A CRITICAL EVALUATION OF THE COURSE FOR GENERAL MATHEMATICS
IN MEETING THE NEEDS OF YOUTH AS REVEALED BY SEVERAL
COURSES OF STUDY AND THE ADOPTED TEXTBOOKS
FOR TEXAS SCHOOLS

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CHAPTER I

INTRODUCTION

Statement and Purpose of the Study

This study is an attempt to determine how a course in general mathematics can satisfy some of the needs of youth. The purpose of the study is to find out how the course in general mathematics can be made to contribute effectively to pupil growth, and how well the present course is contributing to pupil growth.

Delimitations and Definitions

This study is delimited to the materials usually offered in a course of general mathematics in the ninth grade in the State of Texas.

General mathematics usually consists of arithmetic, algebra, plane and solid geometry, graphs, and trigonometry. It is the courses of high school mathematics combined into one course. Of necessity, a limited scope of each subject is made in the one course.

"One view of mathematics is that mathematical statements represent eternal truths; another view is that mathematics is the 'language of size.'"\(^1\) Sometimes mathematics

is divided into pure mathematics and applied mathematics. The needs are those things which make for desirable growth in an individual in our society.

Sources of Data

Sources of data will be from what educationists say, books, reports of committees, pamphlets, articles, and studies made in the field of education.

Proposed Treatment of Data

The proposed treatment of data is to analyze the needs of youth, state what psychology says about learning, and apply the criteria thus formed to Texas practices in general mathematics.

Related Studies

In Christian's thesis, "An Experimental Study of Student Progress in General Mathematics," the problem was an investigation to procure direct evidence of significant gains, normal gains, or losses, in the educational achievement made by two groups of ninth grade students in general mathematics during one semester.

The results showed some gains in grade and age; but they did not furnish overwhelming evidence that all students of the two groups were sufficiently motivated by a course in general mathematics to make the progress that is expected for a given period. The most gains were made by pupils of low
ability. There was very little gain for pupils with high ability. There were some losses in individual cases. A conclusion reached, because of lack of uniformity in gains, was that the methods of measuring achievement on a mass basis are not always satisfactory.²

Christian's study differs from the present study in that achievement in subject matter is emphasized while the present study emphasizes needs. Instead of the pupil satisfying standards in the mathematical field, the present study is an attempt to integrate the mathematical field to the student according to his needs.

In a study by Bales, "A Study to Determine Sound Methods of Teaching High School Geography," the problem was to determine some method of organizing a sound geography program in the high school based on the concepts of democracy, psychology, and sociology. His conclusions were:

1. The subject matter arrangement of the social studies does not insure effective training in democratic, psychological, and sociological practices.
2. In the instances when it partially meets the requirements of these three practices it is found that the possibilities were so remote as to render them practically negligible.
3. The subject matter approach to the social studies is not based upon what is known of the ways in which effective learning occurs.
4. The correlated approach makes only very slight contribution toward any acceptable meanings of democracy, psychology, and sociology, since it is governed by the basic subject-matter ideas.

5. The correlated approach assumes the superiority of the isolated mental aspects of learning and neglects all others.

6. The broad-fields approach offers more opportunity for practicing democratic principles than does the subject-matter approach.

7. The broad-fields approach is not based upon sound methods concerning ways in which effective learning occurs.

8. The broad-fields approach, having the problem as its center, offers little opportunity for practicing desirable social interaction.

9. The experience approach provides desirable opportunity for practicing democratic living.

10. The experience approach does insure the development of situations through which effective learning can best take place.

11. The experience approach provides for co-operative social interaction within the learning situation, and every phase of it should insure a maximum of training in democratic practices.3

This study by Bales differs from the present study in that he was determining a sound approach to teaching geography while the present study is to determine a sound approach to teaching a course in general mathematics based upon the needs of youth.

In Davis' thesis, "A Study to Determine Provisions made by Secondary Schools of Texas to Meet the Needs of Their Pupils," the problem was to determine by a questionnaire the extent to which, by representative sampling of Texas High Schools, that Texas High Schools provide activities to meet pupil needs. The conclusions reached are as follows:

1. Few schools are taking advantage of the natural over-lapping of courses to teach lessons which deal with

---

other subjects. Home economics can bring to the student the realization that merely being able to cook will not make a successful marriage. It can teach some things in the field of budgeting of buying and using goods wisely. Yet, according to the survey, this is seldom accomplished.

2. On the whole, schools are not making the most of the opportunities provided within the present framework to meet student needs.

3. All population groups fall short on community-sponsored youth activities. The schools appear to accept more responsibility for the student in school and out.

4. Independent student action is not being encouraged. Despite assertions that students should learn to govern themselves, Texas teachers remain firmly at the controls of school policy and activity.

5. Developing rational thinking is considered a worthy enterprise, but few schools can point out activities in use to build logical thinking.

6. Such practical courses as typing, shorthand, and bookkeeping are becoming an integral part of the curriculum. Yet these courses are not interrelated to help give the student some knowledge of consumer education; the student must gain this knowledge either at home or at work.

7. The implication and application of atomic energy are not taught generally.

8. Most communities prefer to let the school sponsor the majority of youth activities. The school, with the sanction of the parents, is accepting more responsibility for the students' out-of-school hours.

9. The group of schools below one-thousand in population is not as active in developing respect for and co-operation with other as the larger schools.

10. Larger schools offer more opportunity for meeting student needs in that they offer all the courses suggested in the questionnaire; while the smaller schools concentrate on such basic courses as the sciences, vocational agriculture, English, business courses and mathematics. Fewer courses deemed essential to cultural development are made available to students enrolled in the smaller schools. Large schools offer more responsibility and democratic leadership to the student through student councils, youth centers, and club work. Consequently, the student in a large school has the opportunity for a broader education than the student in a small school. The student of a small school is penalized in the field of education. He is limited vocationally
and cannot compete on an even basis with the student of a larger school when applying for a job.4

The study made by Davis concerns the whole curriculum and the provisions made for the needs of pupils in it; the present study is concerned only with the course of general mathematics and the provisions made for student needs in that particular course.

In Roach's thesis, "A Study to Determine a Curriculum Pattern Based on Field Psychology," the problem was to find out what the curriculum would be if the theory of field psychology was used as a base. The conclusions reached were:

1. The curriculum should be conceived of as something that is designed in the process of designing. The designing is to be repeated with each new learning situation.
2. The curriculum should be conceived of as something that parallels the ongoing process of living.
3. The curriculum should be conceived of as something that evolves with the whole individual.
4. The curriculum should be conceived of as something that is synonymous with the environment.
5. The curriculum should be conceived of as the flexible environment in which the individual can adjust to a complex society.
6. The curriculum should be conceived of as the dynamic environment that will make provisions for the individual differences of the learners.
7. The curriculum should be conceived of as the environment in which the individual can function as a whole to whole situations.
8. The curriculum should be conceived of as the environment in which the individual can approach a state of integratedness.

9. The curriculum should be conceived of as the environment in which the individual can strengthen his creative individuality.

10. The curriculum should be conceived of as the environment in which the behavior can differentiate from his own varied needs and select as a goal the one that has the most value to him at the time.

11. The curriculum should be conceived of as the environment in which the behavior can live while he learns.

12. The curriculum should be conceived of as the environment in which the individual's carefully selected purposes are considered the integrating elements of learning.

13. The curriculum should be conceived of as the environment in which the individual can solve his own personal-problems-of-living that appear in his psychological field.

14. The curriculum should be conceived of as the environment in which the individual can select some learnings that will improve his quality of living.

15. The curriculum should be conceived of as the environment in which the individual will have ample time for functional reflective thinking.

16. The curriculum should be conceived of as the environment in which the individual can be stimulated, motivated, guided, and directed by kind, sympathetic, and competent adults.

17. The curriculum should be conceived of as the environment in which the individual, through a process of differentiation, can define meanings and refine his understandings from the same whole.

18. The curriculum should be conceived of as the environment in which the individual can manage life-like situations.

19. The curriculum should be conceived of as the environment in which the individual can enjoy wholesome growth and development.

20. The curriculum should be conceived of as the environment in which the individual can expand, differentiate, and integrate within himself and continually grow through the process of intelligent interaction.

21. The curriculum should be conceived of as the environment in which the individual can develop his potentialities to the best of his ability.

22. The curriculum should be conceived of as the environment in which the individual can pursue the interests that have ever increasing value to him.

23. The curriculum should be conceived of as the environment in which the individual can utilize his past experiences.
24. The curriculum should be conceived of as the environment in which the individual can choose subject matter as he sees the need of it in the prosecution of his experiences.

25. The curriculum should be conceived of as the environment in which the individual can have many and varied first-hand experiences.5

The study by Roach differs from the present study in that his study pertains to the whole curriculum and the psychological aspect of it as interpreted through field psychology. The present study concerns only a phase of the curriculum, the mathematical part, and its aspect as interpreted through psychology and the needs of youth.

In a study by Hal Burns Lane, "A Study to Determine the Apparent Extent to Which the 1949-1950 Curriculum of the Richland Springs Secondary School Met Certain Educational Needs of Youth," the problem was to determine the apparent extent to which the 1949-1950 curriculum of the Richland Springs (Texas) Secondary School met the educational needs of its youth. Lane's conclusions were as follows:

1. The offerings of the Richland Springs High School in 1949-1950 were largely traditional in type.
2. Extracurricular activities were few in number and limited to athletics, banquets, dramatics, and field trips.
3. Pupils' needs relative to developing salable skills were not met adequately except possibly in the areas of agriculture, vocational homemaking, and secretarial training.

4. Pupils' health needs were not met adequately except possibly in the areas of physical education, athletics, and vocational homemaking.

5. Pupils' needs relative to experiencing democratic principles and practices were not met adequately since opportunities for such experiences appeared in only two areas -- class elections and field trips.

6. Pupils' needs relative to understanding of family life were not met adequately since vocational homemaking was the only subject offering emphasis in this area, and the churches and the parent-teacher association were the only community agencies which cooperated with the school in stressing the significance of the home.

7. Pupils' needs relative to understanding consumer economics were not met adequately except possibly in the areas of vocational agriculture and nutrition.

8. Pupils' needs relative to understanding of science and its influence on life possibly were met fairly adequately in the areas of general science, biology, homemaking, and vocational agriculture; the needs of pupils not enrolled in these courses evidently were not met.

9. Pupils' needs relative to cultural development possibly were met fairly adequately in the areas of music, literature, and nature, but were not met in the field of art.

10. Pupils' needs relative to experiencing the wise use of leisure time and participation in recreation were not met adequately in after-school hours or during out-of-school months, although they possibly were provided for during school hours and during the school term in the areas of athletics, dramatics, and field trips.

11. Pupils' needs relative to developing respect for others were met to some degree through class elections, dramatics, music, two clubs, and athletics; but were not met adequately with reference to providing special emphasis on a broad understanding of race tolerance and equal opportunity for all.

12. Pupils' needs relative to developing the ability to think rationally were met fairly adequately through traditional-type subjects but few provisions were made for pupils to exercise their rational thoughts in such activities as home-room organizations, student council, or discussion groups.

13. In general, the ten educational needs of youth in Richland Springs were adequately met only to the
degree that a traditional-subjects curriculum can meet them, with possible exceptions in vocational agriculture, homemaking and field trips.\textsuperscript{6}

Lane's study differs from the present study in that the whole curriculum is not considered, but only a phase of it, a course in general mathematics, is considered and how this course can contribute to some of the needs of youth.

CHAPTER II

AN ANALYSIS OF THE NEEDS OF YOUTH

This chapter is about the needs of youth. The findings of others will be taken and analyzed to help in forming a decision as to what are the needs of youth in our society.

The Educational Policies Commission of the National Education Association has given the following ten "imperative" needs of youth:

1. All youth need to develop salable skills and those understandings and attitudes that make the worker an intelligent and productive participant in economic life. To this end, most youth need supervised work experience as well as education in the skills and knowledge of their occupation.

2. All youth need to develop and maintain good health and physical fitness.

3. All youth need to understand the rights and duties of the citizen of a democratic society, and to be diligent and competent in the performance of their obligations as members of the community and citizens of the state and nation.

4. All youth need to understand the significance of the family for the individual and society and the conditions conducive to successful family life.

5. All youth need to know how to purchase and use goods and services intelligently, understanding both the values received by the consumer and the economic consequences of their acts.

6. All youth need to understand the methods of science, the influence of science on human life, and the main scientific facts concerning the nature of the world and of man.

7. All youth need opportunities to develop their capacities to appreciate beauty in literature, art, music, and nature.
8. All youth need to be able to use their leisure time well and to budget it wisely, balancing activities that yield satisfactions to the individual with those that are socially useful.

9. All youth need to develop respect for other persons, to grow in their insight into ethical values and principles, and to be able to live with and work co-operatively with others.

10. All youth need to grow in their ability to think rationally, to express their thoughts clearly, and to read and listen with understanding.  

Voss in her study of the needs of youth give the following:

1. To develop and maintain good health and physical fitness.
2. To be instructed in the proper use of leisure time.
3. A range of personal interests, for esthetic satisfactions.
4. To grow in their ability to think rationally, to express their thoughts clearly, and to read and listen with understanding.
5. All youth need the required knowledge and skills in fundamentals (reading, writing, etc.).
6. All youth need a workable philosophy of life.
7. To understand the significance of the family for the individual and for society and the conditions conducive to successful family life.
8. To know how to make and hold friends.
9. To know about boy-girl relationships.
10. To know about sex relationships.
11. To develop respect for other persons, to grow in their insight into ethical values and principles, and to be able to live and work co-operatively with others.
12. To know how to maintain democratic family relationships.

13. To develop standards of personal conduct — finding what kinds of things others in their group
think are moral and immoral.

14. To understand the rights and duties of the

15. To cultivate the willingness and the ability
citizen of a democratic society, and to be diligent
to co-operate effectively in democratic institutions.

16. To develop the ability to comprehend and to
use the most effective and reliable methods in the
solution of social and civic problems.

17. To understand democracy.

18. To know how to participate in civic affairs
intelligently.

19. Guidance in choosing an occupation and for
vocational preparation.

20. To know about finances — cash, credit, and
installment buying — which to use and when.


22. To develop salable skills and those under-
standings and attitudes that make the worker an in-
telligent and productive participant in economic
life. To this end, most youth need supervised work
experience as well as education in the skills and
knowledge of their proposed occupations.

23. To know how to purchase and use goods and
services intelligently.

Doane in his study of the needs of youth came to the
following conclusions:

1. Youth are concerned about themselves as indi-
individuals.

2. They need adjustment to vocational future.

3. They need adjustment to their fellow youth.

4. They are concerned about their emerging
adult status.

2Frances Geraldine Voss, "To Determine a Sound Program
for Organizing the Needs of Youth and the Curriculum in the
Secondary School" (Unpublished Master's thesis, Department of
Education, North Texas State Teachers College, June, 1948),
pp. 96-98.

3Donald C. Doane, The Needs of Youth, Bureau of Publica-
cations, Teachers College Columbia University, New York, 1942.
Doane also classified needs of youth as shortcomings of society, needs as indicated by adults, and as psycho-biological needs.4

Jersild and Tasch, in their study of children's interests, found there was a lack of parallels between children's expressed interests and their needs in their daily lives; for example, children living in shacks did not express a desire for good housing.5

Children at all age levels were found to be preoccupied with people and personal relations. Gifts were found to be important for all children, especially at the younger levels. With an increase in age self-improvement, vocational fitness or placement, educational opportunity, and understanding of self and others becomes more important.6

Herbert Spencer, in his essay on education "What Knowledge Is of the Most Worth," gives self-preservation, securing the necessaries of life, rearing of off-spring, maintenance of proper social and political relations, and activities concerning the leisure part of life as important in the education of the individual.7

4 Ibid., p. 4.
5 Arthur J. Jersild and Ruth J. Tasch, Children's Interests (Published by Bureau of Publications, Teachers College, Columbia University, New York, 1949), pp. 73, 79.
6 Ibid., pp. 71-74.
Inglis gives as the aims of education physical efficiency, social-civic preparation, economic-vocational preparation, and preparation of the individualistic-avocational activity of the individual. 8

In the "Cardinal Principles" report, the aims of education were given as (1) health, (2) command of fundamental processes, (3) worthy home membership, (4) vocation, (5) citizenship, (6) worthy use of leisure, and (7) ethical character. 9

Koos gives the aims of education or "meeting the needs of life" as the civic-social-moral aim, recreational and aesthetic participation and appreciation, occupational efficiency, and training for physical efficiency. 10

Bobbitt lists a number of areas of living which he considered as belonging in the curriculum. They are: vocation, education for citizenship, life within the family, the life of the body-physical efficiency, instruments of intercommunication, mental efficiency, religious activities, the play or recreational activities of the individual. 11

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The North Central Association has given the ultimate objectives of the secondary school as follows:

1. Health: To secure and maintain a condition of personal good health and physical fitness.
2. Leisure time: To use leisure time in right ways.
3. Social: To sustain successfully certain definite social relationships; civic, domestic, community, and the like.
4. Vocational: To engage successfully in exploratory-vocational activities.  

David Snedden lists eight careers or roles that individuals play and that may be designated as objectives of the secondary school. Those careers are:

1. The vocational career as productive economic work for support of self and independents.
2. The family rearing career, including stages of courtship, marriage and up-bringing of children.
3. The civic or political career based universally on conformistic civic virtues in local and national political societies, plus in genuine political democracies, the wide exercise of the kinetic (voting, party-forming, criticising, etc.) political virtues.
4. The cultural career, consisting of generous and progressive enrichment of knowledge, aesthetic appreciations and vision for its own sake.
5. The religious career, preparation for which U. S. A. is generally accepted as a responsibility of denominations rather than public schools.
6. The health and vigor-conserving career, utilizing the best of our up-to-date medical, dietetic, and eugenic sciences and recreations.
7. The societal career built on give-and-take co-operations in many societies intermediate between the familistic and the political.
8. The pleasure-functioning career, including avoidance of degenerative pleasures and refined use of the higher.  

13 David Snedden, Towards Educational Sciences.
Spaulding in his report gives the following as belonging to secondary education:

1. Self-realization includes health.
2. Economic efficiency.
3. Human relationships.
5. Self-realization includes leisure use. 14

Stratemeyer stresses the persistent life situations in developing a curriculum for modern living. She gives the following as being persistent life situations of everyday living: (1) the family, (2) civic and social activities, (3) work, (4) leisure, and (5) spiritual life. 15 Figure 1 illustrates these life situations.

Will French, J. Dan Hull, and B. L. Dodds in their book entitled American High School Administration have regrouped the ideas of Spencer, Inglis, Bobbitt, Koos, Spaulding, the "imperative needs" put forth by the National Association of Secondary School Principals, and the ideas of the North Central Association into five parallel groups. Figure 2, Some Statements of Purposes for Education, shows the regrouping of the purposes of secondary education. 16

It may be proposed to change the grouping as shown in these studies on the purposes or needs of American youth. It

16 Will French, J. Dan Hull, B. L. Dodds, American High School Administration, p. 79.
Figure 1—Stratemeyer's Chart illustrating life situations.
<table>
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<th>2 Securing necessities of life</th>
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<td>2 Vocations</td>
</tr>
<tr>
<td>Educational Policies Commission</td>
<td>1 Self-realization includes health</td>
<td>2 Economic efficiency</td>
</tr>
</tbody>
</table>

Fig. 2--Regrouping of the purposes of secondary education
and some statements of purposes for education.
Fig. 3--Organization of a High School.
Fig. 4—Organization of a High School.
seems that the health group is not parallel with the other groups. That is to say, it is an aspect of the other groups or comes under each of them. In fact French, Hull, and Dodds in the Figures showing the organization of a high school, which are Figures 3 and 4, have only four divisions under the purpose organized schools.17

In view of this analysis of the needs of youth it is proposed that the needs of youth will be approached with the idea that they can be achieved through emphasizing four apparent major roles of living listed below:

1. Living in the Home -- Family Living.
2. Community Living -- Citizenship.
3. Vocational Living -- Life Work.
4. Recreational Living -- Leisure Time.

17 Ibid., p. 170.
CHAPTER III

AN ANALYSIS OF WHAT PSYCHOLOGY SAYS ABOUT LEARNING

It is proposed in this chapter to note what psychology says about learning. From the studies, to come to some conclusions as to what are basic in the learning process as put forth by present day thought.

Hopkins set forth in the following statements his ideas as to what are desirable principles of learning.

1. An individual learns best when he has his own purposeful goals to guide his learning activities. All human beings are self-regulating, purposing, goal-seeking, energy systems.

2. An individual learns best when he is free to create his own responses in the situation which he faces. The individual facing a life situation is the primary unit of learning.

3. An individual learns best when he is free to make his own organization of materials in the process of satisfying his own purposeful goals. Each individual must create his own materials, he must create his own processes, and he must create the organization in which he holds together both materials and process in his experience.

4. An individual learns best when he can share co-operatively in the management of the learning experiences with his fellows under the guidance but not the control of adults. It is a condition of good learning that children be given large responsibility in planning their own programs of living under the guidance but not the control of teachers.

5. An individual learns best with sympathetic adult guides, such as parents and teachers, who know and understand him as a growing personality. In general, pupils of all ages like best and learn best from a teacher who understands them, is always fair from their viewpoint, never makes them feel inferior,
always encourages them, does not nag and threaten them, is always civil to them when they ask questions, does not assign homework as a punishment, is willing to talk to them when they need advice, and is patient in explaining things they do not understand.

6. An individual learns best with adults who view learning as a genetic process, not as mere immediate overt behavior. The importance of this principle lies in that fact that improvement of behaviors which seem desirable and fruitful assets for future learning and the elimination of behaviors which seem to have undesirable value for subsequent situations are not so much a matter of dealing with the present overt behavior as with the remaking of conditions which have been disintegrating pressures upon the individual for a long period of time.

7. An individual accepts and acts upon the learnings which he believes are personally valuable to him. Not all learnings are kept by an individual. Selection is made by working them over in new experiences. Each individual saves and incorporates into his working organization those learnings which in his best judgment are worth keeping. They include those most useful at the moment and those which appear to have most fruitful possibilities of dealing intelligently with future experiences. This process of selection, acceptance, and incorporation goes on at all times and in all situations whether they occur in or outside of the school. ¹

Lee and Lee give the basic conditions of learning in the following statements:

1. Learning is facilitated when the situation satisfies a need or purpose of the learner.
2. Learning is facilitated in proportion as the situation is meaningful to the child.
3. Learning is facilitated when the situation or concept is suitable to the maturation level of the learner.
4. Learning is facilitated if the situation is interesting to the pupil. ²

²J. Murray Lee and Doris May Lee, The Child and His Curriculum, pp. 172-76.
In relation to the child's success Lee and Lee give as the conditions of learning:

1. Learning is facilitated by reward rather than by punishment.
2. Learning is facilitated by presenting situations in such a way that the pupil's response to them is correct and successful.
3. Learning is facilitated by "punishment" only if that punishment insures immediate correction of the error.
4. Learning is facilitated if the child corrects all errors promptly.
5. Learning is facilitated when the pupil has a knowledge of the success of his result.

In relation to the physical aspects of learning, Lee and Lee give the following conditions:

Learning is facilitated when the learner is in good physical condition.
Learning is facilitated where the physical conditions are favorable.

As related to "method" Lee and Lee give the conditions of learning as follows:

1. Learning is facilitated by one of the "modified-whole" methods.
2. Learning is facilitated when study and socialized activity are combined.
3. Learning is facilitated when the materials or skills to be learned recur at spaced intervals.
4. Learning is facilitated by both positive and negative concepts.
5. Learning is facilitated by increasing the number of associations with the material, where each association adds some new meaning.
6. Learning is facilitated if factors which should be connected are presented together in time and space.

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3. Ibid., pp. 176-182.
4. Ibid., pp. 183-185.
5. Ibid., pp. 185-190.
Commins, in his book *Principles of Education*, gives a summary of our psychological heritage. He gives Locke, Mill, and others as belonging to a group known as Associationists. The mind of the infant is considered as blank and all that is recorded comes from impressions from the world about.

Education then is a stamping in process. Learning is an additive sort of thing. Next came the psychology of mental powers, or the "faculty" idea; that is, the mind was constituted of a number of separate mental powers and each could be trained with the appropriate mental exercises. The psychology of apperception succeeded next and was founded by Herbart. It gave first place to content rather than mental training. It emphasized knowing to doing. It also stressed interest in learning. Another school was the physiologists. The "seat" of learning was the synapse or junction point of nerve fibers.\(^6\)

Learning became a matter of "Conditioning" of reflexes. Mental heredity was rejected and the outcome was "behaviorism." Thorndike, with his studies of animals, formulated the S-R bond theory of learning. Learning was a matter of trial and error. The child was born with certain "bonds" ready to function. Education was thought to consist largely of adding other bonds to the early ones.

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\(^6\) W. D. Commins, *Principles of Educational Psychology*. 
The recent trends in psychology emphasize the Gestalt school. Gestalt psychologists emphasize the study of "wholes" of experience and behavior. The recent trends have cooperated to produce what may be called an "organismic" viewpoint. Commins then defines learning as "the progressive changes taking place in the patterns of our experience and behavior toward better adjustments to the felt demands of life." He sets forth the following as principles and laws of learning:

I. It is the whole organism, the whole individual, that acts and learns.
II. Motive the basis of learning.
III. All situations for the learner are patterned.
IV. All behavior is patterned.
V. Learning is a matter of genesis or development.
VI. Learning is essentially a reorganization of experience and behavior.

That and Gerberich have the following to say about the Gestalt theory:

The Gestalt school holds that the individual undergoes changes as the result of his experiences so that he becomes a new individual in effect. His response to subsequent situations therefore is determined in part by the experiences he has already undergone, as well as by the nature of the new situations. Much emphasis is given to the learner's purpose, for it is this purpose and not merely the sensory stimuli immediately present that will determine the nature of the response. The stress in teaching should be on helping the learner develop desirable purposes, to put them to use in the activities that are of concern to him, and to redefine them in the light of his experiences for use as guides to further learning. Since purposes grow out of experience, are tested in experience, and take on new meaning in the light of experience, learning must be an active, on going, experience-producing process. The pupil learns only as he

Ibid., Chapter II.
actively participates in the educative process. Teachers may help but the dynamic force that makes learning possible must be provided by the pupil himself. The educational content grows out of the problems, needs, and interests of the learner. Pupils must see the purpose of that which they are doing in school before they can enter actively into the learning process. 8

Tildon gives five generalizations concerning behavior and its implication to learning. They are as follows:

1. Behavior is psychologically unified.
2. Within behavior there is usually a core of concentration.
3. Behavior has psychological continuity except as it is segmented into psychological units by a shift in the nature of the core.
4. Behavior is a resultant of influences, including the engrammatic influence of prior experience.
5. The activation of the core of an engram tends to reactivate the whole engram. 9

George W. Hartmann in his discussion of a field theory of learning says:

All events in nature — and this statement plainly includes psychological and educational phenomena — always occur within some field, big or little, whose properties and structure explain the localized occurrence that it embraces and simultaneously permit increased control over it. The so-called inherent properties of an object are said to be ultimately traceable to forces impinging upon it from the surrounding field which is construed as the effective whole determining the attributes and behavior of the part or parts coming within its influence. 10


The following are "maxims" of the field theory of learning as put forth by Hartmann:

1. That learning is best motivated by goals established or accepted by the learner as a result of his needs;
2. That impression, correlation, and expression are all required before a complete learning act occurs;
3. That project learning and systematic course learning are not irreconcilable antinomies but appropriate to different levels of maturity in the content involved;
4. That motivation follows the principle of functional autonomy, i.e., any act, once begun, is carried forward by its own incompleteness and future reference to other emerging goals without constant reliance upon the original impulse;
5. That interest depends upon some congruency between the activity or stimulus and the existing personality organization of the learner, and that without this condition, instruction should not be attempted if it seeks to be efficient;
6. That the process of gradual organization, the slow transition from a worse to a better state of affairs, from a bad to a good gestalt, is just as important for the psychology of meaningful learning as is the "sudden" flash of insight;
7. That the conditions of learning should provide opportunity for the continuous modification and change of the pattern of response;
8. That parts and wholes are never absolutes, for every whole is a part to some larger whole and every part is a whole to some smaller part;
9. That present learning is less dependent upon previous experience and the adequacy of earlier skills and information than upon the clarity, field properties, and excellence of organization of the learning material itself;
10. That the organism's purposes decide for it when it shall consider anything as learned;
11. That errors are usually testimony that the task is too severe for the learner's level of maturation and that material should be so graded or paced that a minimum of mistakes occur;
12. That creativity and originality are commoner among children and all persons than educators usually believe, and that a field viewpoint toward
spontaneous behavior and productivity can heighten the plane of performance in these areas;

13. That orientation, general education, and survey courses harmonize best with the nature of early mental development, but that specialized courses are justified when growth has proceeded sufficiently via differentiation;

14. That forgetting is an active process, probably involving the loss of an item's place in some memory framework;

15. That the more systematized our experiences are, the less likely we are to forget any of them;

16. That transfer is real and positive and has no limits save those imposed by the nature of the world in which the pertinent configurations are found, i.e., some patterns occur frequently and others rarely;

17. That much rather than many should be the pedagogue's curricular watchword;

18. That pupil choice reacts upon the fact that each human body is an independent energy system with its own special requirements and that such preference should dictate educational policy save where the organism itself or other organisms would clearly be damaged thereby;

19. That values and facts are both realities in human experience and intertwine in every situation we face;

20. That Matthew Arnold's eulogy of Sophocles as one who "saw life steadily and saw it whole" remains a valid picture of the end toward which personality growth should constantly be directed.11

In the field theory the following laws have been formulated. They may be stated as follows:

1. The law of field genesis states that wholes evolve as wholes and are primary.

2. The law of derived properties and law of determined action hold that the meanings and the behavior of the parts are determined by the wholes within which they occur.

3. The law of field properties hold that the whole is more than the sum of parts and that the properties of the field are not the same as the sum of the properties of the parts.

4. The law of individuation holds that parts come to have existence through the process of individuation, or differentiation, or structurization.

5. The law of configuration holds that a system of energy always functions as a unit and is able to adjust itself to a number of disturbing factors.

6. The law of least action states that the organism or energy system will take the most direct route to the relief of tension or the restoration of equilibrium.

7. The law of maximum work states that the organism or energy system will exert maximum effort to relieve tension or restore equilibrium.

Lewin, in a discussion of field theory, gives some of the following as conceptual dimensions in this theory of learning.

1. **Position** is a "special relation of regions." Examples are group belongingness of an individual, his occupational position, and involvement in an activity.

2. **Locomotion** refers to a "relation of positions at different times."

3. **Cognitive structure** might be regarded as having the same dimension as position because it refers to the relative position of different parts of a field. Structure does not refer, however, to the position of one point but to the position of a multitude of points or regions.

4. **Force** or "tendency to locomotion" has conceptually a different character from actual locomotion, although locomotion is one of the symptoms (operational definition) for a constellation of forces where the resultant force is greater than zero.

5. **Goal.** This concept does not have the dimension of a force, in spite of the fact that there is a close relation between goals and forces. A goal has the conceptual dimension of a "force-field"—that is, of a distribution of forces in space. Goal (or in field-theoretical terminology, a positive valence) is a force field of a special structure, namely, a force field where all forces point toward the same region.

6. **Conflict** refers not to one force field but to the overlapping of at least two force fields.

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7. Fear may seem to have the same dimension as aversion. However, in most cases fear is related to the psychological future. It has to deal with some aspect of "time perspective." In this respect it is similar to concepts like hope, plan, expectation.

8. Power does not have the same dimension as psychological force. The concept of power refers to a "possibility of inducing forces" of a certain magnitude on another person.

9. Values. It is probably correct to say that values determine which types of activity have a positive and which have a negative valence for an individual in a given situation. In other words, values are not force fields but they "induce" force fields.13

Another principle of field theory, as given by Lewin, is that "Any behavior or any other change in a psychological field depends only upon the psychological field at that time." Also, the situation at a given time does not refer to a moment without time extension but to a certain time-period. A description of such a situation includes the relative position of the parts of the field at that time and the direction and the velocity of the changes going on at that time. The psychological past and future are simultaneous parts of the psychological field existing at a given time. "Habits" of a person have to be treated as parts of the present field. The explanation or prediction of any change in a certain area is the linkage of that change with the conditions of the field at the time.14

14 Ibid., pp. 45-59.
Lewin gave the following as characteristic of the field theory:

... the use of a constructive rather than a classificatory method; an interest in the dynamic aspects of events; a psychological approach; an analysis which starts with the situation as a whole, a distinction between systematic and historical problems, and a mathematical representation of the field.\(^{15}\)

Learning, according to Lewin, refers to a multitude of phenomena. The types of changes are as follows:

1. Learning as a change in cognitive structure (knowledge).
2. Learning as a change in motivation (learning to like or dislike).
3. Learning as a change in group belongingness or ideology.
4. Learning in the meaning of voluntary control of the body musculature.\(^{16}\)

Lewin also characterizes field theory as a method: a method of "analyzing causal relations and of building scientific constructs."\(^{17}\)

Behavior can be represented by the formula \(B = P(P, E)\).
It means that behavior of a person is a function of a person and the environment, with \(P\) and \(E\) interdependent variables.\(^{18}\)

In the light of the principles of which agreements have been reached by different schools of thought, it appears, therefore, that learning may be described as a process that is purposeful and active and goal-directed. It is a function of the total situation surrounding the child and involves

\(^{15}\)Ibid., p. 60.  
\(^{16}\)Ibid., p. 66.  
\(^{17}\)Ibid., p. 45.  
\(^{18}\)Ibid., p. 25.
Insight as well as seeming trial and error. In its highest forms, at least in human beings, learning is intelligent, a creative process, and not merely a mechanistic response to sensory stimuli. Learning affects the whole individual. It is not merely a case of individual sets of neurons and their connections cooperating when one learns, but rather a coordinated and unified pattern of response that occurs in the learner. Education is not a matter of conditioning the individual to a typical mode of reaction and of preparing him to meet fixed situations, but it involves the selection of the significant factors in a situation, ability to adjust to them and to respond in a meaningful way. Learning has as its highest objective the development in the individual of the power to meet new situations intelligently. Since in life the future never patterns itself completely upon the past, the necessity of adaptability, resourcefulness, initiative, and independence in meeting new situations becomes apparent. 19

General characteristics of learning are given as:

1. Learning is growth.
2. Learning is adjustment.
3. Learning is organized experience.
4. Learning is purposeful.
5. Learning is intelligent and creative.
6. Learning is active.
7. Learning is both individual and social.

8. Learning is a product of the environment.
9. True learning affects the conduct of the learner.

In summarizing this chapter it is proposed that the field theory of learning be emphasized; that it is a more adequate theory than the others in the light of present-day knowledge. The thirty psychological guides, given below, are guides which can be used to put the theory into practice.

1. No one learns without feeling some urge to learn. It may be fear, need, inborn drive, curiosity, mystery, challenge, importance, or personal attachment -- or any other motivating force. The force has to be there. And the more the force wells up out of the person himself, the more the person will learn of his own accord.

2. What a person learns is influenced directly by his surroundings. If you want a person to learn something, make that thing a part of his environment, so that he may see it, live with it, be influenced by it.

3. A person learns most quickly and lastingly what has meaning for him. The pupils do not always see the meanings the teacher sees. An act takes on meaning from its outcome -- what the act produces. To produce a thing he wants or can see the value of, a person is likely to master the skill necessary.

4. When an organism is ready to act, it is painful for it not to act; and when an organism is not ready to act, it is painful for it to act. This means that some time must be spent in preparing learners to learn, that physical action is as much a part of school as mental action.

5. Individuals differ in all sorts of ways. When you get a group of people together to do anything, some will be better than others. It is easy to see that some people are taller than others, less easy to see that in the dozens of abilities that relate to success in learning any class will show a vast range of differences.

6. Security and success are the soil and climate for growth. No one can learn well when he does not belong -- any more than a plant can grow without root in the soil. No one can succeed on failure.

20Ibid., pp. 25-29.
7. All learning occurs through attempts to satisfy needs. What people do, consciously or not, they do because of need. And as they do, they learn what to do to satisfy need.

8. Emotional tension decreases efficiency in learning. Before the skills and facts of teaching come friendliness, security, acceptance, belief in success. Without these, tensions are produced. Constant, monotonous attention to any one thing is also a producer of tension.


10. Interest is an indicator of growth. We do not teach to get interest; but if interest is not present, the teaching is not prospering.

11. Interest is a source of power in motivating learning. When you are interested in a thing you are in it and feel a part of it. A teacher who does not hook his teaching to whatever pupils feel they are already a part of is not making the greatest use of the powers he has at his command.

12. What gives satisfaction tends to be repeated; what is annoying tends to be avoided. Practice makes perfect only when it is the right kind of practice. Learning is efficient if the pupil tries to master what fits his abilities and what gives him satisfaction.

13. The best way to learn a part in life is to play that part. This is the apprenticeship idea. Upon leaving school the parts in life which pupils are to play are not completely new to them if they have practiced those parts in the school.

14. Learning is more efficient and longer lasting when the conditions for it are real and life-like. Attitudes, habits, skills for life are best learned when the activities of school are like those of life. Methods of teaching should be as much as possible like those one uses in actual living.

15. Piecemeal learning is not efficient. We learn facts and skills best when we learn them in a pattern, not as isolated bits of subject matter. The facts and skills that we learn become part of a pattern when we learn them in relation to their use — as part of a project, job, or other enterprise.

16. You cannot train the mind like a muscle. There is no body of knowledge that is the key to "mind-training." There is no set of exercises that will "sharpen the wits" as a grindstone will sharpen
steel. This means: Do not isolate the things you want to teach from the real setting in which they belong.

17. A person learns by his own activity. He learns what he does; he gains insight as he learns to organize what he does. Within certain limits, the more extensive a learner's activity the greater will be his learning.

18. Abundant, realistic practice contributes to learning. Learners need much practice in the many intellectual, creative, and social acts which we want them to master.

19. Participation enhances learning. Participation is essential to any complex learning. Complete participation is important, from planning to checking the results.

20. Firsthand experience makes for lasting and more complete learning. There is a difference between reading and hearing about something secondhand and the kind of knowledge and insight that come from firsthand experience.

21. General behavior is controlled by emotions as well as by intellect. Far more than a place to train only the mind, the modern school is concerned with training the emotions also.

22. Unused talents contribute to personal maladjustment. Not only are unused talents a waste to society; they form a core of dissatisfaction in the individual. Frustrated talent can lead to many kinds of neurotic symptoms.

23. You start to grow from where you are and not from some artificial starting point. It is unrealistic to assume that pupils can move through the grades of school like taking the steps on a ladder, jumping from step to step. It is impossible to move a pupil on from some point or grade standard that he has not yet achieved.

24. Growth is a steady, continuous process, and different individuals grow at different rates. It is impossible for a class of first-graders to move along together until they come to the twelfth grade. Each individual learns, but at his own rate. His growth is steady; he does not leap from grade to grade.

25. It is impossible to learn one thing at a time. It is impossible to turn everything else off while learning two times two. The learner as a whole responds to his setting as a whole and takes in many things beside two times two. Learning by problems, topics, and projects, replacing learning by bits, makes capital of this fact.
26. Learning is reinforced when two or more senses are used at the same time. One-cylinder learning sticks only to listening. Pupils learn better if they see with the eye, touch with the hands, hear with the ears, feel with the muscles, at the same time they are seeing with the mind's eye.

27. The average pupil is largely a myth. Grade standards are an average which every pupil is expected to achieve. But any standard that you can set will be too difficult for some, too easy for others. The achievement of a group scatters over a wide range — only a few are at the "average" point. A far greater number are scattered above and below the average.

28. If you want a certain result, teach it directly. Your pupils are not born with the skills you want them to have; nor can we always depend upon other teachers to teach pupils to our satisfaction. If your pupils do not know what you want them to know, the most efficient thing to do is to teach it to them.

29. Children develop in terms of all the influences which affect them. Not only the 180 days of school but the 365 days of living in school, home, and community go to make a person what he becomes.

30. It has been said that a person learns more in the first three years of his life than in all the years afterward. However this may be, it is certain that the early home life is vastly important. Accordingly, to improve its effectiveness a school must do what it can to improve the educational setting of the home.

21 Paul R. Mort and William S. Vincent, Modern Educational Practice, pp. 401-404.
CHAPTER IV

TEXAS PRACTICES

This chapter deals with the course in general mathematics as practiced in Texas. The purpose is to see how well it follows the course as developed in this study which is based on the needs of youth and the field theory of learning.

First, an examination of the current textbooks in use as approved by the Texas Education Agency will be made. The reason for this is that the textbook is used by many schools as a guide, and in many other schools is the course of study.

In the textbook, Useful Mathematics by Flora M. Dunn and others, the following observations are made. According to the authors, this textbook was devised because the traditional courses taught in high school, and taught in a traditional way, do not meet the needs or ability of large numbers of students in our secondary schools. Algebra would be studied if any use for it could be found, or any possibility of understanding it. Students enjoy constructing and computing facts about geometric figures, but they are not developed mentally to master the abstract reasoning based on geometric facts. Students rejoice in concrete things; they love to work with their hands; they are seldom bored by constant
repetition of doing things in which they excel, but they are baffled and disturbed by abstractions.¹

In this highly mechanized age it is impossible to escape meeting situations which are best solved by a working knowledge of mathematics. Topics within the experience of the pupil are not only useful but necessary for him in his life in school as well as in his life after school age.

The selection of topics are chosen carefully showing uses of arithmetic, algebra, and geometry in other school subjects, in life situations, in business, in shops, and in industry.

Computational arithmetic is stressed because pupils from the eighth grade are not good in it. The why of each process, instead of merely the how, is presented. Accuracy and checking are emphasized; each topic is motivated.

The algebra is built upon the equation and the formula. An attempt is made to show their value as mathematical tools and to develop in the pupil skill in using them; algebra is therefore scattered throughout the book, and presented in steps of small gradations of difficulty and introduced at points where the pupil can recognize that the use of algebra is an advantage. Algebraic language and symbols are carefully explained, and ample drill on the order of fundamental operations is afforded; much simple, carefully graded work on equations and formulas is included.

¹Flora M. Dunn and others, Useful Mathematics, pp. iii-vi.
The capabilities and limitations of the pupils were kept in mind and much experimentation was done. The material which proved useful and interesting was put in the book under discussion. It was found even after homogeneous grouping that classes still vary in capacity due to mental differences, and also differences in size of the group. The average class may not be able to master all the material in the text; supplementary topics are provided for the more ambitious classes and students.

A conversational style has been used and vocabulary has been limited to that of the pupils for whom the text was designed. It has been found a good teaching device to have a pupil read aloud much of the explanatory material.

As to content of the book, the following observations are made. The first chapter is called "Why We Study Mathematics." Several examples of use in everyday living are given. The textbook is then divided into two parts for the first and second semesters of work. The chapters are as follows:

**Part 1.**
- Chapter I. Whole Numbers
- Chapter II. Circles
- Chapter III. Common Fractions
- Chapter IV. Angles
- Chapter V. Decimal Fractions
- Chapter VI. Line Segments
- Chapter VII. Triangles

**Part 2.**
- Chapter VIII. Percentage
- Chapter IX. Using Letters for Formulas
- Chapter X. Equations
- Chapter XI. The Formula
Chapter XII. Ratio and Proportion
Chapter XIII. Graphing
Chapter XIV. Scale Drawing
Chapter XV. Measuring Perimeters, Areas and Volume

Supplementary Chapters
1. Formulas of Electricity
2. Lumber Measure
3. Machines

The organization of a chapter in *Useful Mathematics* is usually as follows:

1. Explanation of a mathematical concept.
2. Examples of work.
3. Some sort of game for practice in fundamentals.
4. Some stated problems involving life situations.
5. A review exercise.
6. A test.

In short we may say the course is organized along traditional lines. The emphasis is on learning mathematical processes. Traditional drill is used largely, with a game used as motivation sometimes. Unrelated stated problems involving life situations are sometimes used. Each chapter is put into a separate category as whole numbers, fractions, decimal fractions, etc. In other words each process is learned and used without relation to other mathematical processes. The traditional test is given at the end of a chapter.

\[^{2}\text{Ibid., p. vi.}\]
\[^{3}\text{Ibid.}\]
A second textbook used in Texas for the course of general mathematics is *Mathematics in Daily Use* by Walter W. Hart, Cottell Gregory, and Veryl Schult. It states that all pupils in the secondary school are not required to study algebra, but every pupil in high school should be required to study mathematics. A specially designed course, suitable to those students for whom algebra will not be a profitable study or for those who will study algebra later, is desired. This course is the general mathematics course.4

The primary purposes of this textbook are to produce appreciation of the presence of quantitative problems in daily life and to develop the understandings and skills that are needed to solve them. These are mostly in arithmetic but further important aims are developed of broadened mathematical knowledge and interest, conviction of ability to master mathematics, and a desire to pursue other courses in it.

The purposes are accomplished through teaching fundamentals of arithmetic, limited instruction about graphs, formulas, and equations, by use of the foregoing tools in solving real problems that arise in daily life, by its manner of organizing the instruction about these tools and their use, and by a brief exploratory introduction to a few topics from algebra.

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The first four chapters are devoted to integers, fractions, including decimals, measurement, and percentage. Each chapter is introduced by a motivating preview and an informal test. Instruction about necessary knowledge and skills then follows. Practice examples to develop mastery of skills and problems to develop desirable understanding and appreciation are given. Chapter V is devoted to graphs and emphasizes interpretation of graphs. Mastery of fundamentals are maintained and extended in Chapter VI to Chapter IX by use of them in solving real quantitative problems, formal review and tests, and chapter tests. Organization of problem material in Chapter VI to Chapter IX is suggested by the Cardinal Principles of Secondary Education: namely, by problem materials relating to activities of leisure time, home life, community life, or business life. It therefore develops desirable knowledge, appreciations, and attitudes in the four important activities in which people engage. These are not a substitute for accomplishment in algebra and geometry that are desirable and even necessary for many pupils.

Techniques of teaching and bookmaking have received attention as follows:

(a) One process at a time is taught.
(b) The vocabulary, sentence structure, and paragraphing are adapted to the pupils.
(c) Various forms of motivation are employed.
(d) The instruction is inductive and very complete.

Ibid., p. ii.
(e) High standards of form in the solution of problems are set by the illustrative solutions in the text.

(f) An abundance of well-graded examples and problems provide the practice needed to develop mastery of each new idea or process.

(g) Diagnostic tests (usually informal) precede instruction; mastery tests, untimed, round out each chapter; and review tests aid in maintaining mastery.

(h) A variety of sizes and styles of type distribute emphasis over instruction, new vocabulary, rules, notes, etc.

(i) There is a page-unit organization that facilitates reading the text; that is, each new topic appears on one page, or, usually, on a pair of adjoining pages.

(j) There is an adequate number of original line drawings that are related to the subject matter of the page on which they appear. These, of course, increase the interest of the pupils.

(k) Diagrams appear wherever they are needed.

(l) A series of brief tests, necessary tables, and an index appear at the back of the book.

The contents of the course are as follows:

I. Integers -- Home Life Problems.
II. Fractions -- Home and Business Problems.
III. Measurement -- Vocational Problems.
IV. Percentage -- Business Problems.
V. Graphs -- Pictured Number Relations.
VI. Leisure Time Problems.
VII. Safe-Guarding Family Income.
VIII. Community Activities.
IX. Business Transactions.
X. Introduction to Algebra.

This book has many examples for mastery of mathematical processes; it has a large amount of drill. It uses a large number of stated problems which are not related in an exercise. The explanatory problem given first depicts a life situation, but an experience unit is not developed. From

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6 Ibid., p. iii.  
7 Ibid., pp. iii-vii.
the headings of some of the units it might be supposed that only integers are used, while in another it might be sup- posed that only fractions are used in that unit, etc.

A third textbook is by Van Tuyll which is titled Mathematics At Work. The author in presenting this book says that the present day trend is away from formal mathematics toward what may be called cultural mathematics. That is, the emphasis on the fundamentals of arithmetic is combined with a general, or cultural, study of algebra, geometry, and trigonometry. He explains that the book has been written to meet the needs of students who prefer such a cultural course to the study of the usual formal mathematics. This text- book's features are:

1. The text is divided into two parts, each of which contains sufficient work for half a year.

2. The first part of the text is in lesson units, each lesson stressing one topic, with review and drill on topics of preceding lessons.

3. The lesson units are arranged to serve as helpful guides to lesson assignments. If any class does not need a particular lesson or topic, it may be omitted and the work may be continued in succeeding lessons.

4. The first lessons are of such a nature as to lead the pupil into a study of the subject without the feeling that he is repeating the work of the elementary school. This overcomes at the outset a natural reluctance on the part of the pupil to a further study of arithmetic.

5. Diagnostic tests and remedial drills are given through Part I.

6. The mode of presenting the various topics, operations, and calculations attracts and holds the interest of the pupils. An abundance of drill material is provided.

George H. Van Tuyll, Mathematics At Work, p. v.
The purpose of Part I is to develop accuracy and skill in handling the fundamental operations of arithmetic. The applications cover such topics as family budgets, keeping cash, banks, and personal accounts, reading gas and electric meters, finding the cost of freight, express, and parcel-post packages, and computing simple interest. Part II provides further problems to which operations of Part I may be applied and furnishes the subject matter for a cultural study of the elementary principles of algebra, geometry, and trigonometry. The chapter on algebra presents fundamentals of positive and negative literal quantities. The use of the equation in the solution of problems is explained and illustrated. Some of the simpler principles of geometry are presented through "learning by doing." Geometric constructions are developed through pupil activity. Algebraic expression of geometric truths is applied to numerous formulas. The chapter on trigonometry gives the meaning and use of the tangent, sine, and cosine. These relations are applied to the solution of problems involving right triangles. In brief, the book furnishes essential drill in fundamentals of arithmetic, and at the same time provides that cultural study of algebra, geometry, and trigonometry so necessary to a general education.9

The contents of the book are as follows:

Part I  (1) Family -- money problems

9Ibid., p. vii.
(2) Aliquot Parts -- Business uses
(3) Other problems using aliquot parts
(4) Interest
(5) Fractions
(6) Decimal fractions
(7) Rates -- business

Part II

I. Algebra -- notation, fundamental operations, equations
II. Ratio and proportion -- problems
III. Graphs -- line, bar, circle, profile, equation
IV. Percentage
V. Interest
VI. Taxes
VII. Insurance
VIII. Investment
IX. Partnership
X. Miscellaneous problems
XI. Review tests
XII. Geometry -- explanations, constructions, problems
XIII. Trigonometry -- tangent, sine, cosine, table
XIV. Denominate Numbers -- English measure, the metric system

From the foregoing discussion it is seen that this text follows the traditional course in mathematics. There is an abundance of drill exercises, aliquot parts to be memorized, and a repetition of the same type of problems on a graduated difficulty basis. There are a few life situations given, but there is no experience unit development. The daily lesson is the basis for instruction.

A fourth textbook used in Texas is Mathematics We Use by Brueckner, Grossnickle, and Bedford. Mathematics used as a tool is evident in this book. The airplane is emphasized as ushering in a new age or new way of life. The

\[\text{Ibid., p. viii.}\]
mathematics used is the same as usual but the setting for the use of the mathematics is changed. Applications are presented first. Arithmetic already used in preceding grades, but which have not been mastered, are used. Algebra, geometry, and the graph are introduced by an applied present-day use. The method used in the text is an experience first, followed by mathematics as a tool to understand and give meaning to the experience. The book reflects the social changes to a new way of life.11

The three main objectives are:

(1) An extension of instruction in arithmetic beyond grade 8.
(2) An orientation to algebra, geometry, and trigonometry.
(3) An opportunity for growth in quantitative thinking by the inclusion of units dealing with significant social problems. These problems arise from such changes as the universal use of aircraft, the amazing developments of chemistry, the dehydration of food products, the use of synthetics.12

The author says:

...mastery of arithmetic and of all mathematical processes is the result of continuous experiences, that practice with one process does not mean its mastery at that one time. This each book is based upon a continued practice in the processes which are fundamental, with each process extended in scope as the student reaches a more advanced year.13

Disuse means that the process will be forgotten. Repetition of fundamental processes for review purposes, and for

11. Leo J. Brueckner, Foster E. Grossnickle, and Fred L. Bedford, *Mathematics We Use*, p. i.
those who have not had them before, are used extensively in the book. The spiral treatment of topics to the element of difficulty is used. The tools of algebra used are the formula, the equation, the graph, and extension of the number system so that further work can be done in mathematics, and the elementary sciences. Trigonometry is used with the tangent ratio and applications to indirect measurement. The book has an inventory test at the beginning of the year; it has diagnostic tests in basic processes. Each chapter includes a review of material covered, followed by a chapter test.

Beginning with the third chapter, progress tests are included. Visual aid includes pictures, drawings, charts, and graphs. The table of contents is as follows:

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<tr>
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<td>Indirect Measurements</td>
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<td>XIII</td>
<td>Taxes</td>
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<tr>
<td>XIV</td>
<td>More About Algebra</td>
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</table>

From the above discussion of this book it is seen that the experience unit is used; also the subject-matter unit

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14 Ibid., p. iii.
is used. Mathematics is generally used in this book as a tool to solve and give meaning to life situations.

A fifth adopted textbook is *Mathematics for Everyday Affairs* by Virgil C. Mallory. This textbook, according to the author, was prepared for that large body of students who are interested and need that mathematics which will fit them for useful citizenship. Topics which are socially useful have been selected mainly for the fields of arithmetic and intuitive geometry. In addition to such topics, the more elementary parts of algebra and trigonometry of the right triangle have been included.

The four main objectives which guided the author in preparing the textbook are as follows:

a. The material must be socially useful.

b. The explanations must be simple and direct.

c. Appeal must be made to the pupil's interest.

d. Every possible opportunity must be given for pupil expression and pupil activity. 15

In the selection, presentation, and illustration of the textual material the following features are used: The problems are set in socially useful situations and are closely related to the familiar surroundings of the student in play, work, school, and home. Special attention has been given to the vocabulary used. The book is illustrated with photographs and drawings which show the uses and applications of

mathematics. Discussions, with questions, are used to guide the student in an interpretation of the quantitative aspects of his daily life. There are scattered throughout the textbook twenty diagnostic tests to discover specific weaknesses of the student. The drill work is placed in the last chapter of the book in order that new and interesting topics can be taken up at the beginning of the course.

For maintenance of mastery, fifteen sets of exercises (Keeping Up With Arithmetic), besides the diagnostic tests, are placed in the book to cover skills in arithmetic. In addition there are tests at the end of each chapter and cumulative tests at frequent intervals.

Pupils are encouraged in self-reliance by self-teaching explanations. Gradations of ability are provided for by simple exercises above a line, and more difficult ones below it; starred exercises are for honor work. Activity is provided in drawing, measurement, graphical solution of problems, and other ways. 16

Contents of the textbook are as follows:

Chapter I. Why Study Mathematics
Chapter II. The Need for Measurement
Chapter III. Scale Drawings
Chapter IV. Telling Stories with Graphs
Chapter V. The Meaning of Per Cent
Chapter VI. Geometry
Chapter VII. Areas, Volumes, Formulas
Chapter VIII. How Algebra Is Used
Chapter IX. A New Kind of Number
Chapter X. How Per Cent Is Used

16 Ibid., p. iv.
Chapter XI. Mathematics of the Home
Chapter XII. Mathematics of the Community
Chapter XIII. Keeping Accounts and Saving Money
Chapter XIV. Investing Money
Chapter XV. Indirect Measurement
Chapter XVI. Practice in Computation
  Tables of Weights and Measures
  How to Make a Simple Transit
  Interest Charge Formula
  Answers to Exercises in Chapter XVI.
  Compound Interest Tables.\textsuperscript{17}

In the textbook by Mallory, life situations are used to an extent as shown by the chapter headings. The drills are of the conventional type for practice in mastery of mathematical processes. An explanation of the mathematics to be used is generally given first; the life situation then follows. The chapters on geometry and algebra are subject-matter units. The last of each unit is devoted to practical problems, using the mathematics studied beforehand to solve them.

In a report from the Austin schools, the committee on mathematics gave the problem as being:

\ldots to show how through the medium of mathematics the social, emotional, physical, and mental growth of the child can be developed. The program for the high school should correlate mathematics with business, industry, and daily living as a consumer, in such a way as to give him the mathematical competence that is necessary for him to take his place in our democratic society.\textsuperscript{18}

\textsuperscript{17} \textit{Ibid.}, p. vii.

The general objectives of the mathematical program are stated thus:

1. To develop the habit of estimating results.
2. To develop the habit of neat, careful, accurate work.
3. To develop the habit of carefully checking work done.
4. To have the students acquire the essentials of mathematical computation.
5. To bring boys and girls to realize that mathematics is a vital part of everyday life by stressing the social implications of problems rather than computations alone.  

The use of the problem instead of a unit of experience of the child is used as the basis in this course of study.

In the Dallas (Texas) Public Schools, the course of study states that the general mathematics course should stress social mathematics and applied mathematics in everyday life; that a course of this type fills the needs of the pupils far better than the traditional first course in algebra. The pupils are directed:

1. To develop a favorable attitude toward mathematics and the study of it.
2. To learn how mathematics functions in everyday life.
3. To develop a facility in handling numbers and the ability to think quantitatively.
4. To learn the importance of the many by-products resulting from the use of mathematical skills.

Learning the processes of mathematics seems to be emphasized, with applications to everyday affairs, in this course.

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In a bulletin put out by the State Department of Education on Teaching Mathematics, the course of study is stated as being prepared with the unit of understanding as a basis of organization. The units are developed on the basis of areas of life experiences in which quantitative thinking is used. A conscious effort was made to relate mathematics and the other experiences of the curriculum with the idea that both mathematics and the other experiences would become more meaningful and more educative to the child. The activities under each unit were so arranged that the child is first introduced to the unit by experiences with which he is already familiar. Drill work was not eliminated but comes in its proper place; that is, it comes only after meanings have been developed. The teaching procedures are given to help the teacher develop the units and to show how each unit contributes to the basic concepts and principles of mathematics. Mathematics should be conceived of as a mode of thinking, as a tool for thinking, and as the ability to think about the social situations of life in quantitative terms. The child should be a part of the whole process. The students should participate in the planning, the purposing, and the executing of the unit of work. He should understand the purpose of the whole course and of each unit as it contributes to his ability to meet life situations more effectively. Conscious effort should be made to develop habits of accuracy, neatness, and estimating and checking results. Development of self-
criticism and self-evaluation should be stressed. The course should be planned around units of work.21

A suggested subject-matter chart is given as follows:

1. Continuation of whole numbers, common fractions, mixed numbers, complex fractions, and decimals as in eighth year with a little extension of difficulty and more stress on meaning and accuracy.
2. Continuation of the three problems of percentage and their application.
3. The use of the formula and equation in the solution of practical problems of life.
4. Continuation of ratio and proportion.
5. Indirect measurement.
6. Simple geometric concepts with an idea of the nature of a proof.
7. Extensive use of graphs.
8. Finding mean, mode, and average.
10. Some uses of positive and negative numbers.22

The units of work given for the course are the following:

Unit 2. Everyday Problems.
Unit 3. Figures that Tell the Truth (statistical data).
Unit 4. Enjoying the Collection of Data.
Unit 5. A Brief Survey of Algebra.23

The above was given for the ninth grade in a junior high school. A two-year course in general mathematics is suggested for the eighth and ninth years of the high school. It suggests arithmetic, algebra, and geometry be included in the ninth year. It gives the following topical suggestions:

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22 Ibid., p. 16.
23 Ibid., pp. 46-59.
The Nature and Character of Algebraic Numbers

The language of algebra
Fundamental operations
Special products
Simple factoring

Functional Relationships Involved in Fractions
and Fractional Equations

Functional Relationships Involved in Linear Systems

Functional Relationships Involved in Ratio, Proportion, and Variation

Use of Tables and Other Mechanical Devices by the Consumer

Sliderule
Adding machine
Multiplier
Micrometer
Squares and cubes
Square root
Reciprocals
Averages (statistics)
Logarithms
Trigonometric functions
Weights and measures
Interest (simple and compound)
Installment buying
Insurance
Sinking fund
Mortgages
Stocks and Bonds
Commission
Taxation

The Nature of Plane Geometry

Some Simple Propositions

Fundamental construction
Congruent triangles
Isosceles triangles
Parallel lines
Angles in a triangle

An Insight into Three Dimensions or, Geometry and the World in Which We Live

Basic principles of the secondary courses in mathematics are given as follows:

1. Secondary mathematics should be approached as a series of meaningful life experiences involving quantitative thinking.

Ibid., p. 78.
2. Necessary explanations and drill may be brought in whenever needed in the development of technique for the solution of specific problem situations.

3. Explanations should be dynamic, showing the functional dependence of one variable for its value upon the values of other independent variables.

4. General concepts are best acquired through actual observation of the common elements in a series of special cases or numerical examples.

5. The mathematics classroom should be a well-equipped laboratory.

6. Testing should be for the purpose of directing further teaching and reteaching. Self-direction and evaluation should be encouraged. The results of tests should be recorded in terms of each pupil's own achievement, without regard to any fixed amount or nature of subject matter.

7. Evaluation includes more than testing.25

Criteria to be Used in a Course of General Mathematics

In the light of Chapter II on the Needs of Youth and Chapter III on the Psychology of Learning, it is proposed that the following criteria be used in a course in general mathematics for the secondary school.

Criterion I. Is the role of living in the home emphasized in the course of general mathematics?

Criterion II. Is the role of community living emphasized in the course of general mathematics?

Criterion III. Is the role of vocational living emphasized in the course of general mathematics?

Criterion IV. Is the role of recreational living emphasized in the course of general mathematics?

25 Ibid., pp. 76-77.
Criterion VI. Does the learning situation have meaning for the individual student?

Criterion VII. Is the thing to be learned made a part of the student's environment?

Criterion VIII. In the learning situation are the conditions real and life-like?

Criterion IX. Are two or more senses used at one time so that the learning is reinforced?

Criterion X. Is provision made for learning through the student's own activity?

Criterion XI. Are physical defects taken into consideration in the learning situation?

Criterion XII. Is interest used as a source of power in motivating learning?

Criterion XIII. Is provision made for pupils to master what fits their abilities and what gives them satisfaction?

Criterion XIV. Is provision made for special talents of a pupil?

Criterion XV. Is learning by wholes emphasized?

Criterion XVI. Is pupil growth considered as steady, continuous, and that each pupil has his own rate of growth?

Criterion XVII. After insight and interest, is provision made for practice so that there will be mastery of skills?
Criterion XVIII. Is there a motivating force which comes from within the pupil himself so that he will learn of his own accord?

Figure 5 shows how much the criteria developed in this study has been followed by the textbooks and the several courses of study. The textbooks are labeled as Nos. 1, 2, 3, 4, and 5. The order is the same as the discussion of each. The courses of study are: A, Austin; B, Dallas; S, State Department.

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Fig. 5—Correlation of criteria, textbooks and courses of study.

The numbers 1, 2, 3, 4, and 5 are used in checking. 5 means that the criteria is used all the time. 4 means that the criteria is used most of the time.
3 means that the criterion is used approximately one half of the time.

2 means that the criterion is used less than one half of the time.

1 means that the criterion is used very little if any.
CHAPTER V

FINDINGS, CONCLUSIONS, RECOMMENDATIONS

Findings

The findings of this study as to the needs of youth and an adequate theory of learning are as follows:

1. The Needs of Youth are to be approached with the idea that they can be achieved through emphasizing the apparent major role of Living in the Home.

2. The Needs of Youth are to be approached with the idea that they can be achieved through emphasizing the apparent major role of Community Living.

3. The Needs of Youth are to be approached with the idea that they can be achieved through emphasizing the apparent major role of Vocational Living.

4. The Needs of Youth are to be approached with the idea that they can be achieved through emphasizing the apparent major role of Recreational Living.

5. An adequate theory of learning through which better learning takes place is the field theory.

6. The field theory emphasizes learning by wholes.

7. It emphasizes the learning organism as being a product of the organism and its environment, the two being interdependent.
8. Learning takes place when there is an urge to learn, especially when the force comes from within the person himself.

9. Learning takes place better when the thing to be learned is a part of the person's environment.

10. Individuals differ in all sorts of ways; therefore, as a group there will be differences in ability to learn a particular thing.

11. Security and success are necessary for growth of the individual.

12. For efficiency of learning, it is necessary that emotional tensions be kept at a reasonable level.


14. Interest is a source of power in motivating learning.

15. Learning is efficient if a person tries to master what fits his abilities and what gives him satisfaction.

16. Learning is more efficient if the conditions for it are real and life-like.

17. A person learns by his own activity.

18. Special talents should be used by a person in his learning.

19. Growth is steady and continuous, and different persons have different rates of growth.

20. Practice, after insight and meaning, makes for mastery of skills.

21. Learning is reinforced when several senses are used at the same time.
Conclusions

Conclusions in regard to the courses of study and the adopted textbooks in meeting the needs of youth in the course of general mathematics are as follows:

1. Generally speaking, the courses of study and the adopted textbooks do not meet the needs of youth as developed in this study. Several chapters at the most are devoted to such development. Of the four roles of living, family living and community living are emphasized; vocational living and recreational living receive scant attention.

2. Textbooks numbered 4 and 5 give the most attention to needs and the field psychology of learning. Of the courses of study, the State Department of Education gives the most attention to such development of the course of general mathematics.

3. The experience unit or life situation is adhered to most by textbook number 4, and the State Department of Education course of study.

4. The traditional or atomistic theory of learning is adhered to in textbooks numbered 1, 2, and 3, and in arrangement of material by textbook number 5.

5. The use of mathematics as a tool of learning is used most in textbook number 4. The course of study by the State Department of Education seems to have the same idea.
6. The use of arithmetic as a tool to be used in solving and giving meaning to life situations is more evident than in the other branches of mathematics.

7. In textbook number 4, geometry is developed and used as a tool of learning.

8. In the main, algebra, geometry, and trigonometry are developed merely as an orientation to those branches of mathematics with the view that they will be studied fully in subsequent courses. In other words, the meaning and processes of those branches are stressed, with little application or none to life situations.

Recommendations

If the needs of youth and the field theory of learning are emphasized in a course of general mathematics it seems that the following recommendations may be advocated:

1. The course may be developed by emphasizing the apparent major roles of

   (a) Living in the Home
   (b) Community Living
   (c) Vocational Living
   (d) Recreational Living

2. The principles of developing these ideas should be in the form of experience units.

3. The textbooks and courses of study may be used as materials and guides in development of the course.
4. The subject matter lines need not be adhered to. For example, a life situation may need whole numbers, fractions, geometry, etc., to give meaning to the situation.

5. The mathematical processes should be mastered when there is a need for them.

6. The mathematics needed should be conceived of as a tool in which the experience can be brought to completion satisfactorily.
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