AN INVESTIGATION OF THE DIFFERENT TYPES OF CLASS ORGANIZATION IN THE TEACHING OF ARITHMETIC IN THE INTERMEDIATE GRADES

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B. S., Kansas State University, 1958

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1969

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ACKNOWLEDGMENTS

The writer expresses her appreciation for the assistance given by Dr. Harlan Trennepohl in the preparation of this report.

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INTRODUCTION

Much has been written about the individual differences that exist in the elementary classroom. The differences that exist are even greater today than they have been in the past. This is partly due to the current promotion and retention policies of the school. The slow learner and rapid learner are kept with their chronological age group in an attempt to assure the social and emotional development of all children. Socially this may be best for the child, but unless the teacher provides for the various levels of ability in his classroom, the rapid learners coast through the grades with very little challenge and the slow learners are quite often frustrated by demands which are beyond their abilities.[1]

Reading instruction has received the most attention in regard to handling individual differences while arithmetic has received very little attention. Many teachers still teach arithmetic as though individual differences did not exist in that area. The class proceeds from topic to topic with no variation in the material and assignments. Evidence has been established that "Children in a typical fifth grade class may differ in arithmetic ability as much as five years."[2]

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[1]Charles Johnson, "Grouping Children for Arithmetic Instruction," Arithmetic Teacher, I (February, 1954), 17.

[2]E. T. McSwain and Ralph J. Cook, Understanding and Teaching Arithmetic in the Elementary School (New York: Holt, 1958), p. 353.

Differences in arithmetic do not correlate highly with intelligence according to the National Council Teacher of Mathematics.

> Theoretically, differences in arithmetic achievement might be expected to vary as greatly as intelligence or as aptitude for arithmetic varies. Actually the variation is probably somewhat greater. The correlation between intelligence (or any of its factors or combinations thereof) and arithmetic achievements rarely exceeds .60, and in most cases proves to be lower. Obviously unmeasured factors such as experience, emotional stability, modes of thinking, and attitudes contribute to success in arithmetic.[1]

In order for the teacher to best take care of the differences that exist in the students of his classroom he must be able to recognize the differences that exist and then plan his arithmetic class carefully. The first step the teacher faces is the organization of his class. There are several ways in which he can organize his arithmetic class.

Statement of the Problem

The purpose of this paper was to investigate the advantages and disadvantages of the following methods and determine which method best takes care of the individual differences:

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[1]National Council Teacher of Mathematics, Instruction in Arithmetic, (Washington, D.C., 1960), p. 124.

1. The class as a whole method.
2. Grouping the class into permanent groups according to arithmetic ability.
3. Individualized instruction.
4. Combination of whole class and small groups.

Questions

This report was written to answer the following questions concerning the teaching of arithmetic in the intermediate grades:

1. What are some of the factors causing individual differences in the intermediate grades?
2. What are the advantages and disadvantages of the various methods of organization in an arithmetic class in the intermediate grades?
3. Which method does research say enables the individual child to make the most measureable gain?
4. Which method is the most feasible for the teacher to use in regard to time and materials?
5. Do the various methods have other affects on the individual child such as social adjustments?
6. Is the behavior of the child affected by the organization of the class?

Research Design

This is a library report which compares the existing information concerning the various methods of class organization in the teaching of arithmetic in the intermediate grades.

Limitations and Delimitations

This report is limited to the resources of the Kansas State University Library. Study was concentrated on the teaching of arithmetic in the intermediate grades.

Definition of Terms

Differentiating arithmetic instruction. Refers to adjustment in depth and scope of arithmetic topics presented in keeping with individual and trait differences.

Individual differences. The variations that exist among the various individuals of a group on any single measure or trait.

Mathematical phase of arithmetic. The phases of arithmetic having to do with computational skills.

Social phase of arithmetic. Those phases of arithmetic which are essential for intelligent living among human beings. Examples of this would be buying and selling, money, or standard time and measurements.

Trait Differences. The variations in scores made

by a single individual on a number of tests dealing with different abilities in a single area.

REVIEW OF LITERATURE

Much has been written concerning individual differences and how to allow for these differences in educating children. This report is a summary of the individual differences in regard to arithmetic ability and the types of classroom organization that will help the individual to make the most measureable gain.

Literature on Individual Differences in the Intermediate Grades

One of the most difficult and perplexing problems faced by the arithmetic teacher is how to recognize and provide for the wide range of differences among the individuals in his classroom. It is the teacher's responsibility to help each child achieve to his fullest potential in accordance with his ability. In order to do this, the teacher must be able to determine factors causing differences in achievement and must know how to deal with these factors to develop the achievement potential of each child.[1]

Studies indicate that high achievers in arithmetic display such personality and intellectual characteristics

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[1]Frances Flournoy, Elementary School Mathematics (Washington, D. C.: The Center for Applied Research in Education, Inc., 1964) p. 86.

as a healthy ego, relative freedom from conflicts and anxieties, independent thinking, creativity, flexibility, and the ability to handle abstract symbols and relationships.[1]

In accordance, the following are commonly recognized factors relating to achievement in arithmetic.[2]

1. Intellectual ability. Related to learning arithmetic are attentiveness, ability to remember what is heard, seen, and read, ability to work with abstract symbols, and ability to generalize and see relationships. A person may not be able to succeed in all of these areas because he is below average general intelligence. However he may have other attributes which will enable him to do well in certain areas of arithmetic. At the same time, a person with high intelligence may do poorly in arithmetic because he is adversely affected by other factors.
2. Environmental influences. Favorable environmental influences such as a happy home life with a favorable

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[1]Ernest A. Haggard, "Socialization, Personality, and Academic Achievement in Gifted Children," The Social Review, LXV (1957), 388-414.

[2]Frances Flournoy, Elementary School Mathematics (Washington, D. C.: The Center for Applied Research in Education, Inc., 1964), pp. 86-87.

attitude toward arithmetic experiences will play an important role in the development of the child's arithmetic abilities. A classroom environment that makes learning exciting and important is also conducive to developing the child's potential abilities.

3. Emotional factors. Emotional factors greatly influence learning. A thorough understanding of the emotions surrounding the child is essential if the teacher is to help the child to develop his potential arithmetic ability. Often an adverse factor can not be altered but an understanding teacher can help the child develop as far as possible under the existing circumstances.

4. Physical factors. Learning like anything else is best accomplished when the individual is in good general health, eats the right food, and gets plenty of rest. Very important to learning is seeing and hearing properly.

5. Instructional factors. Since this paper is concerned primarily with the teaching of arithmetic in the intermediate grades, the arithmetic instruction previously had by the child is important. Pupils will differ in their understanding of the numeration system and number operations,

their mastery of basic facts, and their understanding of the social usefulness of arithmetic.

The fact that arithmetic involves abstractions complicates the learning further. These concepts may be understood only after the child has succeeded in making generalizations based upon various experiences with numbers in situations which help him identify the abstract number relationships.[1]

Numerous investigations have demonstrated the fact that at all grade levels there is a wide range of abilities. The older the students the greater will be the range of abilities. Bruekner and Grossnickle found the range in arithmetic age to be even greater than the chronological and mental ranges of the students. They also found a tendency for differences to increase grade by grade.[2] This makes it even more difficult for the teacher of the upper elementary grades because the differences are even greater here than in the primary grades.

There are two kinds of differences that should be of

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[1]Charles F. Howard and Enoch Dumas, Basic Procedures in Teaching Arithmetic (Boston: D. C. Heath and Company, 1963), p. 5.

[2]Leo J. Brueckner and Foster E. Grossnickle, How to Make Arithmetic Meaningful, (Philadelphia: The John C. Winston Company, 1947), p. 77.

concern to the teacher of arithmetic, namely, individual differences and trait differences. An individual may vary as much as three or four grade levels on separate traits.[1] This fact must be recognized in planning and organizing the instructional program.

Probably the most difficult problem facing a teacher in the intermediate grades is that of trying to develop a program which is suited to the needs of each child in a large group of from twenty-five to thirty-five children. By selecting and arranging learning activities, the teacher attempts to provide learning experiences which are most valuable for the low achievers in the class and at the same time provide stimulating experience for the high achiever. The problem is made even greater in that the fast achiever will advance at a greater speed than the low achiever and the ability levels tend to become even greater as the children move through the elementary grades.

Although no perfect solution to this problem has been found, research has provided many suggestions which are helpful in alleviating certain types of situations, thus making it possible for the good teacher to function

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[1]Leo J. Brueckner and Foster E. Grossnickle, How to Make Arithmetic Meaningful, (Philadelphia: The John C. Winston Company, 1947), pp. 398-399.

effectively where extreme differences are not too great.

Literature on Class Organization

The fact that pupils in all arithmetic classes differ in such ways as understanding of number operations, rate of learning, background of experience, and interest in the subject, indicates that arithmetic instruction should be adjusted to provide for the apparent variations in pupils.[1] Classroom teachers are concerned with methods of instruction which will meet the individual needs of the students. Authors of texts are concerned about the variations in the ability of the students and offer suggestions on classroom organization and methods of handling the individual differences. M. Devault stated:

> Recognized authorities in the teaching of arithmetic generally agree that providing for differences in learning ability is an essential element of a good instructional program. But these authorities differ as to the means by which we should provide for these differences.[2]

In discussing individual differences Harold H. Lerch said:

> Most of the proposals and methods for adjusting

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[1]Harold H. Lerch, "Arithmetic Instruction Changes Pupils' Attitudes Toward Arithmetic," Arithmetic Teacher, VIII (March, 1961), 117.

[2]M. Devault, Improving Mathematics Programs: Trends and Issues in Elementary School Mathematics (Ohio: C. E. Merrill Books, 1961), p. 266.

> arithmetic instruction to pupil differences in arithmetical abilities and understandings are concerned with some organizational procedure and involve some type of ability grouping or some type of individualized program.[1]

Whole class organization. The class organization that is the most common in the intermediate grade arithmetic class is the whole class organization. In this type of organization the whole class moves through the assigned arithmetic program for that grade level and the teacher gives individual help to those students who need it. The whole class is introduced to the basic list of topics at the same time. Efforts at meeting individual differences might include help for individual pupils as time permits, occasional variation in practice, extra assignments for individual pupils, and whatever enrichment the teacher encourages rapid learners to pursue.[2]

The whole class organization is the most often used in the classroom. Frances Flournoy gives several reasons for this:

> The arithmetic texts available are written for the average children with only token provisions for

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[1]Harold H. Lerch, "Arithmetic Instruction Changes Pupils' Attitudes Toward Arithmetic," Arithmetic Teacher, VIII (March, 1961), 117.

[2]Frances Flournoy, Elementary School Mathematics (Washington, D. C.: The Center for Applied Research in Education, Inc., 1964), p. 88.

> the slow or rapid learner. Teachers have found from experience that it takes a great deal of time, effort, and ability to operate more than one arithmetic grouping and consequently have shied away from several groupings because of the work involved and an inefficient amount of time allotted to the arithmetic program which would make grouping impossible.[1]

Even though the whole class method of organization is the easiest, it may not be the best for the children involved. The class usually is taught for the average achiever with the few minutes of time that the teacher can spare working with those children who can not keep up with the average group in the class. Even with the extra help the low achiever is often working at the frustration level and growing to dislike every minute of arithmetic instruction. "It is never possible, try as we may, to bring the performance level of the slow moving child up to the level of the rapid learner unless we place the latter in an intellectual deep-freeze."[2]

While the low achiever is frustrated the high achiever may be coasting through arithmetic, learning poor study habits and becoming quite uninterested in school due to the lack of challenging material.

The whole class organization may not always be detrimental to the children involved. If a teacher has a fairly

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[1]George H. McMeen, "Differentiating Arithmetic Instruction for Various Levels of Achievement," Arithmetic Teacher, VI (April, 1959), 114.

[2]Ibid., p. 114.

homogeneous group this type of organization may be best and conserve both the children's and teacher's time without negative affects on the children. However if a teacher has a heterogeneous group it would seem logical that children at either end of the arithmetic spectrum would not receive the attention due them under the present whole class method of teaching.[1]

In a report on an in-service project designed to meet individual differences in the teaching of arithmetic, Flournoy observed that there was less variation in an attempt to provide the extra help needed by slow learners and the extra challenge needed by fast learners in the whole class teaching organization than in other types of class organization.[2]

Ability grouping. The most research has been done in organizing arithmetic classes into groups according to the arithmetic ability of the children. No effort is made to keep the entire class together as successive topics are studied. At the beginning of the school year, the class is divided into two or more subgroups on the basis of general

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[1]George H. McMeen, "Differentiating Arithmetic Instruction for Various Levels of Achievement," Arithmetic Teacher, VI (April, 1959), 114.

[2]Frances Flournoy, "Meeting Individual Differences in Arithmetic," Arithmetic Teacher, VII (February, 1960), 80.

arithmetic achievement. Each subgroup starts with the topics and level of difficulty at which it can experience reasonable success. Each group moves forward through the logical sequence of arithmetic topics at its own rate.[1]

The other area in the elementary curriculum that we think of when grouping is discussed is reading. There are some important differences that make ability grouping in the teaching of arithmetic more difficult than in the teaching of reading.[2]

1. Arithmetic has a more exacting and definite sequence than other fields.
2. Most new steps require reasonable facility with background skills.
3. Text books are not available for a given grade written at different levels.
4. Diversified supplementary resourses are usually not available in the elementary school library.
5. Most teachers do not have access to a reservoir of diversified practice materials or teaching aids.

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[1]Frances Flournoy, Elementary School Mathematics (Washington, D. C.: The Center for Applied Research in Education, Inc., 1964), p. 89.

[2]M. Devault, Improving Mathematics Program: Trends and Issues in Elementary School Mathematics (Ohio: C. E. Merrill Books, 1961), p. 128.

Authorities in the teaching of arithmetic do not agree on the advisability of forming groups in the teaching of arithmetic. One area of concern is the attitudes of parents and children involved in the groups. Those who severely criticize grouping feel that the pupils in the lower group will lose self respect. Parents will object that their child is classified as a slow learner and will denounce this form of class organization as undemocratic. Spitzer felt that the lack of class unity when groups are working separately would be detrimental to a class.[1]

Pinney felt a disadvantage to the grouping would be that the high achiever group would receive the high grades and honors and there would develop a feeling of snobbery and aloofness when associating with the other children in the class.[2]

McSwain warned that there was considerable danger in hurting children by fitting them into a slow, average, or rapid category too soon.[3] Because of this danger, if a

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[1]Herbert F. Spitzer, The Teaching of Arithmetic (Boston: Houghton Mifflin Company, 1954) p. 400.

[2]Grant C. Pinney, "Grouping by Arithmetic Ability - an Experiment in the Teaching of Arithmetic," Arithmetic Teacher, VIII (March, 1961), 120-123.

[3]E. T. McSwain and Ralph J. Cooke, Understanding and Teaching Arithmetic (New York: Henry Holt and Company, 1958), p. 353

teacher chooses to group the children, he should make the groups flexible enough so a child can be moved from one group to another.

Proponents of grouping children with like abilities together, believe that a child's success at his own level will have favorable affects on attitude.[1] However, in a study conducted by Lerch the changes in attitude toward arithmetic of pupils taught in grouped arithmetic classes were compared with the changes in attitude toward arithmetic of pupils taught in a traditional non-grouped situation. As measured by the instruments used in this study, the changes in attitudes toward arithmetic of the experimental classes were not significantly different from the changes in attitude toward arithmetic of the contrast class. In both groups, more than one half of the pupils indicated changes to more favorable attitudes toward arithmetic. "The experimental grouping procedures had no more adverse effect upon the pupils' attitude toward arithmetic than did the more traditional approach."[2]

In a study conducted by Holmes and Harvey, a con-

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[1]Harold H. Lerch, "Arithmetic Instruction Changes Pupils' Attitudes Toward Arithmetic," Arithmetic Teacher, VIII (March, 1961), 117-119.

[2]Ibid., p. 118-119.

clusion was reached that no differential effect on the attitudes of children toward arithmetic appeared when the children were placed in groups.[1] Kavaraceus and Wiles reached a somewhat different conclusion in a similar study.[2] They ascertained that when pupils were classified into groups according to their achievement and apparent abilities, diciplinary problems were reduced and pupils' attitudes toward the study of arithmetic seemed to have been improved. However in both types of grouping, the attitudes of pupils toward arithmetic were less favorable at the end of the year than at the beginning.

Reports by Ivie, Fowler, and Graham[3] and by Ivie, Gunn, and Holladay[4] do not completely support these finding. They indicate that some pupils are disatisfied with working in small groups and would rather work with the total class instead.

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[1]Darrell Holmes and Lois Harvey, "An Evaluation of Two Methods of Grouping," Educational Research Bulletin, XXXV (November, 1956) 213-222.

[2]William C. Kavaracues and Marion E. Wiles, "An Experiment in Grouping for Effective Learning," Elementary School Journal, XXXIX (December, 1938), 264-268.

[3]Claude Ivie, Eugenia Fowler, and Virginia Graham, "Grouping in the Normal Mathematics Class," The Mathematics Teacher, LI (October, 1958) 450-452.

[4]Claude,Ivie, Lilybell Gunn, and Ivon Halladay, "Grouping in Arithmetic in the Normal Classroom," Arithmetic Teacher, IV (November, 1957) 219-221.

In a pilot study reported on by McLaughlin, fourth, fifth, and sixth grade students were grouped according to arithmetic ability.[1] In this particular study the ranges in the regular class were from four to five grade levels, while the range in most of the ability groups were less than one year. However, the highest achiever and lowest achiever groups had ranges of between two and three years. Results were reported as follows:

1. The capable but lazy students began to show determination to achieve. The motivation was to be placed with their peer group.
2. The low ability child seemed to be happier with less dicipline problems.
3. The rapid learners were no longer permitted to loaf.
4. If parents were unhappy it was due to the fact that the parents felt the child was placed in two low an achievement group.

Dewar conducted a study with sixth graders in which he used eight classrooms of sixth graders.[2] Three classrooms

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[1]Jack W. McLaughlin, "A New Approach to an Old Problem," Arithmetic Teacher, VIII (March, 1961), 112-114.

[2]John A. Dewar, "Grouping for Arithmetic Instruction in Sixth Grade," Elementary School Journal, LXIII (February, 1963), 266-267.

were taught the traditional organized class method. The others used three group organization to teach arithmetic. The study sought to determine which group would show the greater amount of achievement and also to determine the attitudes of teachers and students toward grouping. The experimental classrooms were divided into three groups on the basis of Stanford Achievement Tests and teacher judgement. The control groupswere also divided into three groups on the same basis for purposes of statistical analysis but not for instruction. Both the experimental and control groups used well known series of textbooks and both were taught fifty-five minutes a day. The conclusion of this study was that the children in the high and low ability groups in the experimental groups made significant gains over their counterparts in the control classrooms. There was no significant difference in the average achiever. The opinionnaire given to the teachers and students involved, indicated that pupils and teachers in the experimental groups could see more and better learning going on.

Provus conducted a study similar to Dewar.[1] His results showed that the more competent student profited

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[1]Malcolm M. Provus, "Ability Grouping in Arithmetic," The Elementary School Journal, LX (April, 1960), 391-398.