THE USE OF DIRECTED STUDY AS AN AID IN IMPROVING MATHEMATICS INSTRUCTION IN THE SECONDARY SCHOOLS

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PREFACE

Much work is being done today in an effort to improve mathematics instruction in the secondary schools. However, this work is being done primarily in the areas of curriculum improvement and teacher preparation in subject matter. There is still another area where there is room for much improvement in our efforts to improve mathematics instruction and that is the area of teaching methods.

This study was undertaken in an attempt to present the concept of the directed study plan to the mathematics teacher as an aid in improving mathematics instruction in the secondary schools. This concept is more than the ambiguous term directed study usually implies. We wish to define a specific type of directed study, its implementation and usage, and some of its advantages and disadvantages.

It is impossible for a report of this type to be as comprehensive a study as is needed, and there is much research still to be done in this area, particularly in the area of statistical verification of results. But it is our hope that what we have done in this report will be of some help to the mathematics teacher in the common effort of continually improving mathematics instruction.

Indebtedness is acknowledged to Dr. James H. Zant for his valuable guidance and assistance in this study.

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CHAPTER I

INTRODUCTION

Within the past few years there has been a great deal of attention centered on the subject of mathematics and the improvement of mathematics instruction in the secondary schools.

Mathematics is a basic element in the whole program of revised science education. Education must meet the challenge of our breath-taking movement into a new technological era. We need a well trained citizenry, but we need, perhaps more, an ample supply of high caliber scientists, mathematicians, and engineers.[1]

Two trends are of significance in our educational systems in order to meet this basic need. This represents the revolution in mathematical teaching. These trends are acceleration and modernization of content and point of view.[2]

Generally acceleration in the secondary schools is taking place independently of any curriculum changes. However, both could take place simultaneously.

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[1]James H. Zant, Address to the Second Annual Conference on Recent Developments in Mathematics and the Sciences. Sponsored in cooperation with the Oklahoma Curriculum Improvement Commission by the College of Arts and Sciences of the Oklahoma State University in Stillwater, Oklahoma, February 6, 1960.

[2]Zant.

There are several groups at work on curriculum changes, and already their work is starting to show up in the curriculum offerings. A few of these groups are The School Mathematics Study Group, The University of Illinois Committee on School Mathematics, The Ball State Experimental Program in Geometry and Algebra, and The Commission on Mathematics of the College Entrance Examination Board. There are also others, plus the work that is being done on an individual basis.

Also, much work is being done in order for the teachers to be better professionally prepared to teach the new curriculum. Prominent in this area are the National Science Foundation Academic Year and Summer Institute programs on a nation-wide basis.

All this work has been done in an effort to improve mathematics teaching. The work has been largely concerned with curriculum improvement and teacher preparation. However, there is an area that should not be overlooked in the programs to improve mathematics instruction. That is the area of teaching methods.

Under the traditional recitation plan, students were expected to plan their own studying, usually during periods set aside for that purpose. Some weaknesses of this plan were failure to teach students good methods of study, failure of students to learn good study methods on their own, plus the objections to study halls that are listed in chapter three of this report. It is hard also to study

at home since changed social conditions have so altered home life that fewer students now have satisfactory conditions for home study.[3]

The success of any program in education should be measured by the quality of the end-product; the student. It is the contention of the author that the use of a directed study period in the secondary mathematics class will be of definite aid to the teacher in developing a student's mathematical ability.

There has been much literature written about directed study, supervised study, directed learning, supervised learning, etc., and their various types. We take the position that Shreve took in regarding the terms directed study, supervised study, etc. as being synonymous.[4]

There exist many forms of directed study. A few of these are the lengthened period, full time study coach, conference periods, study hall, double period, divided period, and some others. The divided period plan (assignment, study, recitation) is advocated by Hall-Quest, Erickson, Timpson, Inglis, Farham, Breed, Nutt, and McGregor. This seems to be the best idea established.[5]

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[3]Thomas M. Risk, Principles and Practices of Teaching in Secondary Schools, (3rd ed. New York, 1958), pp. 216-217.

[4]Francis Shreve, Supervised Study Plan of Teaching, (New York, 1927), p. 56.

[5]Ibid., p. 50.

In this paper, the divided period plan will be the type referred to as directed study. Other reasons as set forth in chapters two and three will clarify the choice further.

There has been some confusion as to the meaning of directed study. In fact, this was one of the early objections to directed study and a reason given for the failure of directed study to produce statistically measurable results.[6] However, in this paper we will specifically define directed study as it is used as the subject of this paper.

Directed study is a scheme of instruction in which the class period is divided into three parts: (1) assignment, (2) silent study with the teacher giving individual instruction where needed, referred to as the directed study period, and (3) lecture and recitation.[7] (However, not necessarily always in this order.) It involves the direction of those activities of students concerned primarily with the solution of a problem or the attainment of knowledge or understanding and abilities through planned effort on the part of the learners.[8]

No claims are made for directed study as a super teaching device that solves all of one's teaching troubles. In studying the advantages and disadvantages of general teaching methods, it is found that there exists no single method

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[6]Ibid., p. 70.

[7]Ibid., p. 50.

[8]Risk, p. 243.

which fits all solutions.[9] However, it is the contention of this discussion that directed study, properly conducted, will be of material help to the teacher and is an excellent teaching device to employ.

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[9]John S. Richardson, Science Teaching in Secondary Schools, (Englewood Cliffs, 1957), p. 165.

CHAPTER II

IMPLEMENTATION OF DIRECTED STUDY

Time Element

If the directed study plan of teaching is to work successfully at all, it will be necessary to administer it through differential techniques adapted to the needs of students of different degrees of ability.[1] Therefore we cannot establish a set rule. The time will depend on the topic being covered, what particular purpose the period is being used for, and the students.

When the study portion of the period is used for drill, the periods should generally be rather short.[2] However, for whatever purpose the directed study period is used, the teacher should be sure that preliminary developmental work has been clearly understood before students are allowed to begin their work. Directed study can play its part in the learning processes only if these preliminary instructions have been satisfactorily developed.[3]

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[1]Charles H. Butler and F. Lynwood Wren, The Teaching of Secondary Mathematics, (2nd ed. New York, 1951), p. 191.

[2]Ibid., p. 176.

[3]Ibid., p. 170.

One must also take into consideration the length of the class period. Hall-Quest recommends using one half of the class period for the directed study period.[4] The exact time distribution seems to be a matter that is not firmly fixed in length. However, there are many variable factors involved here and it appears that this is a matter best left to the judgment of the teacher. Most writers recommend that between one third to one half of the class period be alloted to the directed study period as a general rule.

However, the teacher should keep in mind that one of the causes of failure of directed study is the subordination of the period to formal recitation.[5]

Tendency to skip directed study for one or more periods and make up for it by devoting the entire class period to directed study should be avoided. Persistent regular study enhances the growth of interest in a subject and frequent short practice periods give better learning results than infrequent long ones.[6]

The implementation of a directed study program then, can be made by using the present school periods currently in use at one's school and dividing the period.

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[4]Alfred Hall-Quest, Supervised Study, (New York, 1922), pp. 131-135.

[5]Ralph K. Watkins, Techniques of Secondary School Teaching, (New York, 1958), p. 276.

[6]Max Meenes, Studying and Learning, (New York, 1954), pp. 10-12.

Role of the Teacher

The teacher must keep in mind that mathematics is not a general ability, and that a high level in one aspect of mathematics such as computative skill is no guarantee of a correspondingly high level in any other area of mathematics. In a balanced program all areas must be given consideration.[7]

Directed study should not be entirely reduced to an individual basis. It does attempt to combine the main advantages of individual instruction for those students who need it with economy of time and other advantages generally recognized as accruing to group instruction.[8]

The following suggestions have been found helpful to teachers in conducting directed study in mathematics:[9]

1. Be sure that preliminary work has been clearly understood before students are allowed to begin their work. Directed study can play its part in this process only if these preliminary understandings have been satisfactorily developed.
2. Precise, clear assignments should be made. The role of the assignment is very important in the directed study plan of teaching.

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[7]Leo J. Brueckner and Guy L. Bond, Diagnosis and Treatment of Learning Difficulties, (New York, 1955), pp. 194-195.

[8]Butler and Wren, p. 168.

[9]Ibid., pp. 168-170.

3. Be sure each student has the equipment which he will need for his work.
4. As soon as the period begins, make a rapid survey of the room. Check the students' initial progress.
5. If the survey indicates a large percentage of the students in trouble, stop all work and reteach this point. Then resume the directed study period.
6. If no general reteaching is needed, do corrections on an individual basis. Pass as quietly as possible about the room.
7. Spend no more time than is necessary with each student. Do not allow one student or a group of students to dominate your time at the expense of the rest of the class.
8. Establish with the students the idea that they should first try to work their way out of difficulty without asking for help if they can do so.
9. Train yourself to detect key logs in a student's mathematical log jams. These will be of two types, in general:
    a. Computational.
    b. Application of the theory.
10. An Atmosphere conducive to study should be maintained in the room.
11. Learn to spot the student in difficulty and the

lazy student. Do not rush to aid the student at the first sign of difficulty. Mastery will come only through individual effort.

12. Do not allow yourself to be hurried from student to student.

13. Do not be niggardly with information or assistance, and yet do not do all the work for the student. It is a fine art to determine just how much, what kind, and to whom help is needed.

The following list should be appended to the above thirteen also.[10] For continuity we shall start with number fourteen.

14. Make sure that the goals as well as the assignments are clear. Immediacy of a goal is a strong motivating factor.

15. Keep in constant contact with the students about their progress. Do not wait for unfinished or continuously poor work to indicate a trouble spot.

16. Note different ability levels. This affords an excellent opportunity to do some individual work with the gifted students, i.e. work they may do in lieu of the present homework assignment.

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[10] Jean D. Grambs and William J. Iverson, Modern Methods in Secondary Education, (New York, 1952), p. 244.

17. Watch the over-all student work as it proceeds. The teacher may find it advisable to call the attention of the whole class to some particularly difficult passage or interesting point that should not be missed.

It is not intended to imply that this list is completely comprehensive. However, it will serve as a framework for some guiding principles that the teacher can add to as the teacher's proficiency in this type of instruction continues. As we have previously stated, the study period should not be subordinated to formal recitation. The study period has its role to play, and should receive a fair chance to play this role.

Role of the Student

The following list of suggestions will prove to be helpful to the student.[11] These will prove useful both during the directed study period and outside the directed study period.

1. Learning must be initiated and sustained by some driving force or motive. The net result that a student obtains from a period of study is directly affected by what he puts into it. Learning cannot be left to chance.
2. Studying is that form of learning which is directly undertaken for the purpose of

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[11] Meenes, pp. 1-48.

improving a skill, obtaining information, and acquiring understanding.

3. Study is directed learning.
4. Cramming is better than no study, but not as good as regular study. Cramming is risky, creates emotional strain, and poor retention of subject matter results. Planned study is surer, bringing more thorough and lasting learning with less confusion.
5. Persistent study enhances the growth of interest in a subject.
6. Frequent, short study periods give better learning results than infrequent long ones.
7. The feeling of fatigue from study is not physical fatigue, but is a loss of study motivation.
8. There is a special difficulty that you may encounter in mathematics. You cannot get the next lesson until you have mastered the preceding one. If you do not study enough you are likely to fall hopelessly behind and before the course is over you may be altogether lost.
9. For the most memory strength, learn by understanding rather than rote, with insight; see the relations. What one learns with understanding and insight may never be forgotten.

10. Forgetting occurs the moment learning ends and as a result of failure to use learning. In general, the more thoroughly you learn, the more you repeat, the slower the forgetting.
11. Use of a fact strengthens one's memory of the fact.

The following list should also be appended to the previous one.[12] For continuity the numbering is continued.

12. Form the habit of getting down to work at once. Do not dally.
13. Form the habit of paying concentrated and sustained attention to your work after you start.
14. Do not allow avoidable interruptions after you start.
15. Work as rapidly as you can after you start.
16. Work by yourself for the most part. However, in the directed study period your teacher is there to help you on points you do not understand, and will check your work to see if it is correct. (This is one of the major advantages of a directed study period.)
17. As a preparatory step, get the assignment clearly in mind. Recall the teacher's explanation, and if necessary, study again the sample exercises and explanation in your text.

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[12]Butler and Wren, pp. 172-174.

18. Read the problems and exercises carefully. In each case be sure you understand clearly what is given and exactly what you are to do, find, or prove.
19. If you are to copy an exercise or problem, be sure that you copy it correctly.
20. Take plenty of time to think. Do not start to solve a problem or make a proof until you have clearly in mind exactly what is given and exactly what is wanted.
21. Try to write out the questions that bother you, making them very clear and specific. Often the answer will suggest itself.
22. Do not give up. At least try to find out just where and what your difficulty is.
23. Form the habit of using the index and the reference tables in your book as sources of information about new words, formulas, numerical values, and etc.
24. Form the habit of listing all new words and concepts and of learning them at once. Use the dictionary and your text.
25. Memorize important rules, formulas, and facts, but be sure you understand their meanings and can use them correctly.
26. It is easier and better to memorize statements and formulas as wholes than to memorize them by parts.

27. Work carefully. It is easier to avoid mistakes than it is to find and correct them after they are made.

28. Do your work neatly. Never use scrappy, dog-eared paper. Use scratch paper as little as possible.

29. Remember that every symbol has a definite meaning. Always read meaning into the symbols that you use.

30. Read thoughtfully, and reflect as you read. Superficial reading in mathematics is generally just a waste of time.

31. Form the habit of expressing verbal statements in symbols.

32. When time permits, check your work and answers.

33. Compare exercises in algebra with similar types of exercises in arithmetic. Sometimes this will give a cue or suggestion as to the possible solution of your problem.

34. When listening to discussions in class, listen with your whole attention. Do not have books opened or pencils in hand unless asked specifically to do so.

35. Be critical of all statements made, whether by yourself or someone else. Be especially critical of statements that are not adequately supported by reasons.

The student in the directed study plan of teaching will spend part of his time in lecture and recitation and part of his time in study. The study may be the working of an assignment, participating in drill, reading, or a special project.

The student should always bring the required materials to class, and, when it is time to begin the directed study period, be prepared to commence study at once. This is necessary in order for maximum results to be obtained, other factors involved being favorable also.

An advantage of the directed study period is that the teacher is there to help the student if needed. However, the student should, as much as possible, be self-reliant, and above all, not attempt to monopolize the teacher's time or get the teacher to do the work for him.

The complete cooperation of the student is an important factor in the obtaining of maximum results in the directed study plan just as it is in any other method of teaching.

CHAPTER III

USES OF DIRECTED STUDY

Many operations in mathematics need to be performed not only correctly but with reasonable facility and skill if they are to be very useful. Some need to be actually automatized. This acquisition of facility in such operations can be secured only through systematic and repeated practice.[1]

The following is a list of some considerations regarding the use of drill in the directed study period.

1. Drill, to be effective, must be well motivated.
2. Drill exercises should be conducted in such a manner that students can work at differing rates and at different levels according to their abilities.
3. Drill periods should generally be rather short.
4. In order to be most effective, drill must be specific.
5. When drill is begun on any process or skill, correctness should be insisted upon as a prime consideration, and for the time being, speed should be regarded as of secondary importance. The teacher must avoid fixing wrong habits.

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[1] Butler and Wren, p. 176.

6. It is a direct stimulus to students to know immediately if their answers are correct.

Before beginning drill a clear statement of exactly what is to be accomplished by the work at hand should be made. Then the teacher should check with the students to see if they interpreted correctly what was done. However, these steps are applicable to any use of the directed study period and not just the use of the period for drill.[2]

Another use that can be made of the program is that of maintenance of skills and material learned.[3] For best results, this must be a well planned program of cumulative drill and review.

A third and fourth use of the program is as an aid in learning and the retention of skills.

The use of the directed study period for these functions was recognized early. The chances of securing more permanent retention are better if the knowledge that is gained is immediately utilized.[4] This is just as true today. Meenes lists as one of the major causes of a student forgetting material the failure to use the material being taught. Meenes immediately adds to this by making the generalization that

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[2]Watkins, p. 278.

[3]Butler and Wren, p. 181.

[4]Ralph S. Newcomb, Modern Methods of Teaching Arithmetic, (New York, 1926), p. 60.

the more thoroughly you learn, the more you repeat, the slower the forgetting.[5]

One can immediately see that the use of the directed study period following a lecture would enable the teacher to put this principle into practice.

The following are six factors listed by Dent as significant factors in learning:[6]

1. Existence of a problem or goal.
2. Motivation is essential.
3. Learning involves activity.
4. Learning frequently depends on understanding.
5. Reconstruction or reorganization of past experiences.
6. Maturity, ability, and interests.

The directed study period affords the teacher an excellent opportunity to put the above principles into practice. The following two ideas that are discussed will illustrate this.

It is known that one does not necessarily "learn by doing." One learns to do only by not doing what he did at first. In learning, the learner makes a theory. It is generally an inadequate theory; and often incorrect.[7]

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[5]Meenes, p. 47.

[6]R. A. Oliver, Effective Teaching, (Toronto, 1956), pp. 23-24.

[7]Harry Grove Wheat, Foundations of School Learning, (New York, 1955), p. 169.

The teacher is in a position to make an adequate analysis and develop a helpful theory. Thus by using the directed study plan the teacher has an opportunity to better help the student in this area, and there is an opportunity for the learner to execute this under the teacher's immediate supervision.

Immediacy of a goal is a known incentive and very strong motivating factor. For example, a student may expend much effort during the afternoon of a school week in athletic practice with his teammates. He expends much less effort during the week studying his lessons in geometry. The reason is clear. The goal of his athletic practices is the game on Friday night or Saturday afternoon. The goal of his geometry lesson is an understanding of a proof. Yet it is a far-off value. Similarly, the immediate goal of gaining a yard or a foot on the next play is more important at a given moment than the goal forty or sixty yards away. For present effort, a person needs an immediate goal. If he reaches it, he may move ahead to succeeding immediate goals, and on and on to the far-off and more important goals.[8]

Definiteness of the task corresponds with immediacy of the goal. "Do it now" provides more incentive than "Do it tonight." The teacher should seek to set up definiteness, impressiveness, and immediacy to the goals of the learner.[9]

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[8]Alfred A. Knopf, Foundations of School Learning, (New York, 1955), pp. 168-170.

[9]Ibid., p. 169.

The directed study plan of teaching as defined in this report is well suited to the application of these principles.

A fifth use is the working of the assignment. Under the recitation and homework plan of teaching mathematics the students are often compelled to do their studying under conditions both physically and psychologically unfavorable to effective work.[10]

Using the recitation and homework plan the student will usually do his assignments (if he does them) in study hall, at his home, or possibly at a friend's home.

Both the home atmosphere and the study hall have conditions both physically and psychologically unfavorable to effective study.[11]

Some reasons why this is true are:

1. Size of study halls.
2. Teachers conducting study halls have not done much work in the field of mathematics.
3. Nearly all students need help at times. Usually there will be no one able to help them.

To this list might be added the interval of time between the teacher's lecture. Also the traditional recitation plan has been criticized because of the failure to teach students good methods of study and the failure of students to learn

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[10]Richardson, p. 167.

[11]Ibid., p. 168.

good methods of study on their own. Also changed social conditions have so altered home life that fewer students now have satisfactory conditions for home study.[12]

This indicates some of the weaknesses of the traditional plan of teaching and also indicates that by using the directed study plan one could overcome some of the weaknesses of the lecture and homework plan.

A sixth use is the teaching of students to find reading and writing material in mathematics, and how to read and study in mathematics. Too many times the assumption is made that the students know how to read and study in mathematics. Class time should be devoted to study, the students directed by purposes that are understood.[13] The directed study period is well suited to the teaching of good study habits.

A seventh use is the opportunity to identify and work with the academically talented student. The National Education Association of the United States states that students with high mathematics potential will fall in one of four areas:[14]

1. Group A consists of students that are readily identifiable. They will usually take all the mathematics that is offered.

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[12]Risk, pp. 216-217.

[13]Richardson, p. 61.

[14]National Education Association of the United States, and National Council of Teachers of Mathematics, Mathematics for the Academically Talented Student in the Secondary School, (Washington, 1959), p. 11.

They do good work and have high interest in mathematics.

2. Group B consists of students with high measurable ability, but whose performance has been poor or certainly not commensurate with their ability. Possible reasons for their under-achievement are: inadequate motivation; a negative attitude--sometimes due to poor instructional procedures; lack of insight intc the areas of learning for which mathematics is required.
3. Group C is those pupils whose environmental background has retarded them. Often it is found that these students are from low socioeconomic areas. They have not had an opportunity to do well.
4. Group D is that group of students who do good work only in mathematics.

Now since the directed study plan offers more individual work than the traditional lecture and homework plan, the directed study plan affords the teacher an opportunity to identify these pupils and work with them.

These selected students should not be withdrawn from the general life of the school. In school life, social and athletic functions. the academically talented should be in the general stream of school life.[15]

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[15]Ibid., p. 15.

To handle these students, ability grouping is gaining wide acceptance. This trend is manifested by the following three types of grouping:

1. Special classes.
2. Honor school.
3. Grouping within classes. (Especially of benefit in the smaller schools.)

However, whichever method is used, the directed study plan is readily applicable. The first two are just classes with superior students. In the case of the third, as early as 1922 the advantages of directed study were recognized for double track programs, differentiated assignments and individual instruction.[16]

We could list as an eighth use the opportunity to help the slow learner and the average student. This has long been considered one of the stronger points of directed study.[17]

It is not pretended that the eight uses form a comprehensive list. But one can see that this list of possible uses certainly illustrates the merit of the directed study plan of teaching.

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[16] Hall-Quest, pp. 149-151.

[17] Francis Shreve, A Comparative Study of Directed and Undirected Teaching, (Nashville, 1922), pp. 1-19.

CHAPTER IV

SOME PREVIOUS CRITICISMS OF DIRECTED STUDY

Although we have been concerned with one particular type of directed study, it is to be remembered that there are many other forms. A list of some of the other types is given on page three of this report.

The literature on directed study of all types begins at least as early as 1909. The early movements were without a doubt a reaction against the memorizing processes of the text-recitation process.[1]

There have been some criticisms against directed study. The following are some of the criticisms that have been made and a brief discussion of each. However, the advantages of a properly administered directed study plan will offset the criticisms of directed study.[2]

Criticism number one is the poorer students benefit more than the gifted under directed study. This was a frequent criticism in the past. If the plan is to work successfully at all, it will be necessary to administer it through differential techniques adapted to the needs of

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[1]Watkins, p. 276.

[2]Ibid., p. 277.

students of varying degrees of ability.[3] However, the same criticisms can be made of conventional teaching methods.

Of course, the crucial element in any program is the teacher. In general it is not true that bright students can and will learn in spite of the teacher.[4]

The field of identifying and teaching the academically talented is relatively new. There are some excellent advances being made in this area, especially so in the field of teacher preparation and teaching these students.[5]

As more information becomes available to the teacher on the matter of teaching the academically talented, criticism may no longer be valid, if it is valid now.

For example, in an earlier experiment, Shreve found the reverse true. His study found that directed study helped the gifted more than the slower student.[6]

Butler and Wren attribute the failure of directed study to provide for the gifted as well to the present administration of the directed study plan and not to the theory of directed study.[7]

As we have previously stated, the teacher is the crucial element in any program. The validity of criticism one will

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[3]Butler and Wren, p. 191.

[4]NEA, p. 39.

[5]Ibid., pp. 39-43.

[6]Francis Shreve, A Comparative Study of Directed and Undirected Teaching, (Nashville, 1922), p. 155.

[7]Butler and Wren, pp. 190-192.

be decided by the manner in which the teacher operates the program of directed study.

A second criticism is that teachers have not been adequately trained in conducting directed study.[8] Unless the teacher on an individual basis corrects this it would be safe to say that directed study would have little hope of succeeding. The same statement could be made of any other system of instruction.

This second criticism has been listed as the major cause of failure of directed study in schools that have tried the directed study plan and discarded it.[9]

The teacher trying directed study will find the steps listed in chapter two of this report helpful. As has been previously mentioned in this report, the subordination of the directed study period to the lecture and recitation period of the class time has severely handicapped the directed study plan of teaching in its efforts to give maximum results. The assignment plays a key role, and much attention must be paid to the planning and direction of this phase by the teacher.

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[8]Watkins, p. 276.

[9]Ibid.

CHAPTER V

SUMMARY

Although there is much work being done in an effort to improve mathematics instruction, most of the work is being done in the areas of curriculum improvement and teacher preparation. It is true that these areas are very important. But there is another area that should not be overlooked in the programs to improve mathematics instruction. That is the area of teaching methods.

In particular the directed study plan of teaching is a method that should not be overlooked. Attention in this report has been restricted to the divided period plan. This has been recommended by several prominent authors as the best plan of directed study.

However, this report is more specific in the definition than simply the divided period plan. Directed study was defined as a scheme of instruction in which the class period was divided into three parts: (1) assignment, (2) silent study with the teacher giving individual instruction where needed, which is referred to as the directed study period, and (3) lecture and recitation.

In this scheme of instruction the assignment plays a strong role. The assignment must be will-organized, well-

planned, and well-motivated if the directed study plan is to succeed or obtain its maximum potential, all other factors involved being favorable.

The directed study period must not be subordinated to the lecture and recitation period. The portion of the class time allotted to the directed study period varies from one third to one half of the class. This depends upon what purpose the period is being used to fulfill.

Some uses of the directed study period are:

1. Drill.
2. Maintenance of skills and material learned.
3. Aid in learning.
4. Retention of skills.
5. Working of the assignment.
6. Teaching good study habits.
7. Identifying and working with the academically talented student.
8. Teaching the slow-learner and the average student.

It is not intended to imply that this is a comprehensive list, but it does emphasize the value of the directed study period. In particular, number six will illustrate the advantages of the directed study plan over the conventional lecture-recitation plan of teaching. The failure of this plan to teach good study habits and the failure of the students to learn good habits of study on their own have

been two reasons for criticizing the traditional lecture-recitation plan of teaching.

The directed study plan necessitates, if a teacher has not been using it, the learning of a new style of teaching. At present teachers are not being adequately trained in conducting directed study. This is an obstacle that must be overcome if we are to use the directed study plan as an aid in improving mathematics instruction in the secondary schools.

It is felt that there are three areas in which this report may be of help to the mathematics teacher who is interested in the directed study plan of teaching:

1. Specifically defining a directed study plan.
2. Implementation of the directed study plan. We refer particularly to the second chapter and the fourth chapter of this report.
3. Some uses of the directed study plan of teaching.

It is hoped that this report will be of some help to the teacher in the common effort to improve mathematics instruction.

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Master of Science

Report: THE USE OF DIRECTED STUDY AS AN AID IN IMPROVING MATHEMATICS INSTRUCTION IN THE SECONDARY SCHOOLS

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