THE USE OF PERIODICAL MATERIALS
IN TEACHING JUNIOR HIGH
SCHOOL MATHEMATICS

A Thesis Presented for the
Degree of Master of Arts

By

Grace Louise Harrison Hetherington, B.S.

THE OHIO STATE UNIVERSITY
1947

Approved by:

[Signature]
ACKNOWLEDGEMENT

The writer wishes to make acknowledgement of appreciation to Dr. Harold P. Fawcett, and to Dr. John J. Kinsella, for their helpful advice and suggestions offered in the preparation of this thesis.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II THE PROBLEM</td>
<td>7</td>
</tr>
<tr>
<td>III THE SELECTION AND ORGANIZATION OF MATERIALS</td>
<td>15</td>
</tr>
<tr>
<td>IV THE PROGRAM IN ACTION</td>
<td>24</td>
</tr>
<tr>
<td>V EVALUATION</td>
<td>53</td>
</tr>
<tr>
<td>VI CONCLUSIONS</td>
<td>65</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>66</td>
</tr>
</tbody>
</table>
ILLUSTRATIONS

Note: The use of the capitol letter following the page number indicates that the illustration was taken from the writer's files. (Explanation: The illustration of 'Clock Faces' appears in this thesis as page 39-A.) Student scrap book pages are indicated by a small letter following the page number. (Explanation: The illustration of 'A House Plan' appears in this thesis as page 32-a.)

The Halls of Congress ........................................ 26-A
The Dome of the Capitol ........................................ 26-B
Geometric Forms .................................................. 27-a
An American Home ............................................... 28-a
The Life Saver Maypole ......................................... 29-a
Recipes .............................................................. 31-a
................................................................. 31-b
A House Plan ...................................................... 32-a
Advertisements using percent ................................... 33-a
The Sign Painter at Work ........................................ 38-A
Clock Faces ......................................................... 39-A
London Bank Clock ............................................... 39-B
Brooklyn Bridge ................................................... 40-A
A Railroad Bridge ................................................ 40-B
Winter in the Catskills ......................................... 40-C
Plan for a circular game field ................................... 45-A
The Modern Art Museum .......................................... 45-B

(All illustrations are filed in Appendix I)
CHAPTER ONE

INTRODUCTION

The purposes of this chapter are to review the place which the textbook holds in education today and to consider what its contributions to the learning process are or might be.

The consensus of opinion is that the textbook usually falls short in at least two major respects when it is made the dominant factor in classroom teaching: 1. The textbook fails to keep up to date. 2. The textbook limits student experience. Both of these are major handicaps in the setting of the stage for the process of learning.

George Henry, in a recent article, attempts to place the book in its proper perspective.

Books wait upon experience, are referential and inert, and must be catalogued, and therefore do not integrate themselves with the other books on the shelves. For instance, there is still a great body of knowledge in commerce and industry, say since 1900 that has been incorporated into the work-a-day world but has not been put into books; first, because events prevent the synthesis and, second, because teachers either cannot do the task or are not brave enough to risk it. We have, thus obvious to all, a so-called liberalizing list of books that are alien to the present world and that do not house the entire heritage and in some respects they are thereby enslaving even while freeing the mind in other ways. Schools seem unaware that the heritage contains the books and not the books the heritage.

The writer sees the situation as a mandate to the teachers as well as to the textbook writers to attempt to

---


* Underscoring is that of the writer of this thesis.
find a remedy. This thesis explains the method used by one teacher in her attempt to remove these two major deficiencies attributed to the textbook.

**Dominant Position of the Textbook.**

There is a general impression that the textbook very largely dominates classroom instruction in American schools. "The significant position of textbooks in the program of American education is so generally recognized that the Society seems to be fully justified in sponsoring a yearbook on the theme 'The Textbook'. It is the textbook that in thousands of classrooms determines the content of instruction as well as the teaching procedures." The reports of school surveys confirm the opinion that our schools are still characterized by the formal mastery and reproduction of textbook materials. Recent reports complain of the prevalence of the textbook-recitation method.

The opening paragraphs of a report, November, 1946 made by U.N.E.S.C.O. on Textbooks sums the situation up in the following manner:

> In most of the schools of the world today the textbook is the keystone of teaching. Thousands of teachers cling to it as their chief and sometimes sole source of information. Millions of children have been trained to look upon it as the final authority. ——— It is powerful not only in its descriptive textual accounts, but

---


4 United Nations Educational, Scientific and Cultural Organization.
also in its illustrative materials. It wields an influence through what it says and what it does not say. 3

Justification of the Use of the Textbook.

Historically, teaching was accomplished by oral instruction. The advent of printing made it possible to put information at the disposal of a greater number of persons. Present day methods within the school room seem to require that the student be able to read as well as to listen. "Pupils must be taught to obtain information from books because they will use this method not only in school, but after they have finished school." 4

Thus, as the situation stands, it is agreed that the student needs to know how to read. The textbook is the most common instrument which is being put into the hands of the student to meet that need. However, there is much evidence to indicate that all is not well. There is much criticism of the textbook both adverse and constructive. 5

Textbooks are the binoculars through which school children, students and many adults look at the world. If scientifically accurate, properly ground, and correctly focused, they can be extremely useful instruments for visualizing the world, for bringing the far into closer view --- a step toward understanding other people and other places. But if they are scientifically inaccurate, improperly ground and incorrectly focused, they mar and distort the distant scene, making it seem even more remote. 6

5. ibid. p. 184
The Textbook and the Learning Process in Mathematics

Irrespective of the particular current school of psychology to which a teacher may ascribe there are certain characteristics which she will recognize as vital to the learning process. McConnell\(^7\) has concluded that the similarities are greater than the differences in the current schools of psychology. Learning is a purposeful and active process. It is a re-organization of behavior.

"Learning goes on best in the degree that the individual sees and feels the significance of his own felt needs in what he does."\(^8\) Work must start from the place in which the individual finds himself. The problem must be real to the individual before he is motivated to solve it.

The sequence in the development of any process in mathematics should start with the study of a real problem situation in which the process is utilized. The textbook, because of its inanimate quality, cannot keep pace with the current events. The more proximate the presented situation the more likelihood that the individual will be able to project himself into the situation and see the problem as his own. A textbook unaided often fails to bring the problem situation up-to-date.

\(^7\) National Society for the Study of Education, "The Psychology of Learning", \textit{Forty-first Yearbook, Part II}

\(^8\) Lucien B. Kinney and Frank N. Freeman, "The Manner in Which Pupils Learn Mathematics" \textit{California Journal of Secondary Education}, Vol. 20 pp.381-7 (November 1945)
The second step in the sequence provides for the study of the process itself. It should be studied and its abstract manipulations mastered. The textbook has proven most useful in this stage of the sequence.

Over-emphasis at this step can have the effect of breaking the sequence. It is even possible that the sequence could start at this point. Motivation could be the learning of mathematical processes for their own sake because of their rhythm and perfection, but such processes are sterile if not integrated with an activity or purpose which is socially or personally significant to the pupil.

The mastery of the abstract process should be followed, if possible, by applications of the process to other real situations with which the pupil is intimately familiar.

Examination of any number of recent textbooks written by competent men for use in the area of junior high school mathematics will show that the major phases of everyday living are dealt with in these books. However, when the variety of teaching situations which must be served is considered and when the large individual differences which exist between students are weighed, the inadequacy of the textbook is not difficult to see. To ask that the textbook provide applications of real interest to all students is asking the impossible.
The Teacher and the Textbook.

As teachers we have textbooks to use. We are the active forces within the school rooms in the area of instruction. Materials are created for the use of people. The effectiveness of the textbook is dependent upon the use which is made of it. If it cannot provide sufficient material for the task which we hope to accomplish, we must supplement it.

Organization

The following chapter, (Chapter II) explains briefly the type of experience which made the writer conscious of the need for supplementing the textbook.

Chapter III outlines the mechanics of the selection and organization of the materials to be used in the solution of this problem.

A candid view of the program in action is presented in Chapter IV by means of extracts from the writer's diary kept during a year's use of these materials.

Chapter V is an attempt to evaluate the program in terms of the evidence collected in the manner exemplified in Chapter IV, supplemented by a student evaluation and standardized test scores.

In the final chapter the writer arrives at certain conclusions based upon her reactions to this study.
CHAPTER TWO

THE PROBLEM

Origin of the Problem

The writer became acutely conscious of the need for supplementing textbooks as she examined the Cooperative Mathematics Test for grades 7, 8, and 9, Form P of the American Council of Education, upon which her seventh grade girls had made very low scores.

This well-known test is divided into four major parts, namely:

- Part I: Skills
- Part II: Facts, Terms, and Concepts
- Part III: Applications
- Part IV: Appreciation

The scores indicated that the students seemed able to handle abstract skills. The many incorrect responses in Part II and Part III implied that there was lacking an understanding of certain facts, terms and concepts, and the ability to apply these in simple problem situations.

The following are sample questions which were incorrectly answered:

Part II, Page 6, 22. To obtain cash for a check which has been made payable to a particular person, that person must
- 22-1 cancel it
- 22-2 balance it
- 22-3 receipt it
- 22-4 overdraw it
- 22-5 indorse it

* Scores
  Part II, possible score 30, class range from 4 to 13
  Part III, possible score 30, class range from 3 to 11
  Percentile range for complete test, according to national norms, from 1 to 64.
Part II, Page 6. 23. The sum that is charged for the use of money is called the
23-1 principal
23-2 interest
23-3 commission
23-4 premium
23-5 rate ...................... ( )

Figure 14

Part II, Page 7. 39. Line segment b in Figure 14 above is called a
39-1 tangent
39-2 diameter
39-3 secant
39-4 radius
39-5 chord -----------------( )

Part II, Page 8. 43. A term which may correctly be applied to all the figures above is
43-1 parallelogram
43-2 rectangle
43-3 trapezoid
43-4 square
43-5 quadrilateral .......... ( )

Part III, Page 10. 39. The accident report of a large city states that so far this year there have been 180 people fatally injured by automobiles, as against 200 at this time last year. This is a decrease of
39-1 1%
39-2 9%
39-3 10% ......................
39-4 11 1/9%
39-5 20% ...................... ( )
Part III, Page 10. 42. A furniture dealer bought a chair listed at $22.50 at a discount of 20%. He paid:

42-1 $4.50
42-2 $18.00
42-3 $18.10
42-4 $22.05
42-5 $22.30

Part III, Page 11. 51. The rate for a certain station-to-station telephone call for the first three minutes is $2.15, and the rate for each additional minute is 30 cents. The government tax on calls costing $2.00 or more is 20 cents. How much will a call lasting seven minutes cost?

51-1 $2.30
51-2 $3.35
51-3 $3.55
51-4 $4.45
51-5 $4.80

The greatest lack of knowledge seemed to be in the areas of business practice such as banking, buying and selling, communications and transportation. They also lacked an awareness of the presence of geometric form in their everyday lives.

Although these topics would be much more fully treated in the eighth grade, their basic concepts and simpler applications were included in the textbook used by the writer's seventh grade. They also occur in the course of study recommended by the National Council of Teachers of Mathematics as can be seen by the following selection from the report:

Arithmetic

I. Basic Concepts and Principles. (7,8)
   (1) Development of a reasonable familiarity with the working vocabulary of arithmetic.

       ..............
(b) Terms used in the applications of arithmetic, such as profit, loss, discount, interest.

III. Using Arithmetic in Problem Situations (7,8)

(3) Continued study of suitable practical problems of increasing difficulty, such as the following:
   (a) Numerical problems arising in the pupil's immediate environment (the home, the school, the store, the community). (7)
   (b) Everyday business problems (buying and selling, profit and loss, discount, commission, simple cases of interest). (7)
   (c) Business or social problems demanding greater maturity (banking, investments, taxation, insurance). (8).
      (Preliminary informal treatment in grade 7, in superior classes).

Informal Geometry

I. Basic Concepts. (7,8)
   (1) Development of a reasonable familiarity with the working vocabulary of geometry.
   (2) The ability to explain the meaning of certain key concepts used in grades 7 and 8, such as: circle, angle, triangle, isosceles triangle, rectangle, square, perpendicular.

III. Important Geometric Facts and Relations. (7,8)
   (1) Introductory study of the geometry of shape, of size, and of position, for purposes of motivation and orientation. (7)
   (2) An introductory study of such basic figures as the circle, the angle, and the triangle, involving (a) the meaning of related terms; (b) measurement; (c) classi-
The writer found the textbook insufficient in her attempts to achieve these requirements for the course. The textbook needed supplementing. Trips to banks, business offices, and stores have been found valuable media for the vitalizing of textbook situations. When a school shop is provided, it can be advantageously used for the construction of geometric models, which have been shown to be helpful in clarifying ideas concerning geometric forms and relationships. However, within the writer's particular teaching situation, with a forty-minute recitation period in effect, outside trips could prove quite disrupting to the school schedule. No school shop was provided. Since these more direct ways of bringing reality to a mathematics class were closed, the writer considered the possibility of experimenting with periodical material as a supplement to the textbook. It was known to the writer that the homes of these particular students were well supplied with various periodicals. Such materials could be brought to the class and discussed without disrupting the routine of the school.


11. Ibid, p. 510
The Problem

The problem is how to supplement the textbook, in order to bring reality and a broadening of interests and experiences to junior high school girls in their study of mathematics. The proposed solution is through the use of periodical materials. The solution as presented in this thesis includes, (1) the selection and organization of these materials, and (2) results of their use during one year.

Other studies

The use of periodical material is not new, for many teachers will admit to the use of newspaper clippings within their classes, but very few have taken the time to explain their method of collection or to attempt to evaluate their efforts in the form which anyone else may read.

Harold P. Fawcett\textsuperscript{12} has made much use of magazine and newspaper materials incidentally in the preparation of his work sheets and tests in his course "The Nature of Proof". He found them most useful in achieving the transfer of geometric reasoning to non-mathematical situations.

June Sharp Frazer\textsuperscript{13} presents material from newspapers and magazines that provide exercises in reflective thinking. Her thesis contains several evaluation media.


\textsuperscript{13} June Sharp Frazer, "Suggested Pupil Experiences in Reflective Thinking for the Geometry Classroom." Unpublished Master's Thesis, Ohio State University, 1939.
Stewart Boger Steiner,\textsuperscript{14} in "The Use of Pupil Collected Material From Current Periodicals in Teaching Algebra and Geometry", presents newspaper materials which he felt were useful in overcoming the inadequacies of the textbooks in the courses. The perusal of a copy of the \textit{New York Times} made him conscious of the potentialities of periodicals as a source of supplementary mathematical materials. His plan provided for student collection and analysis of materials.

Ida D. Fogelson, of the Chicago Schools in a recent article,\textsuperscript{15} states that "pictures showing the principles of mathematics in real life situations should always be before the pupil so that when the time comes to use those principles he is familiar with them".\textsuperscript{15} She does not see pictures as a substitute for the teaching of mathematics, but as an aid to "reading between the lines". She would evaluate results in terms of the original drawings which the students could make to illustrate the principles.

\textbf{Limitations of these studies.}

With the exception of the work of Miss Fogelson, previously reported studies have been limited to the secondary level and have dealt only with geometry and algebra.

\textsuperscript{14} Stewart Boger Steiner, "The Use of Pupil Collected Material from Current Periodicals in Teaching Algebra and Geometry", unpublished Master's Thesis, Ohio State University, 1941.

Periodical materials may mean either pictorial or literal materials. Mr. Steiner seems to have limited his samples to literal illustrations. This is probably more workable with older students. The average student is picture conscious.\textsuperscript{16} Possibly this consciousness is most openly evident at the junior high school level. Thus the writer has chosen chiefly pictorial material to supplement the textbook.

Miss Fogelson pointed to the students original drawings,\textsuperscript{17} illustrating mathematical principles as evidence that her use of pictures did achieve reality in her teaching.

\textsuperscript{16} Edgar Dale, op. cit., p. 226

\textsuperscript{17} The covers of the Chicago Schools Journal, (January, 1946) picture some of the student drawings.
CHAPTER THREE

SELECTION AND ORGANIZATION OF MATERIALS

The first plans for the solution of this problem were laid in the Mathematics Workshop at Ohio State University during the Summer Quarter of 1946. Within the program of this workshop there was an opportunity for each member to work on an individual problem. The writer received many valuable suggestions and comments from the advisors and fellow members of the workshop.

The initial organization of the types of materials to be used in the attack on the problem was achieved within the five and one-half weeks period of the workshop. Three weeks were devoted to searching magazines and papers for any pertinent materials and cutting these. The fourth week was used to mount these materials, while the fifth week allowed time for the execution of the organization and a filing system which could be useful within a school room.

Physical Equipment

The writer made a collection of both old and current copies of such magazines as: Life, Colliers, Saturday Evening Post, Better Homes and Gardens, News Week, American Home, McCall's, Parents' Magazine, and Vogue. Local current newspapers were also used. The highly technical, scientific and financial literature was not included, nor were magazines such as Popular
Mechanics and Boy's Life. The fact that the writer's immediate interest was in the teaching of junior high school girls might account for the selection of some of the above magazines, but these magazines did have much to offer of general interest.

The pages of the magazines were carefully searched for illustrations with any mathematical implications which might be usable in working with junior high girls in an urban district. The major guides in the selection of materials were the six continuing concepts of mathematics of measurement, number, operation, proof, relationship and symbolism.18

Mounting

These clippings were mounted upon construction paper of various colors. The variety of colors was used in order to achieve attractive settings for the various colored illustrations and was not an attempt to attract attention by the mere use of shocking contrasts. The original size of this construction paper was eighteen by twenty-four inches. These sheets were cut in halves and quarters. The halves, the eighteen by twelve inch sheets, were used to mount two page pictures. The most-frequently-used size was the quarter sheet, nine by twelve inches. Two other factors in-

18. Harold P. Fawcett, Lectures, Mathematics Workshop, Ohio State University, Summer, 1946.
The choice of this size mounting; (1) these mountings were to be filed in letter size folders, and (2) this size picture is often found in magazine pages. Some magazine pages do exceed these dimensions, but it is often possible to trim a picture, thus accentuating its important points rather than detracting from it. This size also allowed for the mounting of two or more small related pictures on one sheet. The twelve by eighteen pictures mounted with paper cement could be folded lightly and also placed in the regulation folder.

After trying several types of adhesive substances 'paper cement' was found to be most satisfactory. It was preferable for its cleanliness and ease of application, as well as for its 'non-wrinkling' quality.

The actual physical equipment accumulated in the solution of the problem during the period of the workshop in the summer of 1946 consisted of:

Approximately 150 illustrations
125 construction board mountings
54 letter size manilla folders
150 three by five index cards
30 three by five index markers
(26 alphabetically marked)

With these materials in hand, the task of organization was begun.

The major guides in the organization were the six continuing concepts of mathematics which had been used in the selection of the pertinent materials, namely:
measurement, number, operation, proof, relationship, and symbolism. Each picture was studied and it was placed inside of one of the folders allotted to the concept to which it seemed most related. One picture could contain more than one major concept, but the writer attempted to identify it with the concept to which it was most likely to contribute. Several folders under the various concepts contained several related pictures, but the tendency was toward placing a single clipping in a folder rather than attempting to group unrelated materials.

**Filing and Indexing**

A three-by-five index card was typed for each mounted picture. These cards carried three types of information.

1. The main heading of the card was the name of some outstanding physical feature of the picture, or if it were advertising, the name of the company advertising.

2. The subheading contained the concept or concepts exemplified, and a brief comment concerning the picture.

3. The call number in the upper right hand corner of the card gave the number of the folder in which the picture could be located.

The following are some sample cards:
Arctic circle Map
Measurement of shortest route from Moscow to Chicago

World Air Travel
Symbols identified with air travel time.
A feature of the country or city is used instead of the name.
The call number of the folder in which the material is to be found is noted in pencil in the upper right-hand corner of each card. These numbers were written in pencil when the cards were first made to insure the flexibility of the organization. It was anticipated that as the pictures were used, their relative pertinence to other concepts might dictate a change in filing notations.

The following is a brief outline of the call numbers of the folders:

Measurement, M-1, M-2, M-3, etc.
Number, N-1, N-2, N-3, etc.
Operation, O-1, O-2, etc.
Proof, P-1, P-2, P-3, etc.
Relationship. (This group was so very large that it seemed advisable to break it down into several sub-groups. As comparison is the strongest weapon of advertising, it seems reasonable to find many illustrations of this concept in modern periodicals.)

Relationship-General, R-1, R-2, R-3, etc.
Relationship-Geometric, R-G-1, R-G-2, etc.
Relationship-Numerical, R-N-1, R-N-2, etc.
Relationship-Whole & Parts, R-W-1, etc.

At this point, there were no criteria for the placing of material in M-1 rather than M-2. The mere top folder on the pile involving measurement became M-1 and the upper right-hand corner of each index card made out for each clipping in that folder carried the same call number.

After all index cards were completed with call numbers, they were collected and filed alphabetically in the card index case.
The following are brief descriptions of sample findings which were placed under the various major concepts. All work with current materials must of necessity be dated if it is to have value. These samples may be replaceable at the present time by more current subject matter, but at the time of their selection they were considered to be quite pertinent.

I. **Measurement**

Recipes give evidence of the variety of units of measurement which the average cook must know and be able to use. M-4

An article on hard water, illustrates its points by comparing hair shampooed in hard and soft water in terms of foot-candles of sheen. M-7

'Ten-ton' was used as a unit of measure for tires, to express the weight which each tire was capable of supporting. M-7

An excellent illustration was given of the cost of a 'ton-mile' by camel, this was filed with an illustration of a 'ton-mile' by rail. M-7

Maps
(a) Polar maps. M-1

II. **Number**

The Temple of 1,001 Kwannons or Japanese goddesses was pictured. Five hundred figures faced another column of 500. Heading the two columns was one large statue of the goddess. The statement was made, "In Japan the number 1,001 stands for infinity." N-2

A local bank statement used many large numbers. N-1
III. Operation

Operation is illustrated in periodicals by the use of equations - Milk plus Brer Rabbit Molasses equals a Brer Rabbit Milkshake.

IV. Proof

(Good proofs were rare. The tendency existed to generalize upon limited data. The selection within this area was limited to faulty or incomplete proofs, which would be criticized by the students.)

A Palmolive advertisement says, "Doctors prove that Two out of every Three women have a beautiful skin after using Palmolive for fourteen days."

V. Relationship

General

A four-tone line graph was used to compare changes in wages, costs of living, and building costs over a period of thirty years.

Geometric

These folders include some excellent colored pictures of the halls and rooms of the United States capitol with its many arches and geometric designs.

Numerical

Individual and team athletic scores, for special and seasonal events involve numerical relationships.

Clearance sale advertisements involve the use of discount.

Finance company advertisements imply various numerical relationships.
Whole and Parts

This is well exemplified by a circle graph of the expenditure of the Red Cross dollar. R-3-5

VI. Symbolism

(This area is boundless. We seem to be conditioned to more and more symbolism).

An airways advertisement gives the times of ten flights. The destinations are merely indicated by an outstanding scene or well known feature from that country or city. A Kangaroo stands for Australia. The Eiffel tower is used for Paris.

These folders were to be kept in a vertical steel file in the mathematics classroom, available to both the teacher and the students. The card index could remain on top of the filing cabinet.

Anticipated Uses of the file.

1. Illustrations would be placed upon the bulletin board several days before the particular subject matter was scheduled to be dealt with in the textbook.

2. Materials could be used by the teacher for an initial presentation of new topics without any previous orientation.

3. Clippings, with prepared guide sheets, could serve for student problems and also as media for drill necessary in insuring the understanding of certain skills.
CHAPTER FOUR

THE PROGRAM IN ACTION

The following pages are items from a running account of the year's work in junior high mathematics in both the seventh and eighth grades, which illustrate how students can be aided in gaining a more real idea of the place of mathematics within their lives by the aid of pictures. The topics will follow the chronological sequence of a diary kept by the teacher. The diary consists of notes jotted down on three-by-five cards at the end of those class periods which seemed most significant. The topics developed will be those in which the students of the seventh grade of the previous year had shown themselves to be most deficient. Of necessity, this account can show only sample illustrations which were used in these lessons, but they will be those which the writer considers to be most representative.

Notes from the seventh grade class will be presented first, and in some detail, and supplemented by outstanding incidents from the eighth.

Newspaper clippings were used quite widely in this program in action, but none will be included in this thesis. During war years, news companies were forced to use newsprint of an inferior quality which does not hold its color and tears very easily; thus, it did not seem reasonable to include it in this more or less permanent type of record.
For clearness and consistency in presentation, the diary materials presented in this chapter will follow this general outline.

Date
Grade

1. The major mathematical concept being developed.
2. The topic under which this concept is being studied.
3. The immediate objective in the individual lesson.
4. The picture or pictures used.
5. Comments and questions from the discussion which might indicate that the problem involved was achieving more reality for the student and that interests and experiences were being broadened.

Assignment: When the students were asked to search for some particular type of material, the fact will be indicated; otherwise the reader may assume that the contributions were voluntary.
September 24
Grade Seven

1. Relationship—Geometric
2. Basic geometric forms
3. Purpose: To aid the students in becoming more conscious of geometric forms in a variety of everyday objects, and also to associate mathematics with architecture.
4. The pictures shown included those of the Halls of Congress, 26-A, and the Capitol dome, 26-B.
5. The textbook assignment included a consideration of the following terms: sphere, circle, hemisphere, semicircle, square, rectangle, arc, diameter, and cylinder.

During the class, work examples of each were found in the one picture of the Halls of Congress.

A student saw a diameter as the line of the framework across the base of an arch. It was suggested that the arch might not be a semicircle, hence the imaginary base line would be only a chord. The same student looked further and found a circular figure which she said could be divided into two semicircles, thus she would have a diameter as the dividing line.

One student informed the teacher that her mother said that a hemisphere could exist only in the earth. However, she had a picture of a cut orange in her hand. Thus if
September 24
(contd.)

she called an orange a sphere, she was forcing herself to broaden her definition.

The Santa Fe Railroad emblem was brought to the class by several members. The students used it to demonstrate the semicircle, diameter, and arc, as well as the circle.

Assignment.

1. Find examples of each of these terms and place them in your scrap books. 27-\(a\) 27-b

2. Find a picture of a building which shows as many of these forms as possible. 28-\(a\)

3. Place in your scrap books any other examples of geometric forms which you particularly liked. 29-\(a\).
RECTANGLE

SPHERE

CONE

CYLINDER

QUONSET
A house

Key to geometric forms found in this picture:

1. Circle ........... tricycle wheels
2. Triangle ........ end of house
3. Rectangle ...... table top
4. Cylinder ........ flower pot
5. Arc .......... top of gate
6. Square .......... rug on deck
Life Saver May-Pole

Key to geometric forms found in this picture:

1. Circles ............ Life savers
   Base of May-Pole
   Fruit slices
2. Arc ................. Lemon wedges
   Mushroom top
3. Spheres ............ Cherries
4. Squares ............ Pieces of pineapple
5. Cylinder ............ May-pole
Spring comes in 5 flavors!
October 18
Grade Seven

1. Operation

2. Review of Fractions

3. Purpose: To achieve a meaningful drill in the multiplication and division of fractions by the use of recipes.

4. A variety of recipes from the file were used.

5. Appetizing recipes were discussed in the class.

Possible questions by the teacher:

Did your mother ever serve this ___________ for dinner in your home?

This recipe is for six persons, would that be the most economical amount to prepare in your home?

Wouldn't you like to take this recipe home and prepare some for your mother?

Rewrite the recipe to fit the size of your family.

Assignment.

1. Bring to class a recipe which you have enjoyed, or one which you will find in a current magazine which you would like to try and make it usable

* Recipes would be found filed under the concept of Measurement, because of the variety of units of measure used.
for two or three persons. Possibly you would like to exchange recipes with other girls.

2. Find a good recipe for refreshments for the coming school class party, and figure out the amounts necessary to serve at least eighteen persons.

3. Place in your scrap book your choices of recipes for two persons, 31-a; three persons, 31-a; and for a party of eighteen, 31-b.
Peppermint Stick Ice Cream

Serves Three

1/2 tbs. unflavored gelatin  
1/8 cup cold milk  
7/8 cup milk

1/2 cup (1/8 lb.) peppermint stick candy  
1/8 tsp. salt

1/2 pt. heavy cream

Soften the gelatin in the cold milk. Scald 7/8 cup milk; add softened gelatin and stir until dissolved. Crush the candy and stir into the milk with the salt. Allow mixture to cool. Whip cream and fold into the candy mixture. Pour into a refrigerator tray. When mixture has frozen one inch from edge, remove to a chilled bowl and beat until smooth. Return to the refrigerator tray and continue to freeze until firm.

Rice and Avocado Casserole

Serves Two

1/4 cup rice  
1/3 cup grated cheese  
1/2 cup tuna fish  
1/3 tbs. minced onion  
1/3 tsp. prepared mustard

1/3 of a medium avocado  
salt and paprika  
1/3 can (or 4 ozs.) evaporated milk  
1/9 cup cracker crumbs

Wash rice well and cook in boiling, salted water until tender. Drain and rinse. Mix tuna fish with minced onion and mustard. Peel, pit, and slice avocado. Place alternate layers of rice, cheese, fish and avocado in a casserole. Sprinkle the layers of rice and avocado with a little salt and paprika. Repeat until all ingredients are used. Pour milk over all. Sprinkle the top of the casserole with a little grated cheese and the cracker crumbs. Bake in a moderately hot oven (375° F.) for 30 minutes.
Peppermint stick ice cream

Preparation time: 1 hr.

1 tbsp. unflavored gelatin
1 cup (¾ c.) peppermint stick candy
¾ cup cold milk
¾ cup heavy cream

SOften the gelatin in the cold milk. Scald ¾ cups milk; add softened gelatin and stir until dissolved. Crush the candy and stir into the milk with the salt. Allow mixture to cool. Whip cream and fold into the candy mixture. Pour into a refrigerator tray. When mixture has frozen one inch from edge, remove to a chilled bowl and beat until smooth. Return to the refrigerator tray and continue to freeze until firm.

Serves 6 369 cal. per serving  Source of vitamins A, B complex

Tested in The American Home Kitchen

---

+ rice and avocado casserole

Preparation time: 1 hr.

1 cup tuna
1 cup 1/2 cup
1 tsp. minced onion
1 tbsp. prepared mustard

Wash rice well and cook in boiling, salted water until tender. Drain and rinse. Mix tuna fish with minced onion and mustard. Peel, pit, and slice avocado. Place alternate layers of rice, cheese, fish and avocado in a casserole. Sprinkle the layers of rice and avocado with a little salt and paprika. Repeat until all ingredients are used. Pour milk over all. Sprinkle the top of the casserole with a little grated cheese and the cracker crumbs. Bake in a moderately hot oven (375° F.) for 10 minutes.

Serves 6 451 cal. per serving  Source of vitamins A, C, E complex

Tested in The American Home Kitchen
Nesselrode Chiffon Pie

Party of Eighteen

Three pies.

4-1/2 tbs. unflavored gelatin        3/4 cup sugar or corn syrup
3/4 cup cold water                   1-1/2 tsp. salt
3 cups milk                         6 tsp. vanilla flavor
3 cups thin cream                   1 cup sugar
9 eggs, separated                   6 tbs. chopped maraschino cherries
1 cup sugar                         3 9-inch pie shells.

Soften the gelatin in the cold water. Scald the milk and cream. Beat the egg yolks slightly; add 3/4 cup sugar or white corn syrup and salt. Add scalded milk and cream to the egg mixture slowly, stirring all the while. Cook over hot water until mixture coats the spoon (about 7 minutes), stirring constantly. Remove from the heat; add gelatin and stir until gelatin has dissolved. Cool and add vanilla flavor. Chill in refrigerator until mixture thickens to the consistency of soft custard. Fold in egg whites which have been beaten until stiff with one cup sugar. Add maraschino cherries. Turn into a baked pie shell. Sprinkle the top with shaved chocolate, and chill until firm.
**Nesselrode Chiffon Pie**

Preparation time: 30 min.  
(chill 2-3 hrs.)

- ½ cup gelatin
- ½ cup cold water
- 1 cup milk
- 1 cup heavy cream
- 2 eggs, separated
- ½ cup sugar or corn syrup
- ½ tsp. salt
- 2 tsp. vanilla flavor
- 2 tbsp. chopped maraschino cherries
- 1-½ inch pie shell

Soften the gelatin in the cold water. Scald the milk and cream. Beat the egg yolks slightly; add ½ cup sugar or white corn syrup and salt. Add scalded milk and cream to the egg mixture slowly, stirring all the while. Cook over hot water until mixture coats the spoon (about 7 minutes) stirring constantly. Remove from the heat; add gelatin and stir until gelatin has dissolved. Cool and add vanilla flavor. Chill in refrigerator until mixture thickens to the consistency of soft custard. Fold in egg whites which have been beaten until stiff with ¼ cup sugar. Add maraschino cherries. Turn into a baked pie shell. Sprinkle the top with shaved chocolate and chill until firm.

Serves 6-8  593 cal. per serving  Source of vitamins A, C, B complex

Tested in THE AMERICAN HOME KITCHEN
1. Operation

2. Review of Mixed Numbers

3. Purpose: To achieve a meaningful drill in computation with mixed numbers, by using them in a real life situation.

4. House plans were distributed and studied.

5. The discussion dealt with the skills which the student would have to use in order to answer certain questions about a house plan.
   a. The notations given in feet and inches necessitated a review of linear measure, and the expressing of inches in terms of a fraction of a foot.
   b. To find the areas of individual rooms, it would be necessary to multiply mixed numbers. If the total area was wanted, these individual room areas would have to be added.
   c. Finding perimeters would also give exercise in the addition of mixed numbers.

Assignment: Choose the plan of a house which you like.

find: 1. The areas of major rooms.

2. Find the approximate perimeter of the foundation. 32-a
Area of House

1. Bedroom 10' 3" x 12' 5" = 127-13/48 sq.ft.
2. Bedroom 11' 3" x 13' 8" = 153-3/4 sq.ft.
3. Laundry 6' 0" x 9' 4" = 56 sq.ft.
4. Kitchen 8' 0" x 11' 4" = 90-2/3 sq.ft.
5. Dining 19' 7" x 11' 5" = 109-59/144 sq.ft.
6. Living 16' 3" x 22' 0" = 357-1/2 sq.ft.
7. Garage 12' 8" x 20' 4" = 257-5/9 sq.ft.

1. \( \frac{41}{4} \times \frac{149}{12} = \frac{6109}{48} = 127-13/48 \text{ sq.ft.} \)
2. \( \frac{45}{4} \times \frac{41}{3} = \frac{615}{4} = 153-3/4 \text{ sq.ft.} \)
3. \( \frac{6}{1} \times \frac{26}{3} = \frac{56}{1} = 56 \text{ sq.ft.} \)
4. \( \frac{3}{1} \times \frac{34}{3} = \frac{372}{3} = 90-2/3 \text{ sq.ft.} \)
5. \( \frac{115}{12} \times \frac{137}{12} = \frac{15755}{144} = 109-59/144 \text{ sq.ft.} \)
6. \( \frac{65}{4} \times \frac{22}{1} = \frac{715}{2} = 357-1/2 \text{ sq.ft.} \)
7. \( \frac{38}{3} \times \frac{61}{3} = \frac{2318}{9} = 257-5/9 \text{ sq.ft.} \)

Perimeter

Approximate length of house

Length of Living Area 22' 0"
Length of Bed Room 13' 8"

Approximate width 31' 4"

Length of house 66'12" or 67'

\[ 2(l + w) = 2 \times 67' = 134' \text{ approximate perimeter of the foundation.} \]
November 22
Grade Seven

1. Relationship-Numerical

2. Per cents.

3. Purpose: To aid the students in obtaining a broad over-view of the uses of per cents.

4. Pictures using the per cent sign were shown.

5. An oral discussion of textbook material reviewed previous knowledge of per cents.

Assignment: Bring to class for discussion, periodical material involving per cent.

The following are some of the student suggestions, in addition to those shown in the sample scrap book page. 33-a

A sale of purses. At the bottom of the advertisement appeared: 20% Federal Tax, 5% State Tax.

Legislation. A news note proposed a 30% reduction in income taxes.

Cigarette Advertisement. Claimed to contain 51.6% less nicotine.

Air Mattresses. Sold on the following terms: 50% reduction in price, 100% satisfaction guaranteed, 20% down.

Railroad transportation news note. The B & O railroad stated that it was cutting one train in
Forstmann
100% VIRGIN WOOL

Milliken
100% VIRGIN WOOL

99.99% pure—it floats

Sanforized
Red. US. Pat. Off.
Fabric Shrinkage less than 1% by the Government's Standard Test

Nearly double the detergent capacity... washes four times longer... and still as brilliant white right down even famous pre-war “Everbrite” batterie... at no extra cost. That’s today’s high-quantity “Everbrite” batterie, as proved by the “Light Induced Flashlight” test devised by the American Standards Association.
every four. The student supplied the information that this was a 25% cut.

Sweater advertisement. Content of material 75% wool and 25% chicken feathers.

Highway expenditures. News note found by the daughter of the county engineer gave the various expenditures as 40%, 26%, 25%, 9% of the total, thus accounting for 100% of the money.
January 10
Grade Seven

1. Relationship-Numerical

2. Sales

3. Purpose: To achieve an understanding of the meaning of sales.
   The immediate purpose was to encourage the students to understand the textbook terms.
   Many of the types of sales mentioned in the book were not familiar to the students. They accepted the challenge to see how many different examples they could find in current newspapers.

4. No file material was shown at this time.

5. The following are some of their findings:
   Remodeling sale.
   House sale. No down payment.
   Clearance. Up to 50% off!
   Pre-Inventory Shoe sale.
   Removal Sale of Furs.
   January Drug Sale.
   1/4 to 1/2 price Clearance Sale.
   Odd-size Rugs at Close-out Prices.
   One Cent Sale of Drugs.
   Dollar Day
   Harvest Day Sale
   Anniversary Sale
   Going-out-of-business sale.
January 20
Grade Seven

1. Relationship-Numerical

2. Sales

3. This was a follow-up of the interest previously created involving discounts connected with January Clearance Sales.

4. (No file material shown)

5. Two different coat advertisements from the same store were brought to class. They showed eight groups of coats for sale with all prices ending in the digit nine. A discussion arose as to a possible reason for the use of this digit. The place value of numbers entered into the discussion, but the chief point of interest centered around the sales tax schedule. It was suggested that possibly by the time the tax was added to the sale price, the total would be a round number.

The question raised by the teacher was: What rate of sales tax do you really pay? The following schedule was developed.

<table>
<thead>
<tr>
<th>Amount spent</th>
<th>Rate of sales tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>10¢</td>
<td>at</td>
</tr>
<tr>
<td>20¢</td>
<td>at</td>
</tr>
<tr>
<td>40¢</td>
<td>at</td>
</tr>
<tr>
<td>50¢</td>
<td>at</td>
</tr>
<tr>
<td>$1.00 or 100¢</td>
<td>at</td>
</tr>
</tbody>
</table>
The students were very much interested in how they were being 'gyped' when spending 10 cents and 50 cents. They immediately determined to 'beat' the tax by devising ways of spending 40 cents at a time.

January 20
(contd.)

January 21
3. Follow-up - No. II
5. The students constructed their own problems based upon the advertisements which they brought to class. For example: 10¢ handkerchiefs. On sale, 6 for 39¢.
They readily figured that the first price for six would be 60 cents. Subtract the 39 cent sale price and the result would be a 21 cent discount. But then, someone remembered that the sales tax must be considered. They decided that, in round figures, the price would be 40 cents. In comparison to the original price, the customer was benefiting by approximately a 33-1/3% discount.
They concluded that the sale price ending in '9' would take care of the sales tax, and give even change. They felt that a '3' in tens place looked like a lower price for an article than a '4', even though there was a '9' after the '3'.

April 12
Grade Seven

1. Relationship-Geometric

2. Forms based on circles.

3. Purpose: To broaden the scope of the student's knowledge of the use of geometric forms.

4. Follow-up in the search for practical uses for those shapes which can be constructed with the circle as a base, such as the square, hexagon, octagon.

5. A current newspaper picture of the increase in size of the octagonal city street stop signs was brought to class.

The current Saturday Evening Post, 38-A, depicting the hard-working highway painter resting amid his signs, was examined in the class. Octagons, hexagons, rectangles, squares, and circles were readily found. The points of the arrows were seen as triangles.

The large picture was posted on the bulletin board in the class room.

The geometry students who saw the picture, who incidentally were trying to pass their examinations for driver's license, decided that the picture was all wrong. The octagon was a symbol for 'stop' and not 'slow'.

```Thus, for accurate filing, this illustration should be cross filed for the concept of Symbolism.```
The poets sing of spring as a great awakening, and for the flowers, the trees, and the birds—who have been resting up all winter down South—it may be. But when spring waves her magic wand over mankind, the effect is about the same as if she had used a blackjack, and the gentle spring zephyrs operate as if they contained a light general anesthetic. As the sap rises, ambition sags, and as the birds rejoice, men and women greet the annual revival with a heartfelt yawn. Exemplifying this seasonal languor in Stevan Dohanos' cover painting is Sgt. William McDonough, of the Bridgeport, Connecticut, Police Department, a hard-working man who not posing for a spring-fever picture. He runs the department's sign shop.
April 15
Grade Seven

1. Relationship-Geometric

2. Angles. Special interest in the reflex angle.

3. Purpose: To aid the students in seeing angles in the proper relationship to a circle. To foreshadow the definition of an angle as the 'amount of rotation between the initial and terminal sides'.

4. A page of clock faces was used. 39-A.

5. It seemed odd to the students that all pictured clocks usually register twenty minutes after eight, but the presence of the second hand made a greater variety of angles possible.

They found acute, obtuse, and reflex angles in the hands just as they stood. The reflex angle seemed to have a very real meaning to them when they considered the rapid rotations which the second hand must make.

These clocks brought to light a very unusual bit of terminology used by one of the students. The third, or longest, hand was called the minute hand because it ticked off a minute in each revolution. The next sized hand was the hour hand because it required an hour to make a revolution, but she had no name for the shortest hand.

An illustration of a twenty-four hour clock face was useful at this point. 39-B.
Serves business around the clock, around the year!
Panel depicts Jupiter giving apple to goddess of wisdom, reversing judgment of Paris.
May 1
Grade Seven

1. Relationship-Geometric

2. Equilateral triangles used in design.

3. Purpose: To give reality to abstract design, with special emphasis upon designs based upon the equilateral triangle.

4. Pictures of bridges were used.
   a. Brooklyn - 40-A.
   b. Railroad - 40-B.
   c. Winter in the Catskills - 40-C.

5. The textbook has suggested the use of triangles in the making of all-over patterns as used in linoleum. The students had difficulty in visualizing the basic outlines of the designs.

   The shadows on the floor of the Brooklyn Bridge were most helpful in bringing reality to the 'diamond' designs.

May 15

Follow-up:

A student brought in the picture of a bridge taken from a paper Arbuckle sugar sack.
1. Relationship-Geometric

2. Circle

3. Purpose: Follow-up

4. Newspaper picture of Columbus City Hall Tulip Show.

5. The students were very much interested in the designs formed by the flower beds. Some had seen the tulips at close range, but had not been able to obtain a complete picture of the display. The picture was an aerial view of the arrangement. The beds in the foreground of the picture made the same pattern as that found in the Santa Fe Railroad emblem. Other beds were arcs of very large circles. The pool of the fountain was an octagonal star.

\*Newspaper clippings are not included. See Page 24.
Supplement to Chapter Four

The following pages contain a few brief accounts of activities of the eighth grade students, which give evidence of their reactions to periodical materials.
1. Measurement

2. Units of measure

3. Purpose: To broaden the students' concept of units of measurement, by creating an interest in very small linear units.

4. A picture, advertising precision instruments, was shown.

5. Questions by the teacher.
   What is the smallest fraction of an inch which we use?
   Is it 1/64?

   The picture shown involved the precision in measuring the human hair to 1/500 to 1/1500 of an inch. Interest in the use of an instrument for measuring hair was aroused.

   A student offered to bring a micrometer which her father had so that the students could each measure their own hair.
1. Measurement
2. House plans drawn to scale
3. Purpose: To stress the necessity for being explicit when using mathematical symbols, by the study of house plans.
4. Plans of a variety of types of houses.
5. As solutions of textbook problems, the teacher received mere rectangles with scale inches marked, and with no further explanation.

The student comment, when the teacher objected that the 'picture' was not readable was, "Well you know what we mean, just so the teacher can read a mathematics paper, why bother? No one else would be interested in such drawings."

While studying house plans, the pupils discovered several facts.

a. The actual measurements, rather than the scale, were given on the drawings, with the scale given in the explanation.

b. One student questioned that the scale was accurate. Several rooms were measured on each plan, and the class concluded that magazine house drawings were fairly consistent.

c. Another was interested in knowing the dimen-
sions of a patio in the house drawing which she was examining. She found it possible to measure the unmarked distances after once determining the scale.

d. The students suggested that they might understand scale drawing better if they each drew a simple floor plan for a house to scale. (The teacher suggested that if the student did not want to undertake the task of designing a house, she might find a magazine diagram which particularly pleased her and copy it.)

Follow-up:

Both original and magazine plans were presented. One girl who attempted the original, missed the need for making the same wall an equal length when it was a part of two adjacent rooms.

One student demanded that she be permitted to experiment with a round house. She was encouraged to try it, and another student wanted to work with her on this project. They had difficulty in giving dimensions of the curved walls because they attempted to use rectilinear measure rather than circular.

Exhibit 45-A illustrated to them how circles might be compared in scale drawings.

Exhibit 45-B encouraged the girls when they realized
GARDEN GAMES...

RULES OF THE GAME

As in regulation baseball except as follows—
Number of players: One or two (pitchers only).

Fictitious line-ups may be used for scoring.

Put-outs: All fly balls, wherever caught. All
fair balls fielded on first bounce inside
Zone 1, except those that are hit as a bunt;
these must be fielded while still rolling.

Strikes, strike-outs: There are none in this game.

Balls: Wild pitches count as balls, and so pitches
that strike the ground before hitting box.

One-base hits: All fair balls stopped within
Zone 1, but not caught on the first bounce.

Two-base hits: All fair balls fielded (or fumbled) outside Zone 1.

Three-base hits: All fair balls that reach either
hedge line or hit garage sides, or other
previously agreed upon objects.

Home runs: Fair balls hit over either hedge or
onto garage roof (or elsewhere as agreed).

Base running: Runners advance one base on
each wild pitch, and on any out except the
third, or on a caught fly. They advance two
bases on a double. Then, with a man on third
and one out, the pitcher should try to force
a fly by hitting the top edge of the 8 x 8,
or that of either of the 2 x 4 strips.

Mary Ann White
suggests "Back-yard Baseball"
SPRING OF PICTURES

NEW ART MUSEUM WILL BE NEW YORK'S STRANGEST BUILDING

In this photograph on the opposite page Frank Lloyd Wright, America's most distinguished architect, has lifted the domed glass roof from a model of his new building. In many ways, his strangest architectural creation, the building is a new museum to house the Suytenheim Collection of abstract, non-objective paintings. Construction of the museum on Fifth Avenue at 90th Street will begin early next spring. When it is completed, probably in 1947, at a cost of $10,000,000, it will be the most unconventional building in New York City.

The greatest feature of the building is a cylinder, 185 feet high, 100 feet in diameter. Rising in a spiral inside this cylinder is a ramp three-quarters of a mile long. The Suytenheim paintings will be placed on the continuous outside wall of this ramp. Visitors will be able to take an elevator to the top, then walk down the ramp admiring at paintings on the way. Then before entering the museum and sore feet which hospital nurseries cure.
that their idea was not only considered possible by someone else, but was being put into use.
1. Measurement
2. Scale Drawing
3. Purpose: Follow-up.
4. Blue Print of a house plan.
5. The daughter of a real estate broker brought to class the complete blue prints for the remodeling of their three story home, and the complete landscaping layout.

A scale of $\frac{1}{4}''$ to one foot was used in the major plans. For a large overview, a scale of $\frac{1}{16}''$ to one foot was used. The scales in detail drawings were $\frac{1}{2}''$ and $3''$ to one foot.

The class spent the entire period with these plans.

There was interest in finding that a step was 7' long on the large plan and also the same length according to the detailed drawing. They checked a 5' step on both illustrations, and decided that the plans must be quite accurate.

At this point the girls expressed a desire to go back over their own plans and check the consistency of their measurements.

Various members of the class had been in this home and were very much interested in finding their way about the house and grounds by means of the blue prints.
1. Relationship-Numerical

2. Graphs

3. Purpose: To aid students in seeing graphs as a useful medium for expressing data in a comparative form.

4. Pictures of bar, circle, and pictorial as well as line graphs were shown.

5. The students brought graphs of their own choice to class and were given opportunity to discuss at least one. Two graphs which created much interest were: 1. A pictorial graph of the shifts in congressional seats during four election periods. 2. A line graph comparing the tea and coffee drinking habits of the British and Americans.

The girls expressed a desire to make some graphs for themselves. Their graphs were made of their everyday life activities. They included: 1. Movies attended during different months of the year. 2. Amounts of sleep on different days of the week. 3. Number of minutes at piano practice on different days of the week. 4. A pictorial graph of the flowering in the rose garden each week during the season. 5. Number of miles ridden on horseback each day during a recent vacation. 6. Comparative temperatures for the months of August of two consecutive years as kept by a beekeeper in the neighborhood.
5. A student mentioned an article which had appeared in a recent magazine on education. Her summary was that there were three steps in education. (1) Remember, (2) Observe, and (3) Relate. The comment of the other girls in the class consisted of admissions that they only try to remember, but do not observe or relate.
1. Relationship-Numerical

2. Interest, as collected by Loan Companies

3. Purpose: To investigate the rate of interest charged by loan companies, and to compare it to the usually acknowledged legal rates.

4. Loan payment schedules had been posted and discussed in the class.

5. A student brought to class the newspaper advertisements of two local loan companies.

   The terms were given for $100 for six months, requiring payments of $17.00 and $18.48 per month. The teacher stated that the interest on the unpaid balance under $100 could be found to be figured at approximately the rate of 3% per month. Pupils were both aghast and irritated at such a rate of interest as they proceeded to calculate.

   A discussion followed concerning the place of such companies within our economic system.
January 22
Grade Eight

1. Relationship-Numerical

2. Stocks and Bonds

3. Purpose: To familiarize the students with the stock and bond reports.

4. Stock and bond reports from the New York Times were used, also the brief form which appears in the Ohio State Journal.

5. The following are some comments and questions:

I didn't know that anyone could really read this page.

Why pay more than $1000 for a $1000 bond?

If you buy a bond and want to draw your money out the next year, can you do it?

Who would want a 2013 bond? You would die before it would be paid.

Several students were interested in finding the quotations on local stocks in which their families were interested.
Summary

The purpose in keeping this diary was to illustrate the program in action, and to gather evidence to substantiate the theory that periodical materials could be successfully used to bring about more reality and a broadening of student interests and experiences. The evidence as presented in the terms of student questions, comments and contributions did seem to indicate considerable growth in an awareness of mathematics as used in business transactions of various kinds. A particular delight in the discovery of the presence of geometric forms within the range of the students' possible experiences was also frequently exhibited.
CHAPTER FIVE

EVALUATION

Any program must be evaluated in the light of its objectives. The objectives in the setting-up of this program were to bring reality to junior high school girls in their study of mathematics, and to broaden their interests and experiences.

A satisfactory evaluation program should be designed to reveal more than status at a given time. It should yield evidence of growth or progress toward the important objectives, and it should also tell something about the extent to which abilities once developed are retained. This means that the evaluation must sample the same sorts of behavior at regular intervals over a considerable range of time—ideally it would be an almost continuous process.¹

Thus the attempt to evaluate this program has been threefold, namely: (I) The program in action, (II) Student evaluation, and (III) Scores made on standardized tests.

Part I

The summary of the program in action has indicated the sensitivity with which the students responded to the materials presented, both by the examples which they collected and the very revealing inquiries which they made. The reactions were not all immediate. Evidence showed follow-ups coming weeks and months after the initial presentations.

¹ Commission on Secondary School Curriculum of the Progressive Education Association, Mathematics in General Education, p. 423
Interests ranged into the past and future, as well as the present. They found mathematical implications in the lighter things of life, as well as the more serious.

Part II

Some type of student evaluation seemed necessary in order to obtain a more balanced judgment of the year's work.

The writer can honestly say that the students did not know what her particular project was in this year's work. The pictures were used incidentally, possibly too sparingly, in an effort to keep the various sources of instruction available to the students.

The following check list was decided upon as a means of obtaining individual student expression, which would not have to be put to the test of the criticism of fellow students.

The following pages give an account of the instructions as they were given to the students. These instructions may not be stated in the manner in which they could be most effective nor in the way in which the writer would choose if she were using the sheet again, but this is a statement of what actually was said in the classroom when these students were asked to express their opinions.
<table>
<thead>
<tr>
<th></th>
<th>Skill</th>
<th>Appreciation</th>
<th>Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Textbook</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Workbooks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Oral instruction by the teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Diagrams and demonstrations on the board by the teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Problems explained orally in class by the pupils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Wooden and paper geometric models used in the class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Constructions and designs made by the pupils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Newspaper and magazine pictures posted on the walls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Pictures which you have put into your scrap book and your comments upon them</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Tests on daily work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Semester tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Metropolitan Tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Class drill in rapid calculation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Graph Chart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Name anything else which has been a part of your mathematics classes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(Oral instructions given by the teacher)

There is something which I would like to have you do for me. (Pass out the mimeographed sheets.)

In a few words I shall try to tell you what I believe makes up your year's work in mathematics.

We try to improve our basic skills. By skills I mean your ability to add, subtract, multiply and divide with whole numbers, fractions, decimal fractions, per cents, denominate numbers, etc. Thus, we try to increase our speed in handling these, and also to become more accurate.

As I see it, we have mathematics all about us. It is a part of our everyday life. We use it when we go to the store or to the bank. We measure things. We have been interested in the different geometric shapes about us. We have talked about bridges, buildings, etc. Our ability to see the real mathematical applications in these things is what I have in mind when I put appreciation on this sheet.

Also I have attempted to help you understand better the processes which you were using in your problems. For example: we explained multiplication as a short cut to addition. By use of the chart etc., we have worked with multiplication of fractions as we talked in terms of area.

Now let us look at the sheet. In the column at the left, I have listed the things, and various happenings
which have been a part of our class this year.

Do not put your name on the paper.

Each of these items should serve some purpose.

(On the board the teacher writes)
M Most helpful
H Helpful
L Little help

'Most' does not mean the superlative. It merely means that you learned much from that particular item, or that you liked it. In fact you may be very enthusiastic about certain things which are done in the class and not like others at all.

Some may be 'helpful'! I have not said of no help, but instead have used the word 'little'! For although you may not care for some procedures, possibly you learn a little from them without realizing it.

Thus in the first column, you will mark either 'M', 'H', or 'L', according to how you feel about each item.

Some items will not be 'M' for skills, because they are aimed at either appreciation or understanding. Merely put down your own ideas. Do not be concerned with what anyone else is writing. This has nothing to do with your grades. There are no right and wrong answers.

(Time given to complete the first column pertaining to skills)

I have tried to show you the place of mathematics in your everyday life, to help you see that it is around you everywhere and is a part of all which you see.
Indicate by some letter how these items have been helpful to you in this way. In the second column indicate how helpful each of these items has been in making mathematics seem more real to you as you realize that it exists in so many things you see and do.

The last column is headed 'Understanding'. I have not merely told you how to solve problems and the mechanical ways in which to compute, but I have tried to help you understand what you were doing.

Mark the third column and rate the items according to how helpful you feel that they have been to you.

(Aample time is given for the students' evaluations)

This was a list of the materials and events which entered into our year's work together as the teacher saw them. However, you also probably saw things, some which you liked or possibly some which you did not like. Indicate these opposite the last item on the page; if there is not sufficient space here, turn the page over.

At the end of each grading period, we as teachers are asked to make comments upon your work which will enable you to do better work during the following period. In this last item I am asking you to make suggestions and comments which will help me to do a better teaching job next year.

The following pages present (1) A Summary of seventh grade responses, and (2) a Summary of eighth grade responses.
Chart No. 2

(Seventh Grade Summary)

<table>
<thead>
<tr>
<th>Skill</th>
<th>Appreciation</th>
<th>Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>6.</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>7.</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>8.</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>9.</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>10.</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>11.</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>12.</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>13.</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>14.</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>15.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Textbook
2. Workbooks
3. Oral instruction by the teacher
4. Diagrams and demonstrations on the board by the teacher
5. Problems explained orally in class by the pupils
6. Wooden and paper geometric models used in the class
7. Constructions and designs made by the pupils
8. Newspaper and magazine pictures posted on the walls
9. Pictures which you have put into your scrap book and your comments upon them
10. Tests on daily work
11. Semester tests
12. Metropolitan Tests
13. Class drill in rapid calculation
14. Graph chart
15. Name anything else which has been a part of your mathematics classes.
### Chart No. 3

*(Eighth Grade Summary)*

<table>
<thead>
<tr>
<th>Skill</th>
<th>Appreciation</th>
<th>Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Textbook</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>2. Workbooks</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. Oral instruction by</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>the teacher</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>4. Diagrams and</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>demonstrations on the</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>board by the teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Problems explained</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>orally in class by the</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>pupils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Wooden and paper</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>geometric models used in</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>the class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Constructions and</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>designs made by the</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>pupils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Newspaper and magazine</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>pictures posted on the</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>walls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Pictures which you</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>have put into your scrap</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>book and your comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>upon them</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>10. Tests on daily work</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>11. Semester tests</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>12. Metropolitan Tests</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>13. Class drill in rapid</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>calculation</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>14. Graph chart</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>15. Name anything else</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>which has been a part</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>of your mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>classes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
For purposes of this study, the student reactions to Items 6, 7, 8, and 9 will be considered.

By a careful analysis of the Seventh Grade summary, it was discovered that these students were inclined to be conservative; they preferred to use the middle degree of 'H' rather than the extreme symbols of 'M' or 'L'. Thus, in interpretation of these reactions, the writer shall conclude that if a student considers an item as 'H' for any of the three headings, that it is an activity of value to her.

Item 6, "Wooden and paper geometric models used in class", was rated highest under the heading of understanding. Fifteen of the sixteen members of the class marked this item either 'M' or 'H'.

Item 7, "Constructions and designs made by pupils", was considered to be of most help in the area of appreciations; 12 of the 16 considered it to be of actual help.

Item 8, Fourteen of the 16 students marked "Newspaper and magazine pictures posted on the walls" as 'M' or 'H' under appreciation.

Item 9, "Pictures which were put into scrap books and the comments upon them", also rated by 14 out of the 16 as 'M' or 'H' under the heading of appreciation.

Thus, according to the students' own judgments these activities helped them to realize the presence of mathematics in their everyday lives and understand its terms and concepts.
The Eighth Grade Summary shows that these students saw the greatest value in Item 6 as an aid to Understanding. Constructions and designs made by the pupils were considered helpful both in the area of skill development and in understanding. The posted magazine and newspaper clippings were considered to be of greatest value in the achieving of the reality which would permit them to appreciate mathematics. The eighth grade did not make scrap books, but their materials were discussed in class, and then filed in the teachers folders. Thus the Item 9 as stated, might have resulted in some hesitancy to express an opinion concerning it. The responses indicate that this activity could make a valuable contribution to understanding.

According to the students' individual judgments, they have found that these items which are the material evidences of this program of supplementation-in-action to be of greatest value in bringing reality to mathematics as they learned to appreciate its presence in their many everyday activities and contacts, and to understand it.
Part III

The scores made by the eighth grade students on a retest with the Cooperative Mathematics Test* were considered as one of the sources of evaluation data. It would be impossible to determine the degree to which any one phase of the teaching program may have affected these scores. However, it seems reasonable to say that if the scores showed a normal increase that the use of pictures had not been detrimental to the students.

The scores in comparison to the previous ones had increased. On Part II, dealing with Facts, Terms, and Concepts, with a possible score of 30, the range was from 16 to 22, as compared with the initial range of 4 to 13. An analysis of individual scores showed an increase of from 9 to 14 points in raw score. On Part III, dealing with applications, with a possible score of 30, the range was from 10 to 25, as compared to the initial range of 3 to 11. The increases in individual scores on this part of the test were from 0 to 14 points. The percentile range of the eighth grade total scores on national norms was from 70 to 100, as compared to the range of 1 to 64 for the same students at the seventh grade level one year before.

* American Council on Education, Cooperative Mathematics Test, for Grades, 7, 8, and 9, Form P.
Summary of the chapter

The data presented in Part I shows that the students were seeing their mathematics lessons as real life situations, and that they desired to know more about the world about them, and especially the business world.

Part II of the evaluation, indicates that the students saw in the material the same potentialities which the teacher had seen in it as it was set up. They saw these materials as tools which would aid them in realizing the presence of mathematics in their lives, and as aids to understanding.

The third part of this evaluation should carry weight with those who value test scores as final evidence. The writer does not put much weight upon these. Too many factors can affect test scores to permit a definite statement as to cause.
CHAPTER SIX

CONCLUSIONS

The announced objective in the solution of this problem was its use as a tool in bringing reality and an expansion of interests and experiences to junior high school girls in their study of mathematics by supplementing the textbooks with periodical material.

The writer feels justified in concluding, that based upon the evidence recounted in Chapter Four, she has succeeded in bringing reality with a broadening of interests and experiences to these girls.

The project has been even more helpful to the teacher. It is a very interesting means for the broadening of knowledge of concepts of mathematics. Its use could be helpful to any teacher in the broadening of her own viewpoint in spite of the supposed restrictions of the traditional textbook.

The writer would recommend that fellow teachers take upon their own shoulders the teaching of a mathematics class instead of expecting the textbook to do it for them.

The use of the broad continuing concepts of mathematics as a filing system, make this file most useful in other areas of mathematics instruction and do not limit it merely to the junior high area.
BIBLIOGRAPHY


