according to difficulty.

Conclusion. As stated in the letter enclosed this is only a bare outline. Since this is to be expanded at a future date, no conclusions will be made at the present time.
MICHIGAN ANN ARBOR

MATHMATICS IN THE SECONDARY SCHOOLS

Besides the recognized mathematics courses for the senior high school, mathematics for the Seventh and Eighth grades, and Shop Mathematics are included. Seventh and Eighth grades are not considered in this study.

General information. The author or authors of this course of study are not given. It is a revised copy, dated January, 1945. The course of study is hexographed and stapled. The objectives are given in a list, but the rest of the material is treated as an informal account.

Objectives. The general objectives for high school mathematics are given. Objectives listed under each course are labeled specific, but they are more of a general nature. The general objectives emphasize understanding. The course of study states that drill is necessary, but it must be preceded by understanding. Habits, attitudes, skills, knowledge, and appreciation are desired objectives, but they are not emphasized as much as understanding. The specific objectives stress the same points as the general objectives. Both these objectives are stated as teacher goals. The course, General Mathematics, recognized the social needs of the immediate community. Geometry emphasizes appreciation. The future needs in educational and vocational activities are
recognized in the other courses. The following basic mathematical objectives are included: 1) mathematics as a mode of thinking to aid in applying facts to daily problems (General Mathematics), 2) knowledge as an ultimate goal, 3) preparation for future courses and vocations, 4) character training in habits and appreciations, 5) practical usefulness (General Mathematics), and 6) disciplinary and cultural values.

Organization. The courses are organized on a year's level. Algebra and Geometry down into semesters. Each course is organized according to: 1) When course is offered and who is eligible, 2) Specific objectives, 3) Brief description of course content plus chapter references in the textbook. The objectives are presented in a list, but the remainder of the material is presented in organized paragraphs. No time allotment is included within the course.

Materials. A specific textbook is required for each course. The chapters to be taken up are also included. No other materials are included.

Flexibility. All courses list the minimum requirements. Algebra 2 lists additional material if, "time, ability, and interest" permits.

Content. The following high school courses are offered: Algebra 1, 2, 3, and 4 for the ninth or tenth and eleventh grade; General Mathematics for grade 9; Geometry 1, 2, 3 for
the tenth grade and one semester in the twelfth grade; Trigonometry, and Shop Mathematics. The main topics, only, are listed for each course. The content is to be followed according to the required textbooks.

Conclusions. Many necessary points, such as materials and activities, are omitted. For the most part, the content is very general.
HIGH SCHOOL COURSE OF STUDY IN MATHEMATICS

This course of study is for the Midland Senior High School.

General information. The author or authors of this course of study is not mentioned. There are no stated provisions that would allow for future revision. The date of construction is also not given. Four typewritten pages comprise the course of study. The major phases are treated in the form of lists.

Objectives. A notation at the beginning of the course states the main reason for the mathematics courses. The main reason for taking mathematics is to obtain a thorough knowledge of mathematics. A thorough knowledge is essential for success in the physical sciences and such vocations as engineering, statistics, and many others. The general objectives for each course are listed under the title of "Value". The main emphasis is on knowledge and skill.

Organization. With the exception of Solid Geometry and Trigonometry, the courses are organized on a year's basis. Solid Geometry and Trigonometry are organized as semester courses. Each course is divided into five sections. These are, A) Who May Take It, B) Content of Course, C) Class Meets, D) Value, and E) Text or Texts. Under each heading, a short
account for further explanation is given. The only time allotment for each course is the time per week. The time per week is one period daily for two semesters, except for Solid Geometry and Trigonometry which is one period for one semester each. No time allotment is given for the content.

Materials. The only materials listed are the required textbooks for each course. In most cases, only one textbook is required, but Ninth Grade Mathematics and Plane Geometry require two. No other materials or activities are listed.

Content. The following courses are offered: Ninth Grade Mathematics, Elementary Algebra, Plane Geometry, Advanced Algebra, Solid Geometry, and Trigonometry. Ninth Grade Mathematics is the only course in the Mathematics department not acceptable for major or minor sequences. The courses seem to indicate a wide variety of subject matter but the subjects are listed under general headings only. Elementary Algebra is the only course that suggests other possible topics. It suggests possibly a beginning of Trigonometry. Ninth Grade Mathematics takes up material vital in terms of human experiences. It takes up the wise use of money, checking accounts, budgets, banking, insurance, installment buying and purchase problems. The material for the traditional courses is selected primarily according to value in advanced work in mathematics and need in professional or scientific field.

Conclusions. This is more of an outline of a course of
study, rather than an actual course of study. The material presented is very general. A great deal of material, such as methods, suggested activities, and materials are omitted.
SECONDARY SCHOOL SERIES - MATHEMATICS

This is a mathematics state course of study for grades 9-12.

General information. The course of study was constructed by a general committee in mathematics composed of Missouri teachers in cooperation with the State Department of Education. Stated provisions are made for future revision. A form is provided for each unit so that the teacher may summarize the results of his experience and offer suggestions to improve the unit. The courses will then be revised according to the suggestions given. The present course of study is dated 1941 and contains two hundred and sixty-nine pages. It is printed and bound. The material is presented in organized outlines.

Objectives. The general purposes of mathematics as viewed by the committee are presented. The general purposes of each course are also given. For each unit, the Central Objective is stated and then the Contributory (specific) Objectives are presented. The general objectives of mathematics stress habits, understanding and knowledge. The courses emphasize different phases. General Mathematics stresses skill, knowledge, and appreciation. Algebra emphasizes appreciation, understanding, knowledge and skills (where needed). Plane and Solid Geometry stress habits, knowledge
and appreciation. Trigonometry emphasizes understanding and skills. All of the objectives are listed as teacher goals. All of the courses recognize adult activities, needs, and interests. General Mathematics is offered to meet the general needs of all the students. The sequential courses are offered to meet extended general needs and the specialized needs and interests of pupils in mathematics. They also prepare the students for future courses.

Organization. Most of the courses are organized on a year's basis. Solid Geometry and Trigonometry are offered as semester courses. The content is organized into units for each course, except for Trigonometry. They range from five units in Solid Geometry to twelve units in Algebra. Algebra also contains four optional units. The units are presented in outline form. The units include specific objectives, suggested subject content, pupil activities, suggested teaching procedures, suggested devices for evaluation, and references.

Materials and Activities. No specific textbook is required for any of the courses. Many pupil references are supplied for all the courses. General Mathematics has the best material starred. Algebra and Geometry also includes page references. The page references for Plane Geometry are also broken down by topics. Reading materials to provide a background for the teacher are also included. Visual aids
are suggested, particularly to introduce a new topic. Constructive materials are suggested in General Mathematics and Geometry. The course of study states that government bulletins and various pamphlets published by industrial concerns and social institutions are of inestimable value for General Mathematics.

Method. Suggested units for presentation are offered. These are not to be followed strictly, but should depend on the class. Many suggestions to correlate with community life are given in General Mathematics. Provisions for individual differences are included in a special section of pre-testing. A variety of procedures for starting each unit are given.

Flexibility. Provisions for adapting the course to the groups in the class are made usually by varying the content and activities.

Measurement. Definitions of the standards of attainment are stated in terms of the course objectives. Testing is considered as a part of each unit. Each unit contains sample tests and questions. The tests are to be used for guidance. They are to be given at the end of each unit to determine the amount of mastery.

Content. Only one series of mathematics courses is offered. All students take General Mathematics in grade 9. The remainder of the courses follow the sequential series
program. Algebra is offered in grade 10; Plane Geometry, in grade 11; and Solid Geometry and Trigonometry, in grade 12. The material is well organized, as mentioned previously. An effort has been made to make most of the units functional, that is, relating to life experiences. The course states, however, that some of the units are subject divisions and are presented as such. This is essential to further study and to the practical application of subsequent materials.

Optional topics are offered in Algebra only. The units are presented according to logic, rather than according to difficulty.

References. A sufficient list of up-to-date references are included. General Mathematics, Algebra, and Plane Geometry distinguish between pupil and teacher references. Page references for these books are included.

Conclusion. The course of study has a systematic organization which makes it easily readable and easy to follow. It has also been well prepared.
This is number 13 in a series of course of study publications of the Saint Louis Public School Journal. It includes the Mathematics area on the high school level.

General information. The course of study was constructed by the Mathematics committee of the Courses of Study Council. There are no provisions stated that would allow for revision. This edition, which is the March, 1948 edition of the Journal, contains fifty pages. It is printed and bound and has an elaborate finish. The major phases of the course of study are organized into outlines. The material is written in an interesting style. The pictures and apt quotations which the course of study contains makes it especially attractive to the reader.

Objectives. The general objectives of Mathematics, classified as specific, are presented in the Introduction. General objectives for Algebra, Geometry, and Trigonometry are given. No objectives are given for Introductory General Mathematics and Advanced General Mathematics. There are no real specific objectives to be found. However, if a special theme is to be emphasized, this is mentioned in an informal statement at the beginning of the course or unit. No particular emphasis is placed on any one phase. The following
points are included in Algebra and Geometry: appreciation, skill, habits, enriched living and social well-being, knowledge, and understanding. Trigonometry emphasizes skills and knowledge for the most part. Some of the objectives are listed as pupil goals, but the majority of them are listed as teacher goals. These objectives realize the student's needs, interests, and capacities as well as adult needs and interests. The course points out that if there is understanding, then there is better appreciation. As stated in its Philosophy of Education, the objectives also recognize general educational activities.

Organization. The courses are organized on a year's level. Each grade is then divided into two semesters. No correlation with other subjects is included. Integration with the previous courses is found in all of the advanced courses. The courses are arranged in organized outlines. The outline for the Geometry course is formed in parallel columns. The first column contains the content of the course. The second column contains a Roman numeral and an Arabic numeral (I:21). The Roman numeral refers to the group; and the Arabic numeral to the proposition in the groups of propositions listed in the Appendix. The third column contains A, B, or C. This refers to the relative usefulness of the propositions as types of proof or construction. If the letter P is found, then the theorem can be postulated after sufficient informal discussion. The suggested number of weeks
per topic is also given.

Materials and Activities. No specific textbook is required for each course. No references for materials are included within the course of study. However, pictures of activities included within the course of study contain materials such as models, scales, and measuring instruments.

Provisions for activities are found only in General Mathematics. They provide for out-of-school contacts when students are asked to obtain information on taxes, budgets, bank, etc. For the sequential series, activities are suggested only through the pictures. It seems that the pictures are included to suggest possible activities and perhaps inspire the teacher to do more.

Flexibility. Provisions for individual differences are included in Advanced Algebra and Geometry. This is done by varying the content.

Content. The traditional sequence of courses in mathematics is found in the following: Algebra (First and Second Semester), Intermediate and Advanced Algebra, Plane Geometry (First and Second Semester), Solid Geometry, and Plane Trigonometry. For those not taking the sequential series, Introductory General Mathematics and Advanced General Mathematics are offered. The course of study states that the subject matter of these two tracks be differentiated according to the goals, needs, aptitudes, and interests of
the pupil. Possible topics to be included are suggested only in Advanced Algebra. It suggests theory of equations and probability as possible topics.

References. A bibliography is included in one of the Appendices. This bibliography is useful for teachers only. It includes history books, methods references and magazines. The magazine references are for "The Mathematics Teacher" and "School Science and Mathematics."

Conclusions. The interesting manner of presenting the material, plus the pictures and direct quotations make this course of study interesting. However, more activities, methods and provisions for measurement should also be included.
TENTATIVE GUIDE FOR MONTANA HIGH SCHOOLS

A program of studies for all subjects was prepared at the Curriculum Revision Center of the Montana State University in the summer of 1945. The tentative guides are unfinished and unpolished because of the limited time available.

General information. The tentative guides for mathematics were prepared by the Mathematics Production Committee in 1945. Extensive revisions for the courses are to be conducted after the courses are tried out in the Montana schools. Revision is to be based on the comments, criticisms and suggestions made by the teachers. The present courses of study are mimeographed and stapled and contain eighty-eight pages. The major phases of the courses are presented in parallel columns. An organized outline of the content is found in one of the columns.

Objectives. The general objectives, listed as desirable pupil outcomes, are listed for each course. More specific pupil outcomes are given for the suggested units. Elementary Algebra and Plane Geometry stress knowledge, ability, and understanding. The main understanding to be obtained from Plane Geometry is the understanding of the nature of proof. Ninth Grade Mathematics also includes appreciation in its objectives. The main objectives for Senior Mathematics are: 1) to provide a stimulus to obtain student confidence in
mathematics, and 2) to make mathematics a vital factor in vocations. The objectives are listed as pupil outcomes. They recognize the student's and adult's needs, as well as the general educational activities. The following basic mathematical objectives are included: 1) transfer of training may be secured (Plane Geometry), 2) preparation for future courses and vocations, 3) character training in habits, and 4) practical usefulness.

**Organization.** Elementary Algebra, Ninth Grade Mathematics, and Plane Geometry are organized on a year's basis. Senior or Refresher Mathematics may be given as a semester or a year course. This depends upon the school system. Each course is divided into three parallel columns. These are headed: Content, Suggested Activities, and Learning and Teaching Aids. The content is then presented in an outline form. Each course includes a suggested unit which may be used for a more complete development of one of the topics. The units are presented in the same manner as the courses, but in greater detail. No time allotment is included within the course of study.

**Materials and Activities.** No specific textbook is required for any of the courses, but books are given for references. Suggested activities and teaching aids are included for each course, as were previously mentioned. The course of study states that the lists are necessarily brief
and should be added to by the teacher. It also states the materials are only suggestive and must be adapted to the classroom. The following list gives some idea as to the type of materials included:—films, filmstrips, bank statements, diagnostic tests, recipes, gas charts, tables of rates, geometric figures and solids, thermometers, pictures, tripods, and many others. Besides practical applications of the subject matter learned, many student activities are included. These include:—collecting pictures illustrating the topic under discussion, construction of models, use of scale to show balancing of equations, and many others.

Method. An outline of the topics to be taken up is presented. A sample unit for each one of the courses, except Senior Mathematics, is included so that the teacher can build more like them. The column of suggested activities presents procedures for attacking the various problems. The committee has also included recommendations with regard to mathematics teaching.

Measurement. Provisions for measurements are included only in the sample units.

Content. The following traditional courses are offered in the Montana high schools:—Elementary Algebra, Plane Geometry, Intermediate Algebra, Solid Geometry, Trigonometry and College Algebra. For those that do not take these courses, Ninth Grade Mathematics and Refresher Mathematics are offered. Only the minimum essentials of each course
are included in the content. The units are to take up the content in greater detail. An attempt to associate the content with human experiences, thus making it more interesting to the student, is made.

References. Besides a general bibliography, references are included for Algebra, Geometry, and Refresher Mathematics. The general references include reference books, magazines for teachers, and recommended books for the library. Algebra includes textbooks, supplementary books, workbooks, tests, and teaching and learning aids (including sources for films and filmstrips). Geometry references include textbooks, teaching aids, pupil and teacher magazines, tests, films, and filmstrips. The references for the teaching aids and the magazines are annotated. The bibliography for Refresher Mathematics includes textbooks and supplementary texts only.

Conclusion. For only a tentative course of study, many valuable aids are included. Provisions for measurement and flexibility would make it much more helpful to the teacher.
MATHEMATICS - TENTATIVE GUIDES FOR HIGH SCHOOL TEACHERS

Although mathematics is offered up to the twelfth grade in New Mexico, General Mathematics, Algebra I, and Plane Geometry are the only courses included.

General information. The course of study was constructed by committees for the various courses. The first edition came out in 1946, and the revised copy in 1949. Plans for further revision are not stated. The course is printed and bound. The content and objectives are presented in outline form, but the remainder of the material is presented in paragraph form.

Objectives. The general objectives of Secondary Education are presented. These objectives are then related to the general objectives of General Mathematics. There are no stated general objectives for Algebra I and Plane Geometry. Plane Geometry, however, does include specific objectives. Specific objectives are also given for General Mathematics. The cultural, as well as the practical aspects are taken into consideration. They are stated in detail with reference to skills, understanding, habits, appreciation, and knowledge. The adult's needs, interests and activities are recognized in all the courses. General Mathematics also recognizes the social needs of the immediate community and society at large.

Organization. The courses are organized on a year's basis. The content is presented in outline form, but the re-
remainder of the material is presented in organized paragraphs. The outlines contain the content in detail. Algebra I also includes an example of the type of material to be learned under each heading in the outline. After the introduction is presented in Plane Geometry, the content is divided into five main topics: 1) rectilinear figures, 2) circle, 3) proportions, measurements and similar figures, 4) areas of polygons, and 5) regular polygons, measurements of the circle. Each one of the main topics is divided into: 1) definitions, 2) theorems, corollaries and postulates, and 3) constructions. There is no time allotment included within the courses.

Materials and Activities. No specific textbook is required for any course. A bibliography of learning and teaching aids including textbooks and professional literature is included. This will be taken up in greater detail under the heading of references. Geometry includes a list of visual and equipment aids. These two lists include: pictures, diagrams, graphs, models of prisms and pyramids, surveying transit, training instruments, vernier caliper, sextant, and calculating machine.

General Mathematics is the only course that lists suggested activities to stimulate the individual. Drills and "brain-teasers" are suggested. The student's time should be utilized, also, to do problems of a practical nature: ownership, taxes, insurance, banking, loans, installment buying,
Method. The content to be taken up is presented in outline form as each course is considered. General methods, however, are taken up at the end of the course of study. The following application of methods are listed:— socialization, supervised study, problem approach, use of the project, and use of the learning unit. A variety of methods produces a greater amount of learning. Socialization "encourages and challenges student participation in planning and carrying on learning experiences for the benefit of the group. Supervised study, when used, should be properly organized and administered by the teacher. Problem solving, an everyday aspect of living, should be considered often by the teacher. Projects should be used only wherever and whenever they can be justified. A unit should not be a mere collection of facts, but rather should be based on significant understandings.

Flexibility. Flexibility is provided for in each one of the courses. The minimum essentials of content learning is listed. In General Mathematics, the above average student should be provided with additional problems, topics for special reports and suggested investigations. A list of supplementary work is given in Algebra I to be taken up if the minimum essentials have been covered. Additional material is also presented to be given to the better students, if time permits. Assignment of original problems is suggested in
Plane Geometry.

**Measurement.** The course of study states that the basis for any tests should be the basic requirements of the courses. A list of achievement tests is included in the bibliography for General Mathematics. No suggestions are presented for their use.

**Content.** Although Algebra II, Solid Geometry, and sometimes Trigonometry are also offered in the New Mexico secondary schools, this course of study contains only General Mathematics, Algebra I and Plane Geometry. The content is well organized in outline form. This was described more fully under "Organization". Each main topic contains the content, in detail, that should achieve the desired learning. No attempt, however, is made in Plane Geometry to distinguish theorems, corollaries and postulates. The reason for this is because different tests use various categories in listing these. General Mathematics and Plane Geometry are correlated with almost all possible subjects that are studied in high school, including English, History, and the Sciences.

**References.** A list of both basic and supplementary books are included for all subjects. General Mathematics also includes a list of standardized tests. These books and texts may be obtained through the Free Textbook Division of the State Department of Education. The following periodical are also given as references: "The Mathematics Teacher," "School
Science and Mathematics", and the "Balance Sheet". At the end of the course of study, library provisions for high school mathematics are also made. These include both professional and recreational materials.

Conclusions. Although a few minor points, such as time allotment and suggested use of tests are omitted, this course of study is well prepared. In the hands of a capable teacher, it could make mathematics both a practical and cultural tool for the students.
State of North Dakota

COURSES OF STUDY FOR NORTH DAKOTA HIGH SCHOOLS

MATHEMATICS

This course of study contains the mathematics courses offered in grades 9-12.

**General information.** This course of study was developed by a State Committee of mathematics teachers with Mr. K. W. Hammer of the Jamestown High School as Chairman in 1946.

Revision is inferred. The course of study states that it is possible to revise and rewrite the outlines more readily if each subject matter field is taken separately, rather than compiled in one syllabus. The course of study is printed and bound, and contains sixty-seven pages. The content is presented in two forms. Organized paragraphs introduce each new course. The subject matter is then outlined, but informal statements are found within the outlines.

**Objectives.** The general objectives of mathematics in the secondary schools, as viewed by the committee, are presented. They are based on the objectives stated by the Report of the National Committee on Mathematical Requirements. Emphasis is placed on habits, knowledge, and appreciation.

General objectives are given for all the courses except Advanced Algebra. No specific objectives are presented. Elementary Algebra emphasizes skills, appreciation, knowledge, and acquisition of abilities. General Mathematics
emphasizes skills and appreciation. Plane Geometry emphasizes habits, appreciation, and understandings. Solid Geometry emphasizes skills, knowledge, and understandings. Trigonometry emphasizes understandings, skills, and habits. All of the objectives are listed as teacher goals. They recognize the needs of everyday life, as well as adult activities, needs, and interests. Practical usefulness and cultural values are the main reasons for studying mathematics.

Organization. With the exception of Solid Geometry, and Plane Trigonometry, the courses are organized on a year's basis. Solid Geometry and Plane Trigonometry are organized as semester courses. Advanced Algebra is organized as a year's course and also as a semester course. Each course is divided into three sections. These sections are: 1) a general statement of the course, 2) an outline of the subject matter, and 3) a bibliography. The time allotments are included within the courses. The number of days for each main topic is given as a suggestion.

Materials and Activities. A topic on teaching aids is included in the course of study. To make the material more concrete, the construction of a large number of devices is suggested. The following are given as examples. The construction of a triangle with three pieces of wood emphasizes the rigidity of the triangle. A number scale can be used for the teaching of positive and negative numbers.
Actual measurements of flagpoles, chimneys, buildings, rivers, valleys, etc., can be used for the demonstration of congruent, similar, or equal figures. Simple transits, for measuring purposes can easily be constructed.

No student activities are included within the courses.

Method. In some cases, suggestions for attacking some of the newer topics are given within the outlines. The general statement for each course gives a few general suggestions for the use of the teacher in attacking the course as a whole.

Measurement. The course of study recommends that tests should be given at the completion of each topic rather than at stated intervals. Short tests to keep the teacher informed of pupil progress are recommended within the topics. A cumulative review at the end of each topic is also helpful. The course of study does not state how the testing is to be done.

Content. The following courses are offered:— Elementary Algebra, Plane Geometry, Advanced Algebra, Solid Geometry and Plane Trigonometry. For the students that are not taking the sequential courses, General Mathematics is offered in grade 9. The subject matter for each course is well organized, as previously stated. The material to be presented is given in great detail.

References. The bibliography for each course lists the
textbooks that can be used for the course. Only up-to-date
textbooks are given. They are listed according to the author,
title, publisher, and year. The publisher's index is given
at the end of the course of study. Since the lists of texts
are not complete, and also may not be the latest editions,
the teachers are urged to secure the latest editions as
listed in the publisher's catalogue.

Conclusions. This course of study is an invaluable
aid for subject matter content in high school mathematics,
since it is given in great detail. More student activities,
however, should be included.
A SUGGESTED GUIDE FOR THE TEACHING OF MATHEMATICS

This state course of study contains seventh and eighth grade mathematics, also, as well as the high school courses. As stated in chapter I, these will not be considered.

General information. The course of study was constructed by a mathematics committee under the direction of Professor James H. Zant, Assistant Head of the Department of Mathematics at the Oklahoma Agricultural and Mechanical College. No provisions are made for revising the course of study. The course is comparatively new as it is dated 1949. It is printed and bound. Most of the material is presented in units in outline form, but organized paragraphs may be found in the Introduction to General Mathematics and Plane Geometry. Informal accounts are also found within the units.

Objectives. General objectives of mathematics are inferred in the Introduction, but are not listed. Specific objectives for each unit are presented. Considering the specific objectives as a whole, the major emphasis is placed on skill, understanding and knowledge. The specific objectives are stated in detail with reference to knowledge, but not to habits and attitudes. The objectives are listed as teacher goals. The sequential courses recognize adult needs, while General Mathematics recognizes the social needs of the community, as well as adult needs. In the opinion of
the committee, mathematics ought to provide sound mathematical training for our future leaders of science, mathematics, and other learned fields; and to insure mathematical competence for the ordinary affairs of life.

Organization. The courses are organized on a year's basis. The material is organized into units according to topical subject matter. For General Mathematics and Plane Geometry, the units are divided into 1) specific objectives, and 2) content and method. Algebra has a third division, references. The references list only the textbooks. There is no time allotment within the course.

Materials and Activities. Because the content is taken from many sources, no specific textbook is required for General Mathematics. Rather, references are made to a great number of books. No definite textbooks are assigned for Algebra and Geometry, but references are made to some of them in the units. The books are listed with page references to tie in with the units. A number of references are also given to provide a background for the teachers. Professional books and magazines are listed in the Introduction. The magazine references are for the "Mathematics Teacher" and "School Science and Mathematics". A suggestion to join the National Council of Teachers of Mathematics is also included. Other materials are suggested only for General Mathematics. This includes films and filmstrips to correlate with the units.
The introduction states, however, that the use of films and filmstrips are not fully discussed in the pamphlet. But teachers are advised to become familiar with available films and filmstrips and to make use of them. Suggestions on how to obtain them are also given.

Many functional activities related to life experiences are suggested in General Mathematics. They involve mainly intellectual effort. The following are included: making an expense account, listing items that should be included in the cost of doing business, as well as many others. Some activities involve doing and experiencing. This is evident when students are sent to the bank, post-office, insurance companies, etc., to obtain data relative to the units. No activities, as such, are included in Algebra and Geometry.

Method. Procedures attacking the various situations that might exist in the classroom are given. In most cases, more than one procedure is given. Suggestions to make the material more functional in terms of human experiences are also given. These suggestions aid the teacher to plan the work beforehand.

Measurement. Suggestions for testing and pre-testing are constantly made in the units. However, the introduction states that the testing program should be prepared by the teacher to fit the subject-matter and local situations. It is suggested that testing should come at the completion of
the units and other appropriate places. It also states that objectivity should be the guiding factor.

**Content.** For high school subjects, the following are prepared as guides: General Mathematics, First Year Algebra and Plane Geometry. It is noted that the work was done primarily to fit schools of conventional size and scope in curriculum. This eliminated the necessity of preparing a guide for the more advanced courses. A wide range of subject matter is presented in General Mathematics to fit the needs of any class. Not all the units are to be taken up, but rather those that fit the adapted textbooks. The content is presented according to a logical manner, rather than difficulty. The content is well organized into units. Objectives are clearly stated so that both pupil and teacher can work for their realization. The units also provide abundant material for pupil participation. Many suggestions are given for the teacher to attack the various topics within the unit.

**References.** A good number of both pupil and teacher references are included within the course. This was taken up in detail under the topic of materials.

**Conclusion.** Valuable suggestions to aid the teacher of mathematics are given. All the necessary points of a course of study are taken into consideration. The course of study, however, is helpful only to high school teachers of General Mathematics, Algebra, and Geometry, since it does not include the advanced courses.
PLANE GEOMETRY COURSE OF STUDY

The Plane Geometry course of study was the only one available from the Oklahoma City Public Schools.

General information. The course was constructed by a curriculum committee. It does not contain any provisions for revising. The course is dated July, 1938. It is mimeographed and stapled. The material is mainly treated as an informal account. Eighteen pages comprises the course of study.

Objectives. General objectives for the course are given. There are no specific objectives. Each one of the following points are taken into consideration: habits, enriched living, knowledge, understandings and appreciations. Each one is given equal consideration with emphasis not placed on anyone in particular. The objectives are listed as teacher goals. They appear to recognize adult needs, interests, and capacities. The following basic mathematical objectives are recognized: 1) transfer of training, if definitely taught; 2) preparation for future courses; 3) Character training in habits and appreciations; and 4) cultural values.

Organization. It is organized as one year course divided into six week periods. The time allotment takes into consideration the content for each six week periods. It
states indirectly the time of the year for the topics. This is indicated by the following type of listing: first six weeks, second six weeks, etc.

**Materials and Activities.** No specific textbook is required for the course. Booklists for the pupils and professional literature for the teachers are given in the references at the end of the course. No other materials are suggested. Activities are not included.

**Method.** Descriptions of type lessons include suggestions for correlating instruction with community life. The course also suggests when proofs may be inductive, deductive, or analytic.

**Flexibility.** Mention of this is made in the Forward only. It states that supplementary materials for the accelerated groups may be found in textbooks and in the books on the history of mathematics.

**Content.** The six topics taken up are: 1) Introduction, congruent triangles; 2) Perpendiculars, parallels, constructions; 3) Polygons, circles; 4) Measurement of angles and arcs, loci; 5) Proportion, proportional line segments, similar polygons, trigonometric ratios; and 6) Areas, regular polygons and the circle. Each section, however, gives just a little bit more than this. The course of study tends to assume that the content is already familiar to the teacher. The content of the course is not given. Rather, suggestions
to introduce or take up the new material are given. The content appears to be too general and it does not seem to cover adequately enough material to prepare for future courses. It appears more suitable as an introduction to geometry.

References. There are two classes of references:
1) Plane Geometry Textbooks, and 2) History, Methods and Reference Books. There is a sufficient number of them and, as far as the date of the course of study is concerned, they are up to date. They may be used for individual differences as previously mentioned. There is also reference to the periodical, "The Mathematics Teacher".

Conclusions. Unless a teacher is thoroughly familiar with Plane Geometry, this course of study will be difficult to understand. Rather than a course of study as such, it is made up to give suggestions to teachers for taking up the various topics.
COURSE OF STUDY IN MATHEMATICS

This course of study considers all of the mathematics courses offered in the schools of South Dakota.

General Information. The course of study was constructed by a committee for the mathematics course of study in 1933. Plans for revision are stated only for Tenth Grade Plane Geometry. This course is tentative only. It is printed and bound, and contains one hundred and fifty-seven pages. Most of the pages are devoted to Ninth Grade General Mathematics and Tenth Grade Plane Geometry. General Mathematics contains sixty-three pages, and Plane Geometry contains seventy-one pages. The courses are presented either in outline form or as suggested units.

Objectives. The general aims and functions of courses in mathematics are given. The general objectives of each course, except Solid Geometry and Trigonometry are listed. General and specific objectives are also presented for the units in General Mathematics and Plane Geometry. The practical and cultural aspects are taken into consideration for all of the courses. However, Algebra (both courses) stresses skills and knowledge, while General Mathematics stresses understandings, skills and accuracy. The objectives are listed as pupil goals. All of the courses recognize mainly adult activities, needs and interests, either for the
preparation for future courses or for the needs of everyday life. They also recognize somewhat the general educational activities. The selection of the objectives for Plane Geometry was based upon a number of committee reports, studies relating to objectives, and other courses of study and various books.

**Organization.** Ninth Grade Algebra, General Mathematics, and Plane Geometry are organized on a year's basis. Advanced Algebra, Solid Geometry, and Plane Trigonometry are organized as semester courses. Both courses in Algebra, and Plane Trigonometry are presented in organized outlines. Plane Trigonometry presents only a minimum outline of the work to be covered. General Mathematics, Plane and Solid Geometry are organized on a unit basis. The units are presented according to subject matter topics. Time allotments are given for just the ninth and tenth grades. Algebra and Plane Geometry gives the content per weekly periods; General Mathematics gives the content per number of days, ranging from ten to twenty-five.

**Methods and Materials.** No specific textbook is required for any of the courses. Book lists are given for both Algebra courses, General Mathematics, and Plane Geometry. The courses do not differentiate between pupil and teacher references, but this can be determined somewhat from the titles. Ninth Grade Algebra gives references for diagnosis
and remedial work under the topic, "Unstandardized Tests and Workbooks". This is well done, since each reference has a comment as to its usefulness. Teachers are urged to secure a copy of Waples and Stone's, "The Teaching Unit". This book becomes useful for all courses. The courses suggest the use of materials, but these are not specified. For General Mathematics, the teachers are asked to be familiar with two or three of the latest textbooks which are commonly referred to.

No suggested activities are given in Ninth Grade Algebra. The activities for General Mathematics are only referred to in the textbooks. Plane Geometry, however, lists many and varied kinds of activities within the units. They are practical, purposeful, and interesting.

Method. General Mathematics and Plane Geometry, which are organized into units, suggest many and varied procedures to develop the units. Algebra leaves the formation of the units to the individual teacher so that the work may be adapted to the textbooks in use. Only the main topics to be taken up are listed for Solid Geometry and Plane Trigonometry.

Flexibility. Provisions for individual differences are made by varying the content of the course. The minimum essentials are to be learned by all the students. The brighter students are taken care of through differentiated assignments. Plane Geometry also indicates and suggests
COURSE OF STUDY FOR PLANE GEOMETRY 1 AND 2
SALT LAKE CITY PUBLIC SCHOOLS

This course of study for Plane Geometry is the only one available from the Salt Lake City Public Schools at the present time.

General information. This course of study was constructed by teachers and supervisory officers who worked together. The course is subject to modification based upon the criticisms from the teachers. The course of study is dated 1941. It is mimeographed and bound. The introduction is in the form of organized paragraphs, but the content is presented in unit form.

Objectives. The general objectives of secondary mathematics as set forth by the National Committee on Mathematics Requirements are presented in the Introduction. The course of study then relates these objectives to Plane Geometry. Specific objectives for each unit are presented at the beginning of the unit. The general objectives place the major emphasis on understanding, appreciation, and habits. The specific objectives emphasis knowledge, as well as the others. The objectives are listed as pupil goals. They recognize the student's needs, interests, and capacities, as well as the general educational activities. The following basic
mathematical objectives are included: 1) knowledge as an ultimate goal, 2) cultural values, 3) character training in habits and appreciations, and 4) practical usefulness.

**Organization.** The course is divided into two semesters of three units apiece. Each unit is divided into three parts. The first part, the Overview, contains the specific objectives of the unit. The other two parts are in parallel columns. The left column is titles, Concepts, and the other column is titled, Activities and References. The activities and references are placed beside the concepts to be realized. There is no time allotment within the course.

**Materials and Activities.** It is suggested that each have a textbook, but a particular one is not required. For each activity listed, a book list with page references are given. However, no professional literature for teacher is included within the units. A great number of pupil-made constructive material are suggested. The following are included, to mention just a few: model transit, cardboard model showing how the bee makes use of hexagonal prisms in its comb, models of regular solids, cross-staff, and model of a crane.

Many types of activities to bring out the practical and the cultural aspects of the subject are listed. Activities involve creative effort when the making of posters is suggested. Activities involve intellectual effort when floor
talks and essays are assigned. Activities provide for out-of-school contacts when interviews with a draftsman, carpenter, architect, engineer, or others are suggested.

**Method.** Concepts, plus the suggested activities and references, are the only materials given. Methods, as defined, are not included.

**Flexibility.** Individual differences are provided for in the suggested activities. The better students are expected to complete a greater number of the suggested activities.

**Measurement.** The course suggests that diagnostic tests should be given at the completion of the material of each concept and also at the completion of each unit. The course refers to *The Objective or New Type Examination* by Ruch for helpful suggestions on testing. But, since the new type tests of the demonstration type should also be given periodically.

**Content.** The content is well organized as described under the topic of organization. The following units are offered:

Unit I Geometry Treats of Certain Figures Found in Nature and in the Constructions of Man.

Unit II Society Makes Use of Straight Line Figures in Various Fields of Endeavor, such as in Art, Engineering, Surveying and Science.
Unit III Today Is an Age of Circles and Wheels.
Unit IV A Complete Knowledge of Areas and Propositions is Helpful.
Unit V Similar Polygons Are Figures Which Have the Same Shape.
Unit VI Man Has Always Used the Regular Polygon in Some Form to Add Strength and Beauty to His Architectural Undertakings.

So that the concepts may be understood, many varied activities are listed. Correlation with Biology, Physics and Chemistry exists in many of these suggested activities.

References. A bibliography of textbooks and teacher references are included at the end of the course. No distinction as to textbooks and teacher references is made, but the titles make this quite evident. References for the teacher are made in the periodical, "Mathematics Teacher", as well as the regular methods books.

Conclusions. This course of study is well constructed to realize the cultural and practical aspects of Plane Geometry. The concepts, plus the suggested activities, make this possible.
State of Vermont

SUGGESTED COURSES OF STUDY AND TEACHER'S MANUAL IN MATHEMATICS

Courses of study in mathematics for grades 9-12 in the Vermont schools are included.

General Information. The course of study was prepared by a mathematics committee composed of a chairman and four assistants. There are no stated provisions that would allow for further revision. This work was begun in 1939 and completed in 1942. The course of study is printed and bound, and contains fifty-three pages. Most of the content is written up in organized paragraphs. However, some material, such as the objectives and topics to be included, are given in lists. To provide additional information to the mathematics teacher, many extra features are added to this course. Some of these are: a test for grades 9-12 on functional thinking, study habits in mathematics, and guidance in the mathematics classroom.

Objectives. The general objectives of mathematics are classified under four headings: Knowledge, Appreciations, Habits, and Skills. The general objectives of General Mathematics, Algebra, and Fusion Mathematics also stress the same points. The course states that there is only one main aim in Geometry. The aim is to achieve the ability to think logically. Specific objectives to achieve this are then
presented. The objectives are listed as teacher goals. They recognize mainly general educational activities. Ninth Year Mathematics also recognizes the need of mathematics in everyday life. Algebra, Geometry, and Fusion Mathematics provide for the interests of special students and prepare them also for future courses.

**Organization.** General Mathematics is organized as a semester course for the ninth grade. Algebra is organized for one and a half semesters. Geometry and Fusion Mathematics are organized as year courses. Very general suggested topics are given for each course, except Geometry. Geometry gives the minimum list of propositions requiring formal proof and suggested construction problems. Each of the other courses then gives an illustrative unit on one of the topics.

**Materials and Activities.** No specific textbook is required for any of the courses. Materials and activities are not included within the course of study, but are taken up separately in Part II of the manual. A list of the equipment for the mathematics classroom including pantograph, protractors, sextant, calculating machine, and others, is given. A list of mathematical motion pictures is also given. Sources for obtaining posters, puzzles, plays, equipment, evaluation instruments, and record cards are also presented. Professional literature and mathematical publications for
the high school library are listed. The formation of mathematics clubs to bring teachers and students together is suggested. The course of study also lists possible programs. Possible activities are listed among the teaching methods and hints. Field trips, a theme on "Geometry on the Way to School", an original construction, and amateur instrument construction are among those suggested.

**Method.** Illustrative units for each course are given except for Geometry. Suggestions for beginning the study of geometry, translating theorems for hypothesis and conclusion, and giving original exercises, are presented for Geometry. The remainder of the methods is included in Part II. In this part may be found a topic, "Food for Thought". This is a questionnaire for the teacher to determine if he is using the best methods. Another topic contains general teaching methods and hints.

**Flexibility.** Only general provisions are made for flexibility. The course of study states that the work should be adapted to the ability of the students by elastic assignments. A minimum assignment should be made for all, and additional assignments for those who wish to do more. If it is possible in the larger schools, classes should be grouped according to ability.

**Measurement.** The course of study does not list the standards of attainment. It does list the types of mathematics tests possible. These are diagnostic, achievement,
and prognostic. Provisions for the construction of original tests are also made. A bibliography of standardized tests is included. This is divided into general mathematics, algebra, geometry, and trigonometry tests. The tests that are more commonly used by the Testing Bureau of Teachers College, Columbia are starred.

Content. One semester of General Mathematics is required for all students in the ninth grade. For the second semester, either General Mathematics or Algebra may be taken. The remainder of the courses are elective. Intermediate Algebra is given in grade 10. Plane Geometry and an introduction to Solid Geometry are given in grade 11. The course title for the twelfth year is "Fusion Mathematics". This course contains the essentials of Trigonometry, Solid Geometry, and Advanced Algebra. As stated previously, the content included is very general.

References. A bibliography of professional textbooks is included. The four best ones are starred. Other books for general interest in mathematics, particularly for recreation, are included. Mathematics Yearbooks and periodicals are also listed. Some articles of interest in the periodicals are referred to. The Appendix includes the bibliography for the course of study and various mathematics professional publications.

Conclusion. The content included is very general.
However, many articles of interest make this course of study a valuable aid for the mathematics teacher.
TEMPORARY GUIDES FOR THE SENIOR HIGH

SCHOOL CURRICULUM--MATHEMATICS

This course of study shows the influence of World War II, as will be indicated by the evaluation. It is offered as a source of information. It is hoped that it will not be followed by all schools, but rather serve as a suggestion to develop better curriculum for each individual school.

General information. The course of study was constructed by a curriculum committee composed of public school teachers, administrators and instructors. Revision is inferred. This is evident from the title of the course. It is dated 1943 and it is printed and bound. It may easily be placed in a three ring notebook because it has been punched with the three holes. For the outline of the courses, the pages are divided into two columns. There are twenty-three pages to the course of study. The major phases of the courses are in outline form. Some of the outline is an informal account, however.

Objectives. General aims of mathematics are given as well as the general objectives for each course. No specific objectives are given. Emergency and Refresher Mathematics, however, have no objectives listed. Skill and knowledge are emphasized in Intermediate Algebra, Advanced Algebra, and Trigonometry. Solid Geometry stresses appreciation and
Plane Geometry stresses understanding, as well as skill and knowledge. The objectives are listed as teacher goals. They recognize adult activities, needs and interests and the social needs of the immediate community and society at large by concentrating on the War Effort. The objectives are too general. Therefore, it cannot be determined if they are extensive enough to realize pupil needs. The following basic mathematical objectives are recognized: 1) knowledge as an ultimate goal; 2) preparations for vocations; 3) interrelations with other subjects (e.g. Solid Geometry with Physics and Chemistry); and 4) practical usefulness.

Organization. With the exception of Intermediate and Advanced Algebra which are stated as semester courses, the other courses do not state whether it is for a semester or for a year. The material is mainly presented in organized outlines. However, informal accounts are found within the outlines. The course states that the time allotment should be planned by each teacher to permit emphasis on topics which the war has shown to be important. These are indicated by bold face type in the outline.

Materials and Activities. No course requires a specific textbook. In Plane Geometry, reference is made to two textbooks. In Trigonometry, Emergency Mathematics and Refresher Mathematics, there are a few books listed as references. References for suggestions for adapting the course and to
provide a background for the teacher are made in "The Mathematics Teacher" and the Seventeenth Yearbook of the National Council of Mathematics Teachers.

A great number of visual aids are suggested. The following list is given, to mention just a few. It includes homemade models for Geometry; precision instruments, such as the vernier caliper and the micrometer; stereoscope and stereograph; maps - Mercator, gnomonic, azimuthal and Lambert projections. For construction materials, home-made models and pupil-made instruments for measuring angles are suggested. Construction materials, are given more emphasis in Plane and Solid Geometry than in Trigonometry.

The course suggests comprehensive activities to correlate with the materials so that the teacher may achieve the aims listed. These activities involve doing things to gain experiences when they suggest measuring with a protractor and working with a slide rule. They involve creative effort when they suggest the construction of geometric models.

Method. To give the teacher a suggestion for procedure, a type lesson on loci is presented. However, no suggestions for the methods to be used for each course are given.

Flexibility. This is not mentioned for the most part. However, a standardized test or a home-made one is referred to in Refresher Mathematics for pre-testing.
Content. Mathematics is offered on a double track plan. The following sequential courses are offered: Plane Geometry, Intermediate and Advanced Algebra, Solid Geometry and Trigonometry. For those who cannot take these courses, Emergency Mathematics and Refresher Mathematics are offered. The material offered in each course is the same as that found in similar courses. Attempts to correlate with other subjects are evident. Correlation with Geography and Physics is found in military map reading, navigation, radio beams, and others. Emphasis on drill material is evident by constant and repeated applications. Most of the emphasis is placed on knowledge, skill and applications. The material is arranged according to difficulty rather than according to logic.

References. A large number of references for both pupil and teacher is included. Pupil references are textbooks. Many of the references for teachers may be found in various copies of "The Mathematics Teacher" as well as books.

Conclusions. Since this course of study was made to emphasize the War Effort, it would be rather out of place at the present. Many of the activities, however, could be adapted to peace time.
This course of study is for mathematics from kindergarten to grade 12. Grades 9-12, as defined in Chapter I, only, will be considered. A course of study outline, and a more detailed mimeographed copy comprise the whole course of study. The mimeographed copy was not sent.

General information. This course of study was constructed by a committee of teachers representing all levels of the elementary and secondary schools. The committee worked under the leadership of the Assistant Superintendent-in-charge of instruction. It is dated August, 1943. The material is printed and is contained in a spiral bound notebook. The material is presented in two forms. Each grade and course is discussed in an attractive informal account totaling seventy-three pages. The courses are then presented in parallel columns contained in an additional sixteen pages. Mathematics is worked out as the story of a journey from kindergarten to grade 12. Many pictures illustrating visual aids and methods of presenting the material are included with a short pertinent remark.

Objectives. Four essential principles guided the committee. These are contained in the following objectives for mathematics in general: 1) an understanding of the meaning
of mathematics through actual experience; 2) an appreciation of the utility of mathematics; 3) sufficient practice and drill; and 4) the fact that the textbook is used solely to offer practice material on essential skills and processes. The general objectives are given for each course, also, and these are stated as teacher goals. The major emphasis is placed on skill, understanding, and knowledge. Habits and appreciations are only slightly considered. While the objectives do recognize children's needs, interests and capacities, the main emphasis is on adult needs, activities and interests, particularly in the more advanced courses. The course recognizes the following basic mathematical objectives: 1) Transfer of training (in Plane Geometry); 2) Knowledge as an ultimate goal; 3) Preparation for future courses, particularly the more advanced courses; 4) Increase in computational skills; 5) Practical usefulness (General Mathematics) and 6) Disciplinary values (but this is considered secondary only)

Organization. Algebra and General Mathematics are organized as single-grade courses but are designated as two semesters. The remaining courses are organized as semester courses. There are two kinds of arrangement for the courses; 1) an informal account and 2) parallel columns. An informal interesting account of two or three pages is given for each course. At the end of the book each course is presented in
parallel columns. The columns are headed according to the following: The Course, General Aims, Methods, Content, Materials of Instruction, and Pupil Achievements. The time allotment is considered for the duration of the course only. According to the introduction, the grade placement of the material is taken into consideration.

**Materials.** The course of study states that the materials found widely useful are the only ones included. A specific textbook is required for each course. Reference books are also mentioned, but the course does not include any titles. The only reference for use by teachers is a mimeographed outline which gives in detail the sequence of topics and processes to be presented and also give suggested activities. There are a large number of visual aids. These include display materials, tools, instruments and models (commercial, as well as student made). Some of the materials are available as school supplies, but the greater and vital portion is gathered by students and teachers working together.

Activities (both inside and outside the classroom) are referred to in the informal account of each course, but these are not given within the course of study. The related activities are taken up in much greater detail in the mimeographed outline for the teacher.

**Method.** "Principles in guiding study" are the only things given. Perhaps this is more in detail in the mimeo-
Content. Elementary and Advance Algebra, Plane and Solid Geometry, Trigonometry, General Mathematics and Mathematical Analysis are offered. The topics included in the course are very brief and very general. Only the main points to be taken up are included.

Conclusion. The course of study is attractively presented with an interesting guiding philosophy. Many details necessary are omitted but these perhaps are included in the teacher's mimeographed addition. This material would make the course much more complete.
PROGRAM OF STUDIES FOR METHODS OF EXACT THINKING

This course of study includes both mathematics and science in the secondary schools. Science will not be considered in this evaluation. Algebra and Plane Geometry are the only two courses included.

General information. The course of study was prepared in 1937 by committees on curriculum assisted by many teachers throughout the state. This is only a tentative course of study. Revision is to be based on further study, experimentation, and the application of present and new knowledge of psychology. The course is printed and bound. The content for mathematics is outlined while the rest of the material is presented in paragraph form. The whole course of study contains one hundred twenty seven pages; only seventeen of these are given over to high school mathematics.

Objectives. The general objectives for both courses are given. The major emphasis is placed on understanding. Habits of accuracy and speed are also desired. Geometry stresses appreciation also. The objectives are listed as pupil goals. They recognize mainly general educational activities.

Organization. Each course is organized on a year's basis. They both have five main divisions: 1) general objectives, 2) explanations or introduction, 3) attainments
expected, 4) methods, and 5) standards. The section on attainments expected lists the content of the course. No time allotments are included.

Method. A few of the major points to be considered for the teaching of Algebra and Geometry are given in the sections on explanations. Thought provoking questions on the methods used for teaching are included under the topic of methods.

Measurement. The standards of attainment are presented for both courses, in brief. The course also stated that the standards to be maintained in Algebra should be based on norms set up. Standardized tests are suggested, but not named.

Content. Algebra and Plane Geometry are the only two courses included. Both courses state that the material is well considered in textbooks, and, therefore not given in detail. Only the main essentials of each course are given.

Conclusion. Many necessary topics, such as materials, activities, and references, are omitted. Since this is only a tentative course of study, no definite conclusions will be formed.
GUIDES FOR THE TEACHING OF MATHEMATICS
IN THE LACROSSE PUBLIC SCHOOLS

This course of study includes arithmetic and mathematics from kindergarten to grade 12. However, grades 9-12 only, as defined in Chapter I, will be considered.

General information. The course was constructed by a cross-section committee on mathematics. There are no provisions made for revising. No date of printing is given. The course is mimeographed and in loose leaf form comprising thirty-nine pages. The pages have a binding of scotch tape for protection along the left side. All of the material is presented in outline form. One unusual and different feature is presented in this course of study also. It includes three sections for making reading a more effective skill for the teaching of mathematics. The high school unit is titled, "Making Reading in the Senior High School a More Effective Skill for Use in Teaching Geometry, Algebra and Trigonometry". The course does not state, however, whether these sections are to be included with the other subjects or to be taken as separate courses.

Objectives. Very broad continuing objectives for mathematics from grades 1-12 are presented. General objectives for each course are also given, and for each general
objective, specific objectives to realize the general objectives follow. Emphasis for the most part is placed on understanding, knowledge and skills. Plane and Solid Geometry, Senior Mathematics, and Algebra also stress habits to some degree. Skills and knowledge, habits and understandings are emphasized much more than attitudes and appreciations. The objectives are listed as pupil goals. Rather than recognizing the student's or adult's needs and activities, the objectives seem to recognize general educational activities. The one exception to this is General Mathematics, for this course also recognizes the future needs of the students for everyday living. The course recognizes the following basic mathematical objectives; 1) Mathematics as a mode of thinking, particularly to apply facts to everyday living; 2) knowledge as an ultimate goal; and 3) increase of computational skills.

Organization. The courses are organized according to single grades with the exception of Solid Geometry and Trigonometry. These are organized as semester courses. General Mathematics is given in grade 9; Senior Mathematics is given in grade 12. Algebra is offered in grade 9, and geometry in grade 10, but the other courses have no grade placement. The material is arranged in outline form. The courses are organized according to a minimum school year. There is no time allotment within the course.

Materials and Activities. The materials for the General Mathematics courses are divided into two groups; 1) Basic
materials, and 2) Materials for instruction and demonstration. For the other courses, the materials are divided into: 1) Basic materials, 2) Enrichment materials, and in most cases, 3) Remedial materials. The textbook required for all courses is included in the list for basic materials. A book list is given for Solid Geometry, only, and this is classified as enrichment materials. The following materials are included and may be found under any one of the classifications: drill flash cards for plane geometry; models and charts, where applicable; commercial models of spheres, cylinders, etc; and newspapers.

Some of the activities suggested involve intellectual effort. This is evident when students are assigned to discover situations which involve applications of the theorems and materials learned. Creative effort is involved when students are assigned the construction of models for Geometry.

Flexibility. Provisions for individual differences are made by varying the content of the course and through special assignments.

Measurement. Reference to measurement is found under the classification of Basic Materials. The courses states that organized and frequent testing should be conducted. However, it does not suggest how it is to be done.

Content. The traditional courses of Elementary and Advanced Algebra, Plane and Solid Geometry and Trigonometry
are offered. For those who are not taking the traditional courses, General Mathematics and Senior Mathematics are offered. The material appears well organized for the following. The subject matter to achieve a general objective is listed under that particular objective. Correlation with other subject matter found within the courses. The course states, "Develop correlation of geometry with algebra." In many cases also, suggestions are made to correlate solid geometry with plane geometry. The achievement of the stated aim cannot be avoided. The content necessary to achieve the aim is listed with it. The course does not give other possible topics which may be used for individual differences. The content is presented in a logical form rather than according to difficulty.

Conclusion. There are many good points present in this course of study. Some of these are the following. A wide variety of materials are suggested. A section for making reading a more effective skill for use in teaching mathematics is given. Correlation is evident, as mentioned previously. However, a number of things are lacking. The most obvious of these is the lack of both pupil and teacher references.
CHAPTER V

SUMMARY

Not enough courses of study were obtained to make definite conclusions about courses of study in general. Therefore, conclusions based only on this study will be formed. The conclusions are not to be considered as a typical picture of the status of mathematics courses. This last statement is based on two reasons. First, this study was attempted at a time when many courses of study in mathematics are in the process of revision. This information was obtained from letters received by the writer from the State Departments of Education and from school systems. Even many of the courses of study received are only tentative, and are to be revised. Secondly, the writer does not feel that twenty-three courses of study is a sufficient number to be the basis for definite conclusions.

Table II gives a composite picture of the information supplied by each course of study. The following statements can also be made from this study:

1. State courses of study generally supply more information than local courses of study. State exceptions are Maine and West Virginia. Local exceptions are Chicago, Illinois; St. Louis, Missouri; and Seattle, Washington.

2. Eighteen courses of study were constructed by
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D - in detail.
B - briefly.
N - not at all.
committees, and one was written in part by the State Director of Education. No information is given for the other four.

3. Subject matter is presented in various ways: 10 courses of study in outline form; 5 by units; 1 by outline and unit; one had no subject matter presented; and the other six used various means.

4. Eleven courses of study (mostly State) are printed and bound; nine are mimeographed; two are typed; and one is hexographed.

5. General objectives are presented for each course of study, except for Weston High School; specific objectives, however, were discovered mostly in courses of study containing units.

6. The practical aspect of mathematics is stressed in General Mathematics courses. Very few of the sequential courses consider this aspect.

7. The sequential courses are given mainly to prepare students for future courses or vocations. Geometry, in many cases, recognizes transfer of training to problems of everyday life.

8. Discussion of materials includes mainly texts and reference books. Thirteen courses of study go into more detail about materials and activities.

9. The most common references to periodicals for teachers are, "The Mathematics Teacher", and
"School Science and Mathematics".

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BIBLIOGRAPHY


BOSTON UNIVERSITY
GRADUATE SCHOOL

An Abstract of a Thesis

by

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THE PROBLEM AND PROCEDURE

The purpose of this study was to evaluate courses of study in mathematics for grades 9-12. This evaluation was to determine: 1) what makes a good course of study, and 2) if there are many good courses of study existing at the present time. Only those courses of study in specialized mathematics that are being used in the high schools and which are available on request were considered.

In order to evaluate the courses of study, it was necessary to discover a method of obtaining them, and to set up an evaluation criteria.

An attempt to secure information on the availability of courses of study from the Curriculum Laboratories at Teachers' College, Columbia University and from the George Peabody College for Teachers, Nashville, Tennessee was not successful. This information could not be obtained also from the Federal Office of Education. A letter was then sent to the State Department of Education in each one of the forty-eight states. The letter requested for a list of courses of study that could be obtained from cities, towns, schools, or other localities that might publish them. A reply was received from each State Department of Education. The replies varied from "no information available" to a good suggested list of places to write for courses of study. Seven states sent a state course of study. From the replies
to the letter, it was possible to determine how many states publish a high school course of study. Eleven states publish a state course of study and seven states are either revising the old ones or printing a new one.

Exactly one hundred suggestions of places to write for a course of study were obtained. From these suggestions, eleven courses of study were obtained and thirty-two replies stating the unavailability of curriculum material. It was presumed that the others did not have material to send. Five other courses of study were obtained from various other sources. In all, twenty-three courses of study were received. Courses of study were available from the following states: Iowa, Maine, Missouri, Montana, New Mexico, North Dakota, Oklahoma, South Dakota, Vermont, Washington, and West Virginia. Courses of study were obtained also from Anniston, Alabama; Tucson, Arizona; Chicago, Illinois; Brockton, Massachusetts; Weston High School, Massachusetts; Ann Arbor, Michigan; Midland Senior High School, Michigan; Saint Louis, Missouri; Oklahoma City, Oklahoma; Salt Lake City, Utah; Seattle, Washington; and LaCrosse, Wisconsin.

The courses of study were then evaluated according to the following headings: general information, objectives, organization, materials and activities, method, flexibility, measurement, content, and references. General information
included such items as construction of course, year of publication, mechanical makeup, manner of treating major phases, and provisions for revision.

SUMMARY

Not enough courses of study were obtained to make definite conclusions about courses of study in general. Therefore, conclusions based only on this study will be formed. The conclusions are not to be considered as a typical picture of the status of mathematics courses. This last statement is based on two reasons. First, this study was attempted at a time when many courses of study in mathematics are in the process of revision. This information was obtained from letters received by the writer from the State Departments of Education and from school systems. Even many of the courses of study received are only tentative, and are to be revised. Secondly, the writer does not feel that twenty-three courses of study is a sufficient number to be the basis for definite conclusions.

It was found that, in most cases, the objectives are taken up in detail. Materials and activities are ordinarily considered briefly. The topic of methods ranges from being discussed in detail to not at all. Flexibility and measurement are not considered at all in many cases. If they are taken up, ordinarily it is only briefly discussed. The content was taken up in detail in about one half of the
courses of study. In the other courses, it was only briefly considered. References are presented in most cases. Only six courses of study did not give any references.

The following statements can also be made from this study:

1. State courses of study generally supply more information than local courses of study. State exceptions are Maine and West Virginia. Local exceptions are Chicago, Illinois; St. Louis, Missouri; and Seattle, Washington.

2. Eighteen courses of study were constructed by committees, and one was written in part by the State Director of Education. No information is given for the other four.

3. Subject matter is presented in various ways: ten courses of study in outline form; five by units; one by outline and unit; one had no subject matter presented; and the other six used various means.

4. Eleven courses of study (mostly State) are printed and bound; nine are mimeographed; two are typed; and one is hexographed.

5. General objectives are presented for each course of study, except Weston High School; specific objectives, however, were discovered mostly in
6. The practical aspect of mathematics is stressed in General Mathematics courses. Very few of the sequential courses consider this aspect.

7. The sequential courses are given mainly to prepare students for future courses or vocations. Geometry, in many cases, recognizes transfer of training to problems of everyday life.

8. Discussion of materials includes mainly texts and reference books mainly. Thirteen courses of study go into more detail about materials and activities.

9. The most common references to periodicals for teachers are, "The Mathematics Teacher", and "School Science and Mathematics".

10. First Year Algebra, Plane Geometry, and General Mathematics are most often taken up in detail. In many cases, the others are just mentioned or briefly considered.

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