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A SURVEY OF ARITHMETIC INTRA-CLASS GROUPING PRACTICES
IN THE ELEMENTARY SCHOOLS OF OHIO

DISSertation

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Graduate School of The Ohio State
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By

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The need for arithmetic skills

Today's world has an ever increasing need for citizens with effectively usable arithmetical concepts and skills. This greater need is due to recent progress in science and technology.

The study of science is, to a large extent, based upon numerical knowledge. As scientific progress is made, new scientific fields are opened and more people with this numerical knowledge are needed to work in these new fields. Advances in technology are then needed to put new scientific knowledge to practical use. This in turn calls for more people with numerical knowledge to work as technicians. Two fields in which recent technological advances have been made are transportation and automation.

In transportation many changes and improvements have taken place. In order for an individual to be able to read accounts of travel in the newspaper with understanding, he needs to know considerably more about arithmetic than his counterpart needed to know fifty years ago.

Automation has eliminated, to a great extent, the need for unskilled laborers. With machines doing an increasing amount of the manual labor, man is being permitted to spend more time in the role of the thinker and planner. In most situations where thinking and planning are necessary, man performs more effectively and efficiently if he is well grounded in basic science and mathematics.
Automation, by displacing the unskilled laborer, has forced men to retrain for skilled occupations. Such retraining of individuals is facilitated if the individuals have well developed arithmetical skills and concepts.

In many branches of knowledge, the literature, to a rapidly increasing extent, is being written in mathematical language. No matter what vocation a person pursues, he will need to be literate in mathematics.\(^1\)

In discussing the education of future citizens, Welmers had this to say:

> It is impossible to educate the individual properly without paying attention to the dominating forces in his environment. The world of today with its scientific culture forms the most logical basis for an understanding of the world of tomorrow. The cultural environment of the individual will be heavily dependent on the numerical approach.\(^2\)

Thus, rapid advances in science and technology have expanded man's need for knowledge of arithmetic.\(^3\) However, this need is not purely for his physical and economic well being, but it is also a prerequisite of intelligent citizenship.\(^4\)

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An appreciation, even without complete understanding, of the role of mathematics in the complex technological society in which an individual lives is needed to give him an increased interest in the culture of today and tomorrow.5

Harding sees a need, "...to raise the mathematical literacy of the United States citizenry at least to the level which technology makes necessary for survival."6

In view of these needs, elementary school educators should be alert to find ways and means to improve the teaching of arithmetic.

The importance of the teacher

The teacher and the teaching methods he uses are probably the most important factors in the teaching-learning situation.7 However, other factors in the classroom such as social climate, quality and quantity of teaching materials, and classroom organization are important too.

5Everett T. Welmers, loc. cit., p. 32.


The significance of grouping

One type of classroom organization, subgrouping into ability groups, has been used extensively as a means of facilitating the teaching-learning process.\(^8\)

The major purpose of subgrouping in arithmetic classes, according to Lerch, is

\[ \ldots \text{to provide for individual differences by bringing pupils of like arithmetical backgrounds, skills, understandings, and concepts together into small groups so that they can study and work effectively at rates and levels that are closer to their own abilities and characteristics}\ldots\] \(^9\)

Dougherty,\(^10\) Lerch,\(^11\) and Smith\(^12\) assert that intra-class grouping can set the stage for adjusting arithmetic instruction to pupil differences.

Harding\(^13\) contends that the biggest reason for subgrouping in arithmetic is the variation in arithmetic abilities of pupils.

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\(^13\)Lowry W. Harding, loc. cit., p. 64.
Individual differences in arithmetical ability

It is well known and generally agreed that educational differences in pupils exist and that they are educationally significant.14

The range in pupil arithmetic abilities as well as the range in other abilities such as reading and spelling has become greater than it was before the enactment of compulsory school attendance laws. This is due to having all the children in school, whereas, prior to the enactment of such laws, many slow-learning children dropped out of school and many fast-learning children were advanced to higher grade levels.15

This range of abilities has, according to Jones and Pingry, increased in the recent past. They wrote in 1960,

With nearly 100 per cent of elementary age children in school (and) with rapidly increased birth rates since the last war . . . teachers should anticipate not only more pupils but also greater diversity among them than was the case even a decade ago.16


Children in a given class or grade show a wide range of ability in each phase of instruction. Studies pertaining to individual differences in arithmetic show this same wide range of ability.

Greco stated that "Research shows that a range of five years in achievement is not uncommon in any single grade." However, the typical range in arithmetic achievement appears to be about four years in first grade and about six or seven years in grade six.

If a class is large this wide range of arithmetic achievement requires that the teacher spend considerable time planning for the needs of the pupils. In discussing the typical classroom, Phillips stated that

There are more than 30 pupils in class. The range of measurable academic aptitude is from dull normal to very superior... The teacher has 30-some different children in one classroom, and is faced with the challenge of providing arithmetic and justice for all.

In discussing individual differences with respect to arithmetic ability, Swenson said, "Children are different in their present

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20 J. Fred Weaver, "Differentiated Instruction . . . , *loc. cit.*

21 Anthony J. Greco, *loc. cit.*

knowledge of arithmetic. They are going to stay different, and, as they proceed, they are going to be more and more different. We may as well face the fact.\textsuperscript{23}

Several writers, Durrell,\textsuperscript{24} Eads,\textsuperscript{25} Holmes and Harvey,\textsuperscript{26} Jones,\textsuperscript{27} Jones and Pingry,\textsuperscript{28} and Swenson,\textsuperscript{29} appear to believe that the "poor" teacher decreases individual differences in arithmetic achievement and that the "good" teacher increases such differences.

Kinds of intra-class grouping

Present practice, as reported in the literature, indicates use of a variety of methods of intra-class grouping for instruction in arithmetic. These methods constitute a continuum ranging from the "class-as-a-whole" method to a completely individualized method.\textsuperscript{30}


\textsuperscript{28}Stewart Jones and Robert E. Pingry, \textit{loc. cit.}

\textsuperscript{29}Esther J. Swenson, \textit{loc. cit.}, p. 76.

\textsuperscript{30}Frances Flournoy, "Meeting Individual Differences in Arithmetic," \textit{The Arithmetic Teacher}, 7 (February, 1962), pp. 81-82.
The "class-as-a-whole" procedure is defined as the procedure whereby all pupils in the class receive the same instruction, use the same materials, and perform similar activities. In some instances smaller assignments and extra individual help are given to the "slower" pupils while extra work is given to the "faster" pupils. In other instances temporary groups are formed on the basis of need for additional instruction or practice on certain skills.

Another method of intra-class grouping is sometimes called "flexible" grouping or grouping in "depth." Teachers using this method instruct the class as a group on a new unit or topic and then divide the class into subgroups for instruction and assignment of activities according to need. Need is determined by pupil performance on tests in some cases and by teacher judgment of pupil understandings in other cases. Of course it is possible for the teacher to use a combination of methods of determining need.

Some teachers use what is known as "permanent" intra-class arithmetic ability grouping. Two, three, or more groups may be used. When groups are formed the class is divided according to ability and placed into "high," "average," and "low" groups depending upon the number of groups utilized. When two groups are used pupils are

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31 Darrell Holmes and Lois Harvey, loc. cit., pp. 213-222.
34 Darrell Holmes and Lois Harvey, loc. cit., p. 215.
sometimes divided according to a "balanced"\textsuperscript{36} or "limited-range"\textsuperscript{37} plan. These plans call for placing half the "average" category of pupils in the "high" group and the other half in the "low" group. Whatever the plan of division is, the resulting groups may be taught the same subject matter at different achievement levels or they may be taught as separate classes.

Sociometric grouping for instruction and practice in arithmetic has been used by teachers.\textsuperscript{38} In this type of grouping the pupils may be placed into groups by the teacher according to their friendship patterns as indicated by their responses to sociometric questionnaires. Another method of placement would be to let the pupils form their own groups.

De Witt\textsuperscript{39} and Whitaker\textsuperscript{40} propose plans wherein instruction in arithmetic is individualized. In such a plan group instruction is kept to a minimum and each pupil is taught separately. Most plans of this type utilize self-teaching materials for pupils.


\textsuperscript{40}Walter L. Whitaker, "Why Not Individualize Arithmetic?" The Arithmetic Teacher, 7 (December, 1960), pp. 400-403.
As can be seen from this discussion of kinds of intra-class grouping for instruction in arithmetic, several plans ranging from the whole class method to a completely individualized method have been proposed. With each of these plans in existence and being advocated by certain educators, confusion undoubtedly exists in the minds of elementary school teachers as to which plan should be used in a particular set of circumstances.

**Statement of the problem**

The problem, for which a solution will be sought in this study, is what should be the approved intra-class organization for instruction in arithmetic in the elementary school? The arithmetic grouping practices in use by teachers in the elementary schools of Ohio will be determined, and these practices will be compared with what research findings collectively indicate concerning such arithmetic grouping practices.

Answers will be sought to the following questions:

1. To what extent is grouping for arithmetic instruction practiced in Ohio's public elementary schools?

2. Is grouping for arithmetic instruction considered by teachers to be relatively as important as grouping for reading instruction?

3. What is the relationship between teachers' interest in arithmetic and their arithmetic grouping practices?

4. What is the relationship between teachers' academic qualifications and their arithmetic grouping practices?

5. What is the relationship between teachers' years of
experience and their arithmetic grouping practices?

6. What reasons do teachers give for not grouping pupils for
   arithmetic instruction?

7. What reasons do teachers give for grouping pupils for
   arithmetic?

8. On what basis are pupils placed in groups for arithmetic
   instruction?

9. Into how many groups do teachers who group pupils for
   arithmetic instruction usually divide their classes?

10. How do teachers who say that they group pupils for arith­
    metic instruction divide their teaching time between groups?

11. How many different series of arithmetic textbooks and work­
    books are available to teachers of elementary school arithmetic?

12. Do teachers who group pupils for arithmetic instruction use
    the same arithmetic textbooks and workbooks with all groups?

13. What provisions do teachers make for pupil differences in
    learning arithmetic?

14. Do teachers who group pupils for arithmetic instruction
    indicate that they have sufficient time in which to prepare and dupli­
    cate needed special exercises for groups or individuals?

15. What do research findings collectively indicate concerning
    grouping pupils for arithmetic instruction?

16. What criteria have been established by professional elemen­
    tary school educators as bases for evaluation of intra-class organiza­
    tion for instruction in arithmetic?
Purpose of the study

The purpose of this study is to formulate a clear set of recommendations to elementary school educators with regard to intra-class organization for instruction in arithmetic. Implementation of such a set of recommendations should be of help to individual teachers in selecting the most appropriate form or forms of intra-class organization for use in their classroom circumstances.

Hypotheses to be tested

1. Grouping for arithmetic instruction will be indicated by teachers to be relatively as important as grouping for reading instruction.

2. A higher percentage of teachers who indicate a "very high" interest in arithmetic as a subject will group pupils for arithmetic instruction than will teachers who indicate "average" interest in arithmetic.

3. Grouping for arithmetic instruction is practiced to a greater extent by "highly qualified" teachers than by teachers of "low qualifications".

4. A majority of those teachers who do not group pupils for arithmetic instruction will indicate that such grouping requires too much teacher time for planning and correction work.

5. A majority of those teachers who do group pupils for arithmetic instruction will use three groups.
6. Teachers who group pupils for arithmetic instruction will spend a greater portion of their time instructing their "fast" groups than they will spend instructing their "slow" groups.

Limitations of the study

One limitation upon the accuracy of the study will be imposed by the small size of the sample of teachers involved. Another such limitation will be due to any lack of reliability or validity in the instrument used to measure present arithmetic grouping practices.

The study will also be limited in its usefulness to the extent that teachers do not report arithmetic grouping practices accurately. However, it is expected, since schools and teachers will not be identified in the study, that teachers will report substantially accurate data.

A further limitation will be imposed upon the study by the scarcity of research data on grouping for arithmetic instruction. There has been considerable research in the general field of grouping for instruction in the elementary school but a much more limited amount of research has been specifically directed toward grouping for arithmetic instruction.

Definition of terms

The following terms, used in this study, need to be defined:

1. Elementary School--Public schools that contain some or all of the grades kindergarten through six. Such designations as "Primary Plan", "Ungraded", or "Nongraded" are included when the grade level goes no higher than grade six.
2. Elementary School Teacher--A teacher in the public elementary schools, as defined in number one above, who teaches arithmetic or number study to pupils in his class or classes.

3. "Highly Qualified" Teachers--Teachers who have academic qualifications equal to or above the master's degree level. College training at or above the five year level will be considered equivalent to the master's degree level.

4. Teachers of "Low Qualifications"--Teachers with less than an AB degree. Teachers who indicate a total of four years of college training and no AB degree will not be considered as teachers of "low qualification".

5. Arithmetic--"The art of computation with figures; the study of the integers 0, 1, 2, 3, . . . under the operations of addition, subtraction, multiplication, division, raising to powers, and extracting roots, and the use of the results of these studies in everyday life."^41

6. Individualization of Instruction--The stimulation and direction of the learning activities of pupils to the end that each pupil will develop ideas, meanings, and understandings.^42

7. Ability Grouping--The division of students into classes or within a given class according to their ability to attain.

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Plan of the study

The report of the study will be made in an additional four chapters.

Chapter two will consist of a review of the research on grouping for arithmetic instruction. A short history of grouping in its broader aspects, as it applies to classroom organization in general, will be given first. Then the arguments for and against grouping will be presented in summary form. Following this general review of the subject of grouping will come a review of the research that applies specifically to grouping for arithmetic instruction. All types of grouping from the class-as-a-whole method to individualized instruction will be discussed and all available research will be cited in support of each type. A list of criteria against which teachers may judge their intra-class grouping practices will be presented. The research will then be summarized.

Chapter three will describe the development of the questionnaire and the selection of the sample. Reasons for inclusion of the individual items on the questionnaire will be set forth and the results of its preliminary check will be discussed. Necessary changes of original items will be explained and the final form of the questionnaire will be discussed. Choice of the schools and their teachers used in the sample will be discussed. The method of securing the names of teachers will be explained.

Chapter four will contain a detailed discussion of the findings of the survey. Data from each item on the questionnaire will be
analyzed and the effect of such data upon stated hypotheses will be determined.

A summary of the study will be made in chapter five. Conclusions will be drawn from the study and recommendations will be made to Ohio's elementary school educators.
II. REVIEW OF RELATED RESEARCH

History of grouping

The first recorded instance of group instruction appears to be that attributed to Plato in his Greek Academy in the year 386 B.C. He had his school equipped with lecture rooms for teaching his students in groups.¹

Graded group instruction occurred as early as the sixteenth century in Strasburg. As head of the gymnasium in that city, Johann Sturm organized his school into ten classes, one for each year the pupil was to spend in the school, and placed a teacher in charge of each class.²

In the United States public school instruction began as an individualized affair between pupil and teacher.³ As enrollments increased one-room schools came into widespread use. In these schools,


"... it was normal to depend chiefly on individualized instruction, because of the extreme variations in age and ability of pupils, as well as the narrow curriculum."  

These one-room schools, in most instances, have been replaced by graded schools. Probably the first such graded school was the Quincy Grammar School of Boston that was organized by Professor J. D. Philbrick about 1848. Other graded schools were established in the following twelve years and the principle of grouping pupils by grades was generally considered proper by educators from all parts of the United States by 1860.  

As enrollments increased toward the end of the nineteenth century, this grouping according to grades increased and became common practice.  

The purpose of grade grouping was to keep pupils with their chronological age mates and to make instruction systematic. However, the inability of some pupils to learn the subject matter being taught immediately complicated the situation. Educators found that pupils of the same chronological age varied greatly in their intelligence, achievement, and interests.

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5George S. Beuter, Jr., Necessity for Student Grouping in the Public Schools (Chicago: American Federation of Teachers, 1963), p. 5.  
6Virgil E. Herrick, loc. cit.  
7Lowry W. Harding, loc. cit.  
Attempts were made to reduce the range of individual differences in ability to learn by accelerating the "bright" and failing the "slow" pupils. Failure became so prevalent that by the time pupils reached the eighth grade twenty-five to fifty per cent of them had failed one or more grades.9

Inter-class ability grouping was instituted in public elementary schools during the 1920's as a means of reducing the range of ability represented in instructional groups.10 However, when pupils are grouped according to a general characteristic such as IQ, they still differ widely in ability to learn such academic subjects as reading and arithmetic.11

In spite of the difficulty of reducing the range of pupil abilities in any given grade group to an appreciable degree, many educators still advocate inter-class ability grouping. Such grouping has been and probably remains the most controversial issue of classroom organization in recent years.12

9Ibid.

10Lowry W. Harding, loc. cit.


12Ibid., p. 223.
Arguments for inter-class ability grouping

Much has been written about the merits of inter-class ability grouping. Some writers13, 14, 15, 16, 17 in discussing such grouping list the following or similar arguments:

1. Pupils achieve more because of
   a. instruction geared to their ability levels.
   b. interaction with students of similar ability.
   c. an increased number of successful learning experiences.
   d. use of materials selected for their ability levels.
   e. more individualization of instruction.
   f. stimulating competition from their "equals" for grades.
   g. increased self-confidence.

2. "Slow" and "average" pupils attain better social development because of
   a. a decreased amount of ridicule from the "bright" pupil who is sometimes snobbish.


14Grant C. Piney, "Grouping by Arithmetic Ability--An Experiment in the Teaching of Arithmetic," The Arithmetic Teacher, 8 (March, 1961), pp. 120-123.


b. an increased amount of success in social situations in the classroom.

c. interaction with pupils of similar interests.

3. "Bright" pupils attain better social development because of

a. a decreased opportunity to look down upon or ridicule the "slow" pupil.

b. healthy social competition from their equals.

c. interaction with pupils of similar interests.

4. Pupils like school better when grouped with their intellectual equals.

5. Teachers generally prefer to teach in schools having interclass ability grouping.

6. There is less time wasted by "slow" and "average" pupils in trying to accomplish impossible learning tasks.

7. The education dollar buys more under circumstances where pupils are grouped according to ability.

8. Pupil school life in schools employing ability grouping is realistic because the same or similar groups will be working together or in like occupations in adult life.

9. The "gifted" pupil is better able to recognize his weaknesses and appreciate his strengths when grouped with others of high ability.
Arguments against inter-class ability grouping

Some writers in discussing the merits of inter-class ability grouping list the following or similar arguments:

1. Pupils do not achieve more when grouped according to ability.
2. Pupils are damaged by the social implications of being in a "slow" or "average" ability group.
3. "Slow" and "average" pupils are deprived of stimulation and leadership from the "bright" students.
4. Ability grouping is undemocratic.
5. Parents resent having their children placed in the "slow" and "average" groups.
6. There is a tendency on the part of teachers to neglect individual differences by placing too much emphasis upon similarities of ability grouped pupils.
7. Pupils are handicapped, in solving group problems, by the absence of a heterogeneity of individuals.
8. Teachers dislike teaching "slow" ability groups.
10. Future leaders receive experience in following rather than as leaders.

Grant C. Piney, loc. cit., pp. 120-123.


11. Pupils who are destined to follow receive leadership experience rather than experience in following.

12. After three or four months have elapsed ability grouped pupils must be regrouped because of differing rates of learning.

Prevalence of inter-class ability grouping

Inter-class ability grouping in the United States probably was at its peak during the twenties and thirties of this century. The opinions of certain writers seem to indicate that the practice has not been so widespread in recent years. Shane reported in 1952 that he found ability grouping to be the least common form of classroom organization in the suburban elementary schools he surveyed. Dyer, writing in 1956, stated that "... some schools have tried grouping students according to ability in one way or another, but for various reasons have found it expedient to abandon this device." Spears wrote in 1958 that "... less than a third of our elementary and secondary schools are large enough to practice homogeneous grouping if they wished."

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While the practice of inter-class ability grouping has had a limited and unknown amount of usage in the elementary and secondary schools of the United States, the same is not true of other countries, notably England. In fact, most elementary school classes in England are "streamed" or grouped by ability.\(^2\)\(^5\), \(^2\)\(^6\)

The past decade has brought a renewed interest in ability grouping in this country and many grouping proposals have been made.\(^2\)\(^7\) In England the reverse is true and studies of the effectiveness of "unstreamed" or ungrouped schools are being carried out.\(^2\)\(^8\)

**Opinions of educators on inter-class ability grouping**

Several writers have reached conclusions about the effectiveness of inter-class ability grouping after studying the research on such grouping. Some give qualified support to it while most say the basis of class formation is insignificant. Others would abolish the practice. Still others disagree on the benefit of such grouping to low ability groups.


\(^2\)\(^7\) A. Harry Passow, *loc. cit.*

One of those who give qualified support to grouping is Cornell. She concluded that achievement is better in ability grouped than in non-ability grouped classes when a definite effort is made to adapt the means and materials of instruction to the needs of the different ability levels represented in either type of class.

Several writers from this country agree that the experimental literature has yielded no universally accepted conclusions or that grouping, taken by itself, is insignificant in creating the proper learning environment for pupils. After surveying the literature on grouping or "streaming" in England, Yates and Pidgeon wrote,

It is clear from this review of the sparse research that has been devoted to the problem of streaming that it is possible neither to justify the criticisms that have been levelled against it, nor to prove that streaming is a desirable and effective form of organization.


34 Maurice J. Eash, "Grouping. What Have We Learned?" Educational Leadership, 18 (April, 1961), p. 430.

35 Alfred Yates and D. A. Pidgeon, loc. cit., p. 68.
Faunce\textsuperscript{36} believes that there is no need for inter-class ability grouping, since the teacher can achieve equally good results, without the undesirable side effects of this type of grouping, by employing intra-class ability grouping and individualization of instruction. Another educator with the same general idea is Hamilton who would abolish the practice of inter-class grouping and use intra-class grouping. He wrote that, "Since ability grouping within a school does not do what it is supposed to do and, since it is not in keeping with the principles of democracy, there is no justification for its continuance."\textsuperscript{37}

In England, where educators have become interested in the value of the practice of non-grouping which they call unstreaming, Jackson\textsuperscript{38} proposed the hypothesis that such unstreaming markedly improves the academic achievement of the less gifted child. Another English writer, Daniels,\textsuperscript{39} concluded from his findings that unstreaming was effective in increasing the intelligence quotients of pupils, especially those of low IQ pupils.


\textsuperscript{37}Dwight Hamilton, "Adapting the Arithmetic Program to Varying Levels of Ability and Achievement of Pupils within the Classroom Group" (unpublished Ph.D. dissertation, University of Denver, 1947).


\textsuperscript{39}J. C. Daniels, \textit{loc. cit.}, p. 127.
In this country, on the other hand, Wilhelms and Westby-Gibson concluded that "If any one group has at all consistently gained from grouping it has been the low group."\(^{40}\)

Passow in 1962 gave reasons why he believes the experimental literature has yielded no universally accepted conclusions. He was convinced that the studies differed in the following ways:

1. The scope of aim and purpose.
2. The number of pupils, the number of groups, and the size of classes involved.
3. Duration—ranging from one semester or less to a year or more.
4. The means of matching experimental and control groups.
5. The curriculum and method of teaching.
6. The use of teachers.
7. The instruments and techniques used in evaluating changes in pupil behavior.\(^{41}\)

In discussing the quality of research from the English point of view, Yates and Pidgeon\(^{42}\) wrote that different experimental designs, different teaching methods, different tests, and different learning materials have all contributed to a confused situation.

Since the experimental evidence is believed to be inconclusive, the question arises as to why educators either advocate or denounce


\(^{42}\)Alfred Yates and D. A. Pidgeon, \textit{loc. cit.}, p. 66.
inter-class ability grouping practices. In commenting upon this
Gores states:

Schools which are particularly concerned with the emotional, social, character, and personality development
of young people are likely to group students pretty much
by lot. Conversely, schools with central concern for
learning of subject matter are likely to sort students
into groups according to rate of achievement. 43

It appears that even though most educators accept the same educational goals for pupils their emphasis upon certain goals and methods
of attaining these goals cause them to either advocate or denounce
inter-class ability grouping.

Social maturity grouping

In recent years certain elementary school educators, not being
completely satisfied with either of the above methods of grouping
pupils, have advocated "social maturity" levels as a more equitable and
feasible basis for grouping pupils in classes. 44, 45 Factors consid­
ered in placing pupils in groups are sociometric scores, intelligence
test scores, achievement test scores, physical maturity ratings, and
teachers' pooled judgments. 46 No research was found in the literature
by this writer as to the effectiveness of this type of grouping when
compared with either inter-class ability grouping or heterogeneous

43 Harold B. Gores, "Homogeneous Grouping," NEA Journal, 47
44 Lowry W. Harding, loc. cit.
45 Harold G. Shane and Wilbur A. Yauch, loc. cit., p. 294.
46 Ibid.
Even though the experimental literature indicates no conclusive evidence as to the effectiveness of inter-class ability grouping for scholastic achievement in general, a question remains as to the effect of such grouping on achievement in arithmetic. Eighteen experimental studies were found by the writer, that have a bearing upon this question. These studies will be discussed under the four categories of Inter-Class Ability Grouping, Multi-Grade Grouping, Grouping by Arithmetic Ability, and a Joplin-Type Plan.

Studies supporting inter-class ability grouping

A study was made by Schwartz\(^{47}\) and reported in 1943 on the effect of ability grouping on the scholastic achievement and personality development of gifted pupils in grades one through eight. Gifted pupils were defined as those with an IQ of 130 or above. Four hundred pupils from seven schools were included in the study. These pupils were paired on the basis of intelligence and placed in either experimental or control classes.

The 200 experimental pupils were in special classes for the gifted in one elementary school, while the 200 control pupils were located in six other schools. Two of these control schools had what was termed "activity" programs, two others had "traditional" programs, and two were junior high schools.

On the basis of scores received by the pupils on the Metropolitan Achievement Tests, it was concluded by Schwartz that gifted pupils in ability grouped classes achieved more in all subject matter areas, including arithmetic, than such pupils in heterogeneously grouped classes. This greater achievement by the experimental group was significant at the .05 level of confidence.

Schwartz also concluded that pupils in experimental classes exhibited more wholesome and integrated personality development.

Polkinghorne reported favorably on a primary grade grouping plan in 1951 that was carried out at the Laboratory School of the University of Chicago. Five primary grade rooms in which the pupils ranged in age from six to almost eight years were included in the experiment.

In the three years prior to the report, pupils from the five rooms were grouped by ability, regardless of which home room they were in, for instruction in reading, writing, arithmetic, and music. Achievement of pupils in these three years was compared with the achievement of the pupils from the preceding three years who had not been grouped.

Polkinghorne in reporting the results said that even though the average IQ of the grouped pupils was from six to nine points lower than that of the ungrouped pupils, the scores on the Metropolitan Achievement Tests were slightly higher since grouping. In arithmetic

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the average grade acceleration had been .4 years for the ungrouped pupils and was now .7 years for the grouped pupils.

Savard,\(^{49}\) reported on an experiment, in March 1960, carried out in the Burlingame School District of California, that was started in the 1957-1958 school year and completed in the 1958-1959 school year. A total of 1200 pupils in grades four through eight were involved in the experiment.

The 1200 pupils were assigned to either "upper-range" or "lower-range" ability groups primarily according to their scores on the reading test of the Stanford Achievement Tests. Other factors used as a basis for classification were intelligence quotients, grades, and records in pupils' cumulative folders. "Upper-range" groups were composed of "average" pupils plus a small number of "fast" pupils, whereas, "lower-range" groups consisted of "average" pupils plus a small number of "slow" pupils.

A comparison was made of seven months academic growth in the 1957-1958 school year when pupils were grouped by ability with ten months of such growth during the 1956-1957 school year when pupils were not grouped by ability. Growth was measured by the Stanford Achievement Battery of tests in four areas, paragraph meaning, word meaning, arithmetic reasoning, and arithmetic computation.

The findings of the study were that "upper-range" groups did significantly better in arithmetic reasoning only, while "lower-range"

groups did significantly better in paragraph meaning, arithmetic reasoning, and arithmetic computation.

In Savard's conclusion he made the statement that "... limited range grouping tends to be effective under lower-range conditions and of less advantage in upper-range situations."^{50}

Hart^{51} reported in 1962 on an experiment involving fifty pupils in experimental ability grouped, non-graded classes and fifty pupils in non-grouped, graded control classes. The experiment was carried out in the primary grades of Peter Boscow School, Hillsboro, Oregon. Pupils were matched on the basis of IQ, sex, chronological age, and socioeconomic status in the community. The classes were reportedly similar in class loads, instructional methods, materials available, teaching time, and emphasis given arithmetic instruction.

Three years was the duration of the experiment and results were taken from scores on the Arithmetic Battery of the California Achievement Tests which were administered to all pupils when they entered fourth grade in September. These results showed that the experimental group had a mean score in arithmetic achievement one half year above the control group. This advantage in favor of the experimental group was significant at the .02 level of confidence.

^{50}William G. Savard, loc. cit., p. 59.

Smith\textsuperscript{52} studied the achievement of academically talented students in four secondary schools in Indiana in the 1959-1960 school year. Academically talented was defined as the upper 25 per cent or all students above the seventieth percentile in intelligence. The experimental groups were in three categories: ability grouping with acceleration, ability grouping with enrichment, and ability grouping with no special program. The control groups were in the regular college preparatory program. Intelligence quotients and aptitudes were compared at the beginning of the experiment and found to be about equal.

The Sequential Tests of Educational Progress were given at the end of the year. It was found by Smith that only the accelerated ability group showed significant improvement in progress in mathematics over the control group. This improvement in progress was significant at the \textit{.01} level of confidence.

\textbf{Summary of studies supporting inter-class ability grouping}

Approximately 2800 pupils in grades one through eight, grade eleven, and grade twelve, were included in the five experimental studies examined that supported inter-class ability grouping with respect to arithmetic achievement. Grades one through three were covered by three experiments, grades four through eight by two, and grades eleven and twelve were included in only one study.

Two studies by Hart and Polkinghorne of grades one through three were on a small scale, including approximately fifty pupils each. Both covered a three year period. The study by Polkinghorne was conducted in a laboratory school in which two teachers were assigned to each class. Such an arrangement is not typical of the public elementary school. The study by Hart used the intelligence quotients of six year olds as one criterion for placing pupils in ability groups. This would appear to be a weakness in the study due to the difficulty of obtaining a stable IQ for such a young child.

These studies tend to support inter-class ability grouping for instruction in arithmetic but some uncontrolled factors may have had an effect upon the results. It is known that sometimes any change in method will be accompanied by an improvement in pupil behavior. It is also known that teacher enthusiasm for any new procedure could affect the results of an experiment.

Inconclusive ability grouping studies

In the first of five experiments to report inconclusive results, Cook\textsuperscript{53} studied the achievement of 495 students. The experiment was carried out in Topeka High School, Topeka, Kansas, in the fall term of 1921-1922. The three subjects taught in the experiment were English, geometry, and history.

A total of eight teachers taught experimental and control classes. Of these teachers two were teachers of geometry. Each teacher taught three sections: strong, mixed, and weak.

The strong section included only the better students, while the weak section included only the poor students. The mixed section acted as the control group and contained students of all abilities. Student ability was based upon grades received in Algebra Two the year before.

The two geometry teachers worked together in preparing teacher-made tests and in scoring these tests which were used as the basis of grading.

At the end of the term students were categorized as to whether or not their grades were higher, the same, or lower than they had been in Algebra Two.

It was found that geometry students in the strong sections received no benefits from being in those sections, while geometry students in the weak sections did receive some benefit from being in those sections. Cook reported that the study generally yielded inconclusive results.

Goldberg and Passow\textsuperscript{54} conducted a large-scale investigation into the effects of ability grouping on the academic achievement of fifth- and sixth-grade pupils in New York City. The two-year experiment started in 1956 with 3000 pupils in 86 fifth-grade classes in 45 schools.

The hypothesis tested was that "Neither the presence nor absence of gifted pupils, nor the range of abilities in any given classroom, nor the relative position of a particular ability level within the range will affect the attainment of elementary school pupils."\(^{55}\)

In their conclusion Goldberg and Passow stated, "... narrowing the ability range per se, without specifically designing varied academic programs for the various ability levels, does not result in consistently greater academic achievement."\(^{56}\)

Martin\(^{57}\) investigated the effects of ability grouping on student achievement in 1958 in three junior high schools in Nashville, Tennessee. One school employed ability grouping while another had only "moderate" ability grouping. A third school had no grouping and served as a control.

Student intelligence quotients ranged from 66 to 140 and the 176 pupils involved in the study were divided into three groups. The three groups consisted of students with "high," "middle," and "low" intelligence quotients. Such division had nothing to do with classroom grouping but was for analysis of gains made.

The Stanford Achievement Tests were given before and after grouping. Martin concluded that non-grouping was as effective as

\(^{55}\)Miriam L. Goldberg and A. Harry Passow, loc. cit., p. 483.

\(^{56}\)Ibid., p. 487.

the grouping practices of the two experimental schools, when effectiveness was measured by gains made on the Stanford Achievement Test.

A study by Abramson\(^58\) in New York City on the effectiveness of grouping students of high ability was reported in 1959. Intelligence quotients of the high ability students from four different high schools ranged from 115 to 160. One hundred ninety-two students, of whom 111 took analytic geometry and calculus, constituted the sample. Students in one of the four high schools in which students were not grouped served as controls.

The effectiveness of ability grouping was determined solely by making a comparison of the college grades of the grouped and the ungrouped students. No significant difference in the college grades of the two groups was found.

Mahler\(^59\) studied the achievement of selected junior high school gifted students in four junior high schools in Texas during the 1960-1961 school year. He reached the conclusion, after administering achievement tests before and after grouping, that students should be grouped by ability for reading but that there was no advantage in such grouping for arithmetic instruction.


Summary of inconclusive inter-class ability grouping studies

Approximately 3800 students were included in inter-class ability grouping studies which showed inconclusive results with regard to arithmetic achievement. Only one of the five studies in this group, that by Goldberg and Passow, dealt with grade-school pupils. The grades included in the study were fifth and sixth. This study was on a large scale, including 3000 of the 3800 students, and appears to have been well controlled.

Two of the studies, those by Martin and Mahler, were conducted at the junior high level. Mahler studied only high ability students.

The other two studies, those by Cook and Abramson, were carried out at the high school level. Abramson's study also included only high ability students. The method of evaluating student achievement in these studies is open to question, because both used grades received in courses taken as indicative of achievement.

Studies unfavorable to inter-class ability grouping

First of the studies examined that reported results unfavorable to inter-class ability grouping was carried out by Koontz\(^60\) in the Norfolk County Schools, Norfolk, Virginia, during the 1959-1960 school year.

The five fourth-grade experimentally grouped classes were in the Deep Creek Elementary School. Five fourth-grade classes in two other schools served as controls. The experimental classes were grouped by percentages. The top twenty per cent made up the first class, the second twenty per cent the second, etc.

One experimental class received fifth-grade materials, two received fourth-grade materials, and two received third-grade materials. The control classes all received fourth-grade materials.

The Iowa Tests of Basic Skills were given at the end of the third grade and again at the end of the fourth grade.

It was found that the control group made three months more achievement in arithmetic, as measured by the Iowa Tests of Basic Skills, than did the experimental group.

Another very unfavorable study covering a period of three and one-half school years was made by Daniels in England and reported in 1961. A total of 517 pupils in four "junior" schools, which includes children of ages seven through ten and one-half or eleven years, were involved in the study. He compared the achievement of streamed or grouped pupils in two of the schools with the achievement of unstreamed pupils from the other two schools.

In England it is common practice to stream pupils and so it was reported by Daniels to be rather difficult to find schools in which

pupils were unstreamed. However, when two such schools were found he
experienced no difficulty in finding two comparable schools in which
pupils were streamed.

In each of the four schools group instruction was given to the
class as a whole and then pupils were instructed individually as the
teachers saw a need for, and an opportunity to provide, such individual
instruction.

Daniels concluded that unstreaming increases the level of arith­
metic attainment of junior school pupils. His findings were signifi­
cant at less than the .01 level of confidence. He further reported
that unstreaming increased the average pupil IQ by three points.

Summary of studies unfavorable to
inter-class ability grouping

Two studies, one in England and the other in the United States,
including 817 pupils, produced results that were unfavorable to inter­
class ability grouping when arithmetic achievement scores were used to
determine the effectiveness of such grouping.

There were no apparent weaknesses in the English study made by
Daniels in the junior school. However, an individual more familiar
with English schools than the writer would be better able to evaluate
the study. Streaming or grouping is receiving an increased amount of
attention in that country at the present time.

In the other study, made by Koontz, involving fourth-grade pupils,
a question arises as to why teaching materials used were graded as
reported. If the control classes were to receive all fourth-grade
materials then it would seem logical to give the experimental classes
all fourth-grade materials or some other balanced arrangement of materials. To give two experimental classes third-grade materials while giving only one such class fifth-grade materials seems to be assuming that the average achievement level of the experimental classes is lower than that of the control classes.

**Studies of multi-grade ability grouping and arithmetic achievement**

Two recent experiments on multi-grade grouping, including 496 students, were examined. One study supported this type of organization while the other was inconclusive.

The supporting experiment reported in 1957 by Hamilton and Rehwoldt was carried out in California. Seven multi-age, multi-grade experimental ability groups were located in one school. Eight single grade control groups were located in the same school. Twenty other single grade groups from five different schools also served as controls.

Comparisons of gains made by the experimental and control groups during a one-year period were treated statistically in the areas of reading, language, arithmetic, personal adjustment, social adjustment, social maturity, certain characteristics of behavior, and pupil attitudes towards school. Hamilton and Rehwoldt concluded that the academic achievement of pupils in wide age grade range classes was greater than the achievement of pupils in regular classes. Twenty-two out of thirty-six comparisons favored the multi-grade groups.

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The second of these experiments was made by Metfessel, beginning in 1958 and continuing for three years. Three experimental classrooms were organized from the fourth, fifth, and sixth grades while three classrooms served as controls.

Twenty-three pairs of pupils were matched on the basis of sex, grade level, IQ, and chronological age. The complete battery of California Achievement Tests was given to all pupils each year.

Metfessel's conclusion read as follows:

The hypothesis, therefore, that multi-grade students would show a gain in achievement test scores significantly higher than the single grade students is rejected, as both multi-grade and single-grade methods appear equally effective in terms of the tested abilities measured in this experiment.

In summary, it appears that the main selling point of the reporter of the one favorable study is the help that pupils can give one another in a multi-age, multi-grade classroom. The older pupils can and will help the younger, less mature pupils at times and the "bright" young pupil may be able to help the older "slow" pupil gain insight into situations in a way that the teacher is unable to do. This mutual help can possibly cause both to gain some intangible benefits that are unavailable to them in the regular classroom.

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64 Newton S. Metfessel, loc. cit., p. 158.
A Joplin-type plan and arithmetic achievement

This experiment reported by Davis and Tracy⁶⁵ in 1963 involved 393 pupils, in fourth, fifth, and sixth grade, from two schools.

In the experimental school pupils were grouped for the arithmetic period by arithmetic achievement and IQ. Any given class would contain fourth, fifth, and sixth grade pupils. In the control school, on the other hand, pupils were assigned to classes at random.

The California Arithmetic Test was administered to all pupils in October, 1960, and again in April, 1961. Davis and Tracy concluded from the results of these tests that there is no advantage in having a Joplin-Type grouping plan for arithmetic instruction.

Inter-class grouping by arithmetic ability

A few experiments have been carried out wherein students were placed in classes on the basis of their demonstrated ability or achievement in arithmetic.

One such experiment was conducted by Pinney⁶⁶ in Vieweg Elementary School, China Lake, California. The performance of fifty-eight sixth-grade pupils was compared to national norms while in two ungrouped fifth-grade classes in 1957-1958 and again after being grouped in the sixth grade during the 1958-1959 school year.


⁶⁶Grant C. Pinney, "Grouping by Arithmetic Ability-An Experiment in the Teaching of Arithmetic," The Arithmetic Teacher, 8 (March, 1961), pp. 120-123.
Pupils were placed in either of two groups solely on the basis of their scores on the Science Research Associates Arithmetic Achievement Tests for grades four to six. Prior to being grouped there was a range in arithmetic achievement of eight years. This range was cut in half by the formation of a "high" and a "low" group.

Students in the "low" group were given more time on successive topics and were given shorter assignments. Additional practice was provided by giving special homework to this group.

Students in the "high" group were given additional arithmetic enrichment activities and were allowed to move on to new topics at a faster rate of speed than the "low" group.

Pinney concluded that the program was a success in accomplishing the goal that had been set—to increase academic achievement in arithmetic. The average grade placement of pupils in arithmetic exceeded national norms and increased more than two years during the 1958-1959 school year as measured by the Science Research Associates Arithmetic Achievement Tests. He further concluded that pupils were more at ease in the classroom situation and that preparation and teaching were made easier and more effective.

Another experiment, on a much larger scale, was reported in 1960 by Provus and carried out in Homewood, Illinois, a suburb of Chicago. A total of nineteen intermediate classrooms were involved in the experiment. Pupils in eleven of the classrooms were grouped as to arithmetic ability while those in eight classrooms were used as controls.

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The pupils involved in the experiment were one and one-half years above the national norm in average academic achievement. Their average intelligence reached the seventieth percentile as measured on the Kuhlmann-Finch Scale of Intelligence.

Placement of pupils in groups was based upon performance on the arithmetic concepts subtest of the Iowa Tests of Basic Skills, which were not timed.

Teachers were assigned at random to the experimental and control classes. All teachers attended the same in-service meetings.

Provus reached these conclusions:

1. Children in the experimental groups were familiar with more arithmetic concepts than children in the control groups.

2. In no case were the children in the experimental groups less proficient in the fundamentals than the children in the control groups.

3. "Bright" pupils, when compared with the "slow" and "average" pupils, profited most from ability grouping.

4. Only the upper-ability experimental group achieved at a significantly higher level than the corresponding control group when the groups were matched as to intelligence.

Sommers compared the achievement of pupils when grouped on the basis of arithmetic and English ability with the achievement of pupils not so grouped. The study was carried out in Frost Junior High School, Jackson, Michigan, in the 1957-1958 school year.

The experimental group consisted of 291 pupils taught through the seventh and eighth grades. The control group contained 236 pupils in the eighth grade and covered one-half year in the spring of 1957.

A program was planned for the experimental group that would individualize instruction and permit the pupil to advance at his own rate.

At the end of the experimental period both groups completed the Verbal Reasoning and Numerical Sections of the Differential Aptitude Tests, the Cooperative English Test, and the California Arithmetic Achievement Test.

Sommers concluded that the experimental group showed improved performance over the control group and that there was a closer relationship between scores earned by the experimental group on ability tests and tests of achievement than there was between similar scores of the control group.

Summary of experiments on inter-class grouping by arithmetic ability

Three studies, including 1158 pupils, were examined in which pupils were assigned to classes according to their ability in arithmetic. Two of the three studies were conducted on a fairly large scale, involving approximately 550 pupils, while the third had only fifty-eight pupils. Grades four through eight were included in the experimentation with grade six being in two of the studies.

All three of the experiments reported results favorable to grouping by arithmetic ability. However, in at least two of the three experiments, individualization of instruction was utilized and could
have been the primary cause of the favorable results. Another possible cause could have been the general arithmetic improvement program that was planned and executed in each of the experiments.

Opinions of educators on intra-class ability grouping

The grouping dealt with in this report to this point has been concerned with practices of assigning pupils to the total classroom group. Once pupils have been assigned to a class, by whatever method, the problem of whether or not these pupils should be grouped for arithmetic instruction, and if so, how to group them within the classroom to meet individual differences or to facilitate teaching, arises.

One proposal to solve this problem has been to group pupils within the classroom by ability in arithmetic. Such grouping, commonly known as intra-class ability grouping, appears to be a more acceptable idea among educators than inter-class ability grouping. Faunce, for example, does not encourage inter-class ability grouping but believes in intra-class grouping and individualization of instruction. Hamilton would abolish inter-class grouping while maintaining intra-class ability grouping.

69 Roland C. Faunce, loc. cit.
70 Dwight Hamilton, loc. cit., p. 53.
Intra-class ability grouping is accepted practice in the teaching of reading in the elementary school. Greco believes the same should be true of arithmetic. He states that "If grouping in arithmetic can be as readily accepted as grouping in reading, we shall find classrooms engaged in meaningful work for all . . . ."\(^4\)

The extent to which pupils are subgrouped in classrooms for instruction in arithmetic is unknown. Two studies were found that dealt with this question. However, they did little to clarify the matter.

One study was carried out by Brueckner\(^5\) in 1933. He received by questionnaire the results of 505 observations of arithmetic teaching practices in grades four, five, and six, made by elementary school principals from all over the United States. After compiling data from the questionnaires he stated that "... in approximately 50 per cent of the classes the pupils were divided into two or more groups according to the progress made . . . ."\(^6\)

\(^{71}\) Eugene S. Spence, \textit{loc. cit.}, p. 3.


\(^{74}\) Ibid.


\(^{76}\) Leo J. Brueckner, \textit{loc. cit.}, p. 42.
The other study was conducted by Johnston, through the use of questionnaires to teachers of grades one through eight in the state of Tennessee. Johnston found "... general failure to establish pupil grouping on the basis of ability and interest for instruction and assignments and substituting for this practice that of giving all pupils the same problems daily, regardless of individual differences."

In writing on grouping for child growth and development Morgan listed two basic assumptions: (1) Human beings are more alike than they are different, and (2) each child is unique. Jones and Pingry, in discussing the relationship of the same two assumptions to classroom instruction, said:

If each child is seen as completely unique, it follows that instruction must be completely individualized; if all children are viewed as alike, teaching should be entirely a group process. Neither position is tenable, and all good teaching accepts a compromise somewhere between these extremes.

In examining the professional literature the writer of this report could find no educator opinions to support the one extreme of the class-as-a-whole procedure for instruction in arithmetic. Some writers

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78A. Montgomery Johnston, loc. cit., p. 429.


did maintain, however, that there are times when certain arithmetic concepts should be taught to the class-as-a-whole.81, 82, 83, 84

Several educators, other than the ones who conducted intra-class grouping experiments reported elsewhere in this study, indicate by their writings that they favor intra-class grouping for arithmetic instruction.85, 86, 87, 88, 89, 90, 91, 92, 93, 94,

82 Frances Flournoy, "Meeting Individual Differences in Arithmetic," The Arithmetic Teacher, 7 (February, 1962), p. 82.
85 Sister Michael H. O. P. Cavanaugh, loc. cit.
86 Laura K. Eads, loc. cit., p. 105.
88 Frances Flournoy, loc. cit., p. 81.
89 Sister Michael O. P. Henry, loc. cit.
90 J. Allen Hickerson, loc. cit.
93 Harold G. Shane and Wilbur A. Yauch, loc. cit., p. 301.
Others favor almost complete individualization of instruction in arithmetic. Others favor almost complete individualization of instruction in arithmetic.97, 98

Intra-class ability grouping and achievement in arithmetic

Fourteen experiments on intra-class ability grouping were examined and it was found that various grouping methods have been proposed by educators. However, non-grouping and uniform class-as-a-whole instruction appears to be the most common practice in the elementary school classroom in this country at the present time.99

Class-as-a-whole method

As far as this writer knows, no research has been accomplished with the aim of testing the class-as-a-whole method of instruction. However, several experiments have been carried out using the class-as-a-whole method as a control. Such experiments do not always give this method a fair trial because of such factors as teacher enthusiasm for the new method and the sometimes favorable effect of any change in method.

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95 Wallace H. Strevell and Pauline Oliver, "Grouping Can be Flexible within the Classroom," The Nation's Schools, 59 (February, 1957), p. 90.


No studies were located that showed results significantly in favor of this class-as-a-whole method, however, one study reported in 1960 did show results that were not unfavorable to this procedure.

This one study was conducted by Wallen and Vowles in an attempt to determine the effect of intra-class ability grouping on arithmetic achievement in the sixth grade. The experiment was carried out in two elementary schools in the suburbs of Salt Lake City, Utah. Two teachers, one male and one female, and two classes from each school were included in the study. One school had thirty-one students per class while the other had twenty-five. All four teachers had five years of teaching experience each.

The California Achievement Tests were given in the spring before the experiment was carried out and the scores were ranked. Students were assigned to the two classes in each school by the selection of every other pupil from the ranked list. A different form of the test was given the first week of school as a check on the original administration of the test. Two further administrations of the test were given—one at the end of each semester. Scores from these two tests were used in evaluating the results of the experiment.

In each school one teacher grouped pupils the first semester while the other taught the class-as-a-whole. During the second

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100Norman E. Wallen and Robert O. Vowles, "The Effect of Intra-Class Ability Grouping on Arithmetic Achievement in the Sixth Grade," *Journal of Educational Psychology*, 51 (June, 1960), pp. 159-163.
semester the teachers reversed their procedure with the one who grouped pupils the first semester doing no grouping of pupils while the other grouped.

During the semester in which a teacher grouped he or she would use four groups. The number of students per group varied from five to eight. A different text was used with each group. The teacher met with a group for at least three twenty minute periods each week. For the remaining class time the pupils worked individually and were encouraged to help each other as necessary.

When the class-as-a-whole method was being used, the teacher presented the lesson to the class and then the pupils worked individually with help being given by the teacher as necessary.

In the findings of the study it was revealed that there was no significant difference between the methods of grouping and non-grouping. However, differences were found between schools, semesters, and teachers.
Seven additional experiments,\textsuperscript{101} \textsuperscript{102} \textsuperscript{103} \textsuperscript{104} \textsuperscript{105} \textsuperscript{106} \textsuperscript{107} reported under other types of intra-class grouping, resulted in findings that were unfavorable to the class-as-a-whole method of instruction.

In summary, it appears that studies of this type of teaching method have found that it is inferior to other proposed methods. Some question remains, however, as to what the outcome of studies of this method would be if teachers teaching in experimental classes generally believed that such a method was better than, or at least equal to, other methods. It appears probable that teacher enthusiasm for the experimental method tends to lead to results favorable to that method.


\textsuperscript{106}William M. Smith, "The Effect of Intra-Class Ability Grouping on Arithmetic Achievement in Grades Two through Five" (unpublished Ph.D. dissertation, Louisiana State University, 1960).

\textsuperscript{107}Eugene S. Spence, \textit{loc. cit.}
Flexible intra-class ability grouping

Many educators advocate flexible intra-class ability grouping. Four experimental studies in which such grouping was utilized were examined to determine the reported effect upon arithmetic achievement. Three of the studies reported favorable results while the fourth gave a report that was inconclusive.

The first favorable experiment was conducted by Guiler and Edwards and reported in 1943. The study was concerned with methods of instruction in computational arithmetic in grades seven and eight in Shelby and Lucas Counties of Ohio.

Pupils were paired and put into either experimental or "conventional" classes. Scores on the Guiler-Christofferson Analytical Survey Test in Computational Arithmetic, Form 1, were used as a basis of class assignment. One point was the maximum range between paired individuals. One hundred and sixty pairs had identical scores while forty-six pairs had a one point range.

Two class periods were devoted to experimentation each week. In the experimental group whole-class instruction was given to meet the needs of the majority and then small group instruction was given as needed. Need was determined on an individual basis from the results of the test taken before groups were formed. Pupils were told of their weak areas and given self-teaching materials for those areas. The control group also spent two periods per week in which "conventional" group instruction procedures were used.

Form Two of the Guiler-Christofferson Analytical Survey Test in Computational Arithmetic was given at the end of the twenty-three week experimentation period. Guiler and Edwards concluded from the results of this test that small group instruction based upon individual diagnosis of needs is more effective than conventional group instruction in improving computational habits.

A second favorable experiment was reported by Smith\textsuperscript{109} in 1960 and was carried out in the Lake Charles City School System of Louisiana. The study was concerned with the effect of intra-class ability grouping on arithmetic achievement in grades two through five.

Ninety-five pupil pairs were used as subjects in the experiment. Pupil pairs were chosen on the basis of their average grade placement in arithmetic on the Stanford Achievement Test, Form L, and on their intelligence quotients derived from the Science Research Associates Mental Abilities Test.

The experimental pupils spent 75 per cent of their daily arithmetic class period in intra-class groups while the control pupils spent their arithmetic class period in a classroom where the class-as-a-whole procedure was used.

For evaluation of the results of the experiment, Form M of the Stanford Achievement Test was given during the eighteenth week of the semester.

Smith concluded that, on the basis of evidence presented in the study, intra-class ability grouping is a procedure that may be used

\textsuperscript{109}W. M. Smith, \textit{loc. cit.}
to improve arithmetic achievement in grades two through five of the elementary school.

In the third favorable experiment in which flexible intra-class ability grouping was used, Lerch\textsuperscript{110} studied the performance of 116 fourth graders in the public schools of Urbana, Illinois. An attempt was made to keep the experimental and control groups similar with respect to socio-economic backgrounds, reading ability, class size, range of IQ, textbook and teaching theory used, and length of arithmetic class period.

When a new arithmetic topic or area was to be studied, the experimental group was told of the expectations in the way of skills and understandings to be achieved. A pre-test was then given and groups were formed in accordance with pre-test performance.

The control group received instruction on each arithmetic topic or area by the class-as-a-whole procedure.

Achievement test scores were compared at the end of the experimentation period. Lerch found a difference in arithmetic achievement favoring the experimental group that was significant at the .01 level of confidence.

Holmes and Harvey\textsuperscript{111} reported in 1956 upon an experiment that compared flexible intra-class ability grouping with permanent intra-class ability grouping. The experiment was carried out in San Diego, Illinois.

\textsuperscript{110}Harold H. Lerch, loc. cit.

California, using two third-grade classes from the same school, and two fourth and two sixth-grade classes from different schools.

Pupils were matched by grade levels on the basis of arithmetic achievement tests and assigned to classes which either grouped permanently or used a method of flexible grouping. Third grade pupils were matched from scores made on the Stanford Primary Test. Fourth graders took the Intermediate Battery of the Metropolitan Achievement Tests and sixth graders were given the Intermediate Battery of the Stanford Achievement Tests. All pre-tests were given on the twentieth of October.

Permanently grouped classes used two or more groups that were maintained throughout the experimentation period. Each of such groups was taught as a separate class.

In the flexibly grouped classes the class-as-a-whole was introduced to new materials or topics and then the class was divided into groups on the basis of individual accomplishment in the particular topic being studied.

Evaluation of the results of the grouping experiment was based upon scores made on a second administration, March 4, of the original tests given in October. A different form of the tests was used at that time. Holmes and Harvey reached the conclusion that each method appeared equally good in promoting subject-matter outcomes.

**Summary of flexible intra-class ability grouping studies**

Grades two through eight were included in experiments examined in connection with flexible intra-class ability grouping. The third
grade was included in two of the experiments, the fourth grade in three, and the remaining grades in only one.

The size of the samples surveyed ranged from 116 to 212 pupils.

The three favorable studies all used the class-as-a-whole method of instruction with control groups. The one inconclusive study, on the other hand, used permanently grouped subgroups in its control group.

All of the studies appear to have been well conducted, with experimental and control groups receiving comparable treatment, except the study by Guiler and Edwards. This study was conducted in such a manner as to give the experimental pupils the advantage of individualized instruction and remedial teaching that was unavailable to the control group.

These studies tend to strongly support intra-class ability grouping and seem to indicate that there is an added advantage in keeping such grouping flexible.

**Intra-class ability grouping**

Five experimental studies of intra-class ability grouping in which flexibility was either not mentioned or not stressed were examined by the writer. Four of these studies reported favorable results and one reported inconclusive results.

The first experiment was conducted by Jones\textsuperscript{112} in the 1945-1946 school year in the Richmond, Indiana City Schools. The arithmetic,

\textsuperscript{112}D. M. Jones, loc. cit.
spelling, and reading achievement of a total of 125 matched pairs of fourth grade pupils was studied.

The pupils were matched on the basis of their scores on the Kuhlmann-Anderson Mental Test, Form E of the Stanford Achievement Test in spelling and arithmetic, and Form 1 of the Gates Basic Reading Test, administered in September.

The 125 pupils in the experimental group were located in five classrooms while the 125 pupils in the control group were located in a total of twenty-six classrooms.

Pupils in the experimental classrooms were divided into five subgroups. Materials used with these subgroups varied with the achievement levels, needs, interests, and rates of learning of the individuals composing them. A special effort was made to meet the needs of individuals.

The control classes were conducted as a unit and the teachers generally used only the text assigned to that grade level in spelling, reading, and arithmetic.

For evaluation purposes Form Two of the reading test and Form D of the spelling and arithmetic tests were given to all pupils in May, 1946. The experimental groups were superior in reading and spelling. In arithmetic students in the experimental group who averaged below 90 in IQ were reported to have gained 3.2 months in average achievement over the control group. Those who averaged between 90 and 109 in IQ gained 1.5 months, while those who averaged above 109 in IQ were exceeded to the extent of 1.5 months by the control group. Jones
reported that for all subjects, differences in achievement were not significant for groups who averaged 110 and above in IQ.

In conclusion Jones stated that "... children taught on their individual levels regardless of grade placement make a greater amount of growth than comparable pupils taught as a group the curriculum prescribed for their grade with only minor and incidental provisions for individual differences." 113

Spence 114 did an experiment with intermediate grade pupils in Bethel Borough Public Schools in Pennsylvania, during the 1955-1956 school year, in which he tested intra-class ability grouping for instruction in arithmetic against the whole class instructional procedure.

Five hundred and sixty-seven pupils in nineteen classes made up the experimental group. The control group consisted of 191 pupils in six classes. The California Mental Maturity Test was given to all students as a means of equating them for assignment to either experimental or control classes.

All experimental classes were divided into three groups—high, average, and low—on the basis of performance on the California Mental Maturity Test, the Stanford Arithmetic Achievement Test, and according to teacher judgment. Each group was taught as a separate class with individual help for pupils as needed.

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113 D. M. Jones, loc. cit., p. 270.
114 Eugene S. Spence, loc. cit.
The control classes were taught on a whole-class basis, with individual help being given by the teacher as he determined the necessity for such help.

A second form of the Stanford Arithmetic Achievement Test was given at the end of the school year as an evaluative device. Results of this test showed that the experimental group made a significantly greater gain in arithmetic achievement than did the control group. The difference in favor of the experimental group was significant at the .01 level of confidence.

Spence summarized the findings in the statement:

The evidence presented in this study supports the conclusions that sub-grouping within the classroom for instruction in arithmetic is a practical and successful method of classroom organization to provide differentiated instruction for the various ability levels.\(^{115}\)

Questionnaires were submitted to parents, teachers, and pupils. A majority of these parents, teachers, and pupils indicated by their responses to items on the questionnaires that they preferred intra-class ability grouping.

An experiment was conducted in the 1959-1960 school year by Moench\(^{116}\) in one single, self-contained, heterogeneous, fourth-grade classroom. One-half of the class was matched as closely as possible on a pupil to pupil basis with the other half of the class. The experimental half of the class was divided into three subgroups. Pupils


\(^{116}\) Laurel Moench, *loc. cit.*
were matched and either placed in the control group or subgroups of the experimental group on the basis of scores made on the Tailor Tests and the California Achievement Tests.

Each new topic was introduced to the class-as-a-whole by the teacher; then work was assigned to the three subgroups and to the remainder of the class. Subgroups received work that was suited to their levels of learning, while the control group received work from the regular fourth-grade texts.

At the end of the school year a different form of the California Achievement Tests was given along with the Iowa Tests. From the results of these tests Moench concluded that the experimental pupils gained more markedly than did the control pupils.

Dewar\textsuperscript{117} carried out an experiment in intra-class grouping for arithmetic instruction in the sixth grade. His experiment was reported in 1963 and conducted in eight sixth-grade classrooms selected from a northeast Johnson County, Kansas, elementary school district. This district was reportedly made up of upper middle class families.

Pupils in the four experimental classes were grouped into one of three subgroups—high, middle, or low. Scores on the Lorge Thorndike Intelligence Test and the Stanford Arithmetic Achievement Test plus teacher judgment were used as the bases for formation of these three groups. Pupils in the control group were categorized as high, middle, or low for purposes of data analysis only.

\textsuperscript{117}John A. Dewar, \textit{loc. cit.}
The investigator provided teachers of the experimental classes with appropriate and varied textbook materials and a curriculum outline for each of the three subgroups. The control classes were taught as a whole group, using the regular sixth-grade textbook material.

A post-test was given at the end of the year, using an alternate form of the Stanford Arithmetic Achievement Test. Dewar found that the high and low subgroups of the experimental classes gained significantly in achievement over the same subgroup classifications of the control classes. These gains were significant at the .05 level of confidence.

Dewar related that it was a conclusion of a majority of the teachers of the experimental classes that "... grouping along with differentiated material in the form of a curriculum guide and textbooks was definitely valuable for their pupils."\(^{118}\)

The experimental pupils were also reportedly well pleased with the grouping arrangement.

Last of the five experimental studies of intra-class ability grouping was the one conducted by Wallen and Vowles\(^ {119}\) and described in this report under the class-as-a-whole procedure. This study showed inconclusive results.

**Summary of intra-class ability grouping studies**

In these five studies pupils from grades four through six were used as subjects. Fourth and sixth graders were included in three of

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\(^{118}\)John A. Dewar, *loc. cit.*, p. 64.

\(^{119}\)Norman E. Wallen and Robert O. Vowles, *loc. cit.*
the studies while fifth graders were in only one. The size of the sample of pupils studied ranged from around 30 to 758 with a total of approximately 1,390 pupils being involved in the five studies.

In the experiment by Jones a special effort was made to meet the needs of individuals in the experimental groups which would appear to influence the results of the experiment in favor of these groups.

Moench's experiment was carried out in one classroom with the experimental groups being taught in the same manner as the control pupils. The only difference in procedure was the assignment of seat work to the experimental subgroups according to their level of achievement. The findings of this smallest of the five experiments appear to have more bearing upon the assignment of proper practice work in arithmetic than upon subgrouping for arithmetic instruction.

The other two favorable studies, those by Dewar and Spence, tend to strongly support intra-class ability grouping. However, the inconclusive study by Wallen and Vowles raises some questions about the influence of differences between teachers, semesters, and schools upon results of studies of intra-class ability grouping.

**Sociometric grouping**

One study by Schmid\(^\text{120}\) dealt with the use of sociometric techniques for forming instructional groups for number work in the fifth grade.

Two control classes were formed in which the pupils were grouped according to teacher judgment.

Pupils in the two experimental classes were grouped sociometrically. This means that they were permitted to choose their own groups according to their friendship patterns.

A standardized arithmetic achievement test was administered to all pupils in September and again in May. The results of this test were favorable to the two experimental classes.

Schmid reported that he found the sociometrically grouped pupils to be more responsive to teaching than the teacher grouped pupils. Scores of this group on the May administration of the achievement test were spread over a wider range than were the scores of the control group. Schmid concluded that students will achieve more, as measured by standardized tests, in groups they choose for themselves than they will achieve in teacher formed groups.

In view of the scarcity of research on this type of grouping at the present time it appears inadvisable to attempt to evaluate such grouping.

**Individualized instruction in arithmetic**

Seven studies were examined that have a bearing upon the value of individualization of instruction in arithmetic. Three of these studies have previously been described in this report under the topics of Intra-Class Ability Grouping and Flexible Intra-Class Ability Grouping. The reason for this dual use of these experimental studies is that both subgrouping and individualization of instruction were utilized in all
three studies. No experimental studies of individualization of instruction in arithmetic were found in which the results were either unfavorable to such a procedure or inconclusive.

The first study, reported in 1943 by Guiler and Edwards, was described in this report under the topic of Flexible Intra-Class Ability Grouping. In this study of seventh and eighth graders, each pupil in the experimental group had his needs diagnosed from his performance on the Guiler-Christofferson Analytical Survey Test in Computational Arithmetic and the pupil was given self-teaching materials for his weak areas. The pupils in the control group were taught by "conventional" group instruction procedures.

Guiler and Edwards concluded that methods used with the experimental group were more effective than those used with the control group.

The second study was by Jones in the 1945-1946 school year and was described in this report under Intra-Class Ability Grouping.

The 125 fourth graders in the experimental group in this study were given materials to match their achievement levels, interests, and rates of learning. A special effort was made to meet the needs of individuals. The control group was taught from the regular textbook.

Jones concluded that "... children taught on their individual levels ... make a greater amount of growth than comparable pupils taught ... the curriculum prescribed for their grade level with only

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121 W. S. Guiler and Vernon Edwards, loc. cit.

122 D. M. Jones, loc. cit.
minor and incidental provisions for individual differences. It was also found that normal and dull children profited more than superior children and that the spread of levels of achievement within experimental classrooms increased.

The third study was reported by Tilton in 1947. In this study the Elementary Examination of the Compass Survey Tests in Arithmetic for grades two, three, and four was administered to 138 pupils in four fourth grades. From this group thirty-eight pupils, nineteen boys and nineteen girls with low scores, were selected and placed into a control and an experimental group. The experimental group contained nine boys and ten girls while the control group had ten boys and nine girls.

The experiment was carried on for four weeks. During these four weeks the experimental group received twenty extra minutes of individualized remedial help per week. The control group did not receive this twenty extra minutes of instruction.

Needed individualized remedial help for pupils in the experimental group was determined by pupil scores on the Los Angeles Diagnostic Tests.

Tilton found that the experimental group made .5 month more progress than the control group made in the four week experimental period.

\[123\] D. M. Jones, loc. cit., p. 270.

The fourth experiment was carried out by Sganga at Oak Hill, Florida, in the 1958-1959 school year. Twenty students in one sixth grade class made up the experimental group. No control group was used.

Arithmetic instruction was based upon one workbook that had a range of difficulty from third grade to elementary algebra and geometry. Mimeographed notes and work sheets were used to supplement the workbook.

Students were assigned to specific sections of the workbook in accordance with need as determined from scores made on the arithmetic section of the California Achievement Test Battery and scores made on the different sections of a diagnostic test.

Students checked their own work by using answer sheets provided for that purpose. A file card was used to record a pupil's work as it was completed. A comprehensive arithmetic test was given each six weeks.

The results of the second administration of the California Achievement Test Battery showed that the average pupil gain in arithmetic achievement for the seven months between tests was 1.4 years.

Sganga listed twelve advantages of such a program of individualized instruction. He also stated that "... there was a considerable amount of initial work involved in preparing notes, tests, and keys."126

The fifth study was conducted by Durrell during the 1958-1959 school year in forty-seven self-contained classrooms of eight


126Frank Sganga, loc. cit., p. 88.

127Donald D. Durrell, loc. cit.
elementary schools in Dedham, Massachusetts. Eight hundred and three pupils, in grades four, five, and six, were included in the study.

For evaluation purposes the achievement of the 803 pupils in the 1958-1959 school year was compared with the achievement of these same pupils during the 1957-1958 school year. The Metropolitan Achievement Tests were administered at the end of both school years. All pupils remained with the same teacher during the two years.

An attempt was made to adapt instruction to the various levels of ability, provide for different progress rates of learning, give special help at points of weakness in learning development, encourage individual self-direction and initiative, and enrich learning to make it significant and useful.

Durrell concluded that arithmetic achievement improved significantly under the differentiated program in grades five and six while grade four showed no change in arithmetic achievement.

A sixth study reported by Dougherty\(^\text{128}\) was conducted in Akron, Ohio, during the 1959-1960 and 1960-1961 school years. Ten fourth-grade classes from five schools located in different parts of the city were used in the experiment or improvement program.

School officials in Akron became alarmed by the fact that students in the school system were below the national norm in arithmetic achievement as measured on the Stanford Achievement Test. A program of improvement was instituted and pupils in the ten experimental classes

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were given individualized instruction. An arithmetic consultant was hired and a workshop was held for the teachers involved.

Each pupil in the individualized program was apprised of his strengths and weaknesses as measured on the Stanford Achievement Tests. He was also told of his potential for achievement in arithmetic and a profile chart was maintained for him. Timed tests were given once a month over the four basic arithmetic processes.

Dougherty was reportedly convinced of the worth of the improvement program since the pupils in the experiment made an average arithmetic achievement that was above the national norm; whereas, before the improvement program these same pupils averaged below this norm in arithmetic achievement.

The last study by Moench\textsuperscript{129} in the 1959-1960 school year was described in this report under the topic of Intra-Class Ability Grouping. The significance of this study for individualization of instruction lies in the fact that practice work was assigned to individuals in subgroups on the basis of need. It was reported that the fourth graders in the experimental half of the class gained in arithmetic achievement more markedly than did the pupils in the other half of the class.

\textbf{Summary of studies of individualization of instruction in arithmetic}

Studies examined in which experimentation with individualized instruction in arithmetic was reported involved approximately 3569

\textsuperscript{129}Laurel Moench, \textit{loc. cit.}
pupils in grades four through eight. The fourth grade was included in
five of the seven studies, the sixth grade in two, and the other grades
in only one. These studies ranged in size from one classroom to forty-
seven classrooms and in duration from four weeks to two school years.

Teachers in all of the studies attempted to find pupil weaknesses
in arithmetic and to give assignments that would help pupils to
strengthen these weaknesses.

In the short four week experiment by Tilton, the experimental
group had the advantage of twenty extra minutes per week of total
arithmetic instruction over the control group. This could conceivably
have resulted in the .5 month of extra growth in arithmetic achievement
credited to the experimental group.

In the study by Durrell, the fact that the fourth-grade pupils in
the experimental group made no gains over the control group remains
unexplained. This was the only bit of inconclusive evidence discovered
in the examination of studies of individualization of instruction in
arithmetic.

In general all seven studies reported results that tend to
support the practice of individualization of instruction in arithmetic.
This support was with respect to arithmetic achievement.
Some criteria for intra-class grouping for arithmetic instruction

Certain writers listed criteria for intra-class grouping that cover many aspects of the learning situation as well as arithmetic achievement. These criteria are:

1. A combination of subjective and objective criteria should be used as bases for establishing pupil groups.\footnote{Harold H. Lerch, "Intra-Class Grouping for Arithmetic Instruction: Critique and Criteria," The Arithmetic Teacher, 8 (December, 1961), p. 407.}

2. Any plan of pupil grouping should be established for a purpose.\footnote{Clayton E. Buell, "What Do We Believe About Grouping Instruction in the Junior High School?" The Bulletin of the National Association of Secondary-School Principals, 46 (October, 1962), p. 18.}

3. Flexibility in grouping should be maintained so that each pupil can work with the group which will most appropriately serve his needs, interests, and abilities.\footnote{Harold H. Lerch, loc. cit.}


5. Pupil grouping should minimize loss of self-respect on the part of the "slow" pupils.\footnote{Harold H. Lerch, loc. cit.}

6. Intra-class grouping should not break up the unity of the total class group.\footnote{Tbid.}
7. Pupil grouping should be accompanied by proper selection of content, methods and materials.\textsuperscript{136}

8. Pupil grouping should encourage desirable interaction between pupils.\textsuperscript{137}

9. Pupil grouping should not make unreasonable demands for performance not yet justified by the maturity level of the pupils.\textsuperscript{138}

These criteria should be considered when establishing or evaluating a plan of intra-class grouping for arithmetic instruction. This is important because increased pupil achievement in arithmetic is only one of the aims of the elementary school. Other aims such as the development of the ability to work cooperatively with others, the development of proper attitudes toward school, and the development and maintenance of a healthy self-concept are important also.

\textbf{Summary of related research findings}

In this chapter a short history of grouping for instructional purposes has been given, followed by a summary of the common arguments for and against inter-class ability grouping. It was determined from a review of the professional literature that inter-class ability grouping is not very prevalent in the United States, especially in the elementary school. The reverse was found to be true in England.

\textsuperscript{136}Ibid., p. 406.

\textsuperscript{137}Harold G. Shane and Wilbur A. Yauch, \textit{loc. cit.}

\textsuperscript{138}Ibid., p. 310.
Opinions are divided as to the desirability of inter-class ability grouping for instructional purposes. Some educators in the United States believe that the low IQ pupil is helped considerably by such grouping while others in England believe that he is markedly handicapped by being separated from the brighter pupils. However, a majority of all educators who write on the subject seem to think that grouping, in and of itself, makes no difference in determining the effectiveness of a program of instruction in the elementary school. Some educators were found to favor a type of grouping known as social maturity grouping.

Eighteen studies were examined that have a bearing upon inter-class ability grouping procedures and arithmetic achievement. These were described in four categories: Inter-Class Ability Grouping, Multi-Grade Grouping, Grouping by Arithmetic Ability, and a Joplin-Type Plan. Approximately 9,500 pupils were included in the samples involving grades one through twelve. Nine of these studies favored inter-class ability grouping, while two studies were unfavorable to such grouping. Seven studies neither favored inter-class ability grouping nor reported unfavorable evidence concerning such grouping.

Opinions of educators are more favorable to intra-class ability grouping than they are to inter-class ability grouping. Even though grouping within the classroom for arithmetic instruction is advocated by many educators the extent of such grouping is unknown.

Intra-class ability grouping practices constitute a continuum ranging from the class-as-a-whole procedure to completely individualized instruction. Although the class-as-a-whole method is probably the most often used procedure, no writings of advocates of this procedure were
found in the professional literature. A majority of the writers preferred intra-class ability grouping for instruction in arithmetic with many of those adding that such grouping should be of a flexible nature. Others would completely individualize the teaching of arithmetic. One writer advocated sociometric grouping for arithmetic instruction.

Fourteen experimental studies of different types of intra-class organization for instruction in arithmetic were examined. The types included the class-as-a-whole method, flexible intra-class ability grouping, intra-class ability grouping, sociometric grouping, and individualization of instruction. Approximately 3,600 pupils in grades two through eight were included in the studies.

Eight of the studies utilized the class-as-a-whole method with control groups. One study reported inconclusive results while the other seven reported results unfavorable to the class-as-a-whole method.

Three of four studies that used flexible intra-class ability grouping as the experimental group reported results favorable to such grouping. The fourth study, which used permanent subgroups as control groups, reported inconclusive results.

Four of five studies of intra-class grouping procedures, in which the subgroups were relatively permanent, reported results favorable to such grouping, while the fifth study reported inconclusive results.
The results of the one study of sociometric grouping for arithmetic instruction as compared to teacher subgrouping for such instruction were favorable to sociometric grouping.

Four studies were examined in which experimental groups were taught arithmetic primarily by an individualized method. Three other studies reportedly used individualization of instruction in arithmetic to some extent. One of the three studies was included in the flexible intra-class ability grouping studies, while the other two were included in the intra-class ability grouping studies. All seven studies using individualization of instruction in arithmetic reported results favorable to such a procedure.

Two conclusions can be drawn from the results of the thirty-two studies reported upon in this chapter. One conclusion from an examination of the results of the eighteen studies of inter-class ability grouping is that slightly better results in arithmetic achievement can be expected when such grouping is used in an elementary school. Another conclusion from an examination of the results of the fourteen studies of intra-class organization is that better arithmetic achievement can be expected as intra-class organizational practices progress along the continuum from the class-as-a-whole method toward a completely individualized method of instruction in arithmetic.

A list of nine criteria for plans of intra-class grouping for arithmetic instruction was compiled from the writings of certain professional educators and may be used in evaluating such plans.

The next chapter will describe the development of the instrument used in this survey of arithmetic grouping practices used in the
elementary schools of Ohio and will discuss selection of the sample of teachers whose grouping practices were surveyed.
III. INSTRUMENT DEVELOPMENT AND SAMPLE SELECTION

Purpose of the questionnaire

One instrument, a questionnaire for the collection of data, was constructed by the writer and sent to a representative sample of teachers in the public elementary schools of Ohio. The purpose of this questionnaire was to elicit from these teachers statements of their classroom practices and beliefs with respect to intra-class grouping for arithmetic instruction.

General design of the questionnaire

The questionnaire was designed to obtain information that would be helpful in proving or disproving stated hypotheses and answering questions set forth in the first chapter of this study. In developing this questionnaire, the writer began by studying the recent professional literature on the subject of intra-class organization for instruction in arithmetic. This provided a background of knowledge upon which to base construction of the questionnaire. The original form of the questionnaire was developed after assistance from the writer's adviser, various teachers, and Dr. Desmond Cook of the Bureau of Educational Research and Service, College of Education, The Ohio State University.

It was decided, in order to save teacher time and to insure an adequate return of questionnaires, that the questions should be brief,
concise, and easy to answer.\textsuperscript{1} The complete list of questions were written upon one sheet of standard eight and one-half by eleven inch paper. All answers to questions, except name, date of birth, school name, city or town, and county, could be made by either encircling or checking the right answer or answers. Provision was made for write-in responses to four of the questions for which it was impractical or impossible to provide full lists of optional responses.

Discussion of items on questionnaire

The questionnaire used in the survey may be seen in Appendix II (pp. 151-153). Seven blanks were provided at the beginning of the questionnaire. Five of these blanks were for name, date of birth, school, city or town, and county. Sex of the teacher was to be checked in one of the two remaining blanks. Except for the date of birth and sex of the teacher, this information was not absolutely essential because of a code number placed in the upper left hand corner of the first page of the questionnaire. This code number identified the type of school, the school, and the individual teacher.

The main body of the questionnaire consisted of a total of twenty-five questions. Four of the questions had a total of thirty-two parts and provision was made for additional write-in responses to these four questions. Questions seventeen through twenty-five were to be answered only by teachers who grouped pupils for instruction in arithmetic.

Questions one through five were for the purpose of gaining some general information as to number of classes taught, grade level or levels of class or classes taught, years of college completed, degrees earned, and years of teaching experience.

Questions six through ten dealt with the availability of materials including textbooks and workbooks and also with the amount of teaching time devoted to arithmetic. The teacher was requested to designate the proportionate amounts of such time devoted to the whole class and to individuals.

Question eleven sought to elicit from teachers all the provisions made by them for pupil individual differences in learning arithmetic. Twelve provisions known to be made by some teachers were listed and space for write-in provisions was made.

Questions twelve through fifteen were designed to determine the teacher's interest in arithmetic, employment or non-employment of the practice of grouping for instruction in reading and in arithmetic, and belief as to the relative importance of grouping for arithmetic instruction as compared to the importance of grouping for reading instruction.

Only teachers who did not group were to answer question number sixteen. This question asked for the teacher's reason or reasons for not grouping for arithmetic instruction. Ten reasons were supplied and space for write-in reasons was provided.

Questions seventeen and eighteen sought to determine from teachers who grouped for arithmetic instruction the number of groups utilized by them and their division of arithmetic teaching time between groups.
Questions nineteen through twenty-two concerned the availability of workbooks and textbooks and the use of these materials with groups. The twenty-third question sought to determine whether or not the teacher felt that he had sufficient time in which to prepare and duplicate needed special materials for groups or individuals.

Question twenty-four provided the teacher with a choice of four factors used as a basis for placing pupils in groups. Any or all of these factors could be checked by the teacher. Extra space was provided for write-in responses to this question.

The final question dealt with the teacher's reason or reasons for grouping for arithmetic instruction. Six reasons were supplied with space provided for any additional reasons that the teacher might wish to supply.

Preliminary check of the questionnaire

Pretesting of a questionnaire is essential for the purpose of validating it in terms of practical use. Despite the use of great care in developing a questionnaire, such pretesting can be expected to lead to revisions of, and additions to, certain questions.² Pretesting of the questionnaire used in this study was carried out by sending it in its original form (Appendix II, pp. 148-150) to forty-seven teachers in three elementary schools not to be included in the sample. These schools were located in the Dayton City School System.

Twenty questionnaires were returned in usable form from this group of teachers. Nine other unsolicited questionnaires were received from teaching principals and added to this number. These principals were sent questionnaires only as samples of what was to be sent to their teachers but, since they completed and returned their sample copies, it was decided to take advantage of this action by using such questionnaires in the preliminary check.

**Necessary changes in the original form of the questionnaire**

An examination and rough tabulation was made of the responses of the twenty-nine teachers to the twenty-five questions on the questionnaire. Results of this preliminary check of the questionnaire indicated the necessity for making eight changes in it.

First of the eight changes was made in question six (See Appendix II pp. 148-153 for copies of the questionnaire in both its original and final forms). In this question with regard to average daily class time, in minutes, devoted to arithmetic, the options of "less than 30," "30," "40," "45," "50," "60," and "more than 60" were given in the original form. Two of the twenty-nine respondents wrote in "35" so it was decided to add "35" and "55" to the options.

In question eight, which sought to determine the availability of workbooks in quantities of at least five for arithmetic instruction, the options were "1," "2," "3," "4," or "more than 4." Fourteen of the respondents made a choice among these options; six wrote "0" or "None;" one wrote, "Don't know;" another wrote, "I don't like workbooks." So it was decided to add "0" as an option.
All teachers except one responded in the expected manner to question twelve which pertained to degree of interest in arithmetic. This teacher, who held a master's degree, indicated by his response that he was confused by the typing arrangement of the options. In the final form these options were rearranged so as to eliminate the possibility of others becoming similarly confused.

Question fifteen sought to determine the teacher's feelings as to the relative importance of grouping for arithmetic instruction as compared to the importance of grouping for reading instruction. Sixteen teachers checked grouping for reading as more important, none checked grouping for arithmetic as more important, and nine indicated that grouping was equally important for reading and arithmetic. Three left the question unanswered while one checked two options.

After examining the responses to this question, the writer felt that possibly some of the respondents were checking the relative importance of reading and arithmetic. To avoid this misinterpretation the clause, "With the understanding that skill in reading is more important to most pupils than skill in arithmetic," was added at the beginning of the question. A further precaution was taken by underlining the word "relative" in the question.

Ten of the twenty-nine teacher respondents indicated that they grouped pupils for instruction in arithmetic. Therefore, these ten teachers were expected to answer question number seventeen relative to the number of intra-class groups employed in the classroom. Six of the ten teachers answered the question in the expected manner; one left it blank; one indicated that the number varied; one wrote in the word
"usually;" and another wrote in "this year." After examining these responses it was decided that the addition of the word usually to the question would clarify it. The first sentence of the revised question then read, "If you group for arithmetic, into how many groups do you usually divide your class or classes?"

After examining the answers to question twenty with regard to the use of the same workbook with all groups, it was apparent that many teachers used no workbooks. The option, therefore, of "Do not use workbooks" was added to the options of "yes" or "no."

Question twenty-two asked the teacher whether he would use a different workbook with each group if satisfactory workbooks were available to him. Since two teachers left the question unanswered and one expressed his dissatisfaction with the amount of teacher time required to correct workbooks, it was deemed desirable to add the option of "Do not wish to use workbooks" to the "yes" or "no" options. Change of this question concluded the eight changes made in the original form of the questionnaire.

**Indicated usefulness of the tryout responses**

After making needed changes in the original form of the questionnaire it appeared that stated hypotheses could be accepted or rejected and that answers to questions posed in the first chapter of this study could be found from responses to the final form of the questionnaire. A rough tabulation of the tryout responses as recommended by Good\(^3\) seemed to support this prediction.

\(^3\)Carter V. Good, *loc. cit.*, p. 201.
Selection of the sample

In Ohio there are three major classifications of public elementary and secondary schools: county, city, and exempted village. There were during the 1961-1962 school year eighty-eight county, one hundred and fifty-one city, and sixty-eight exempted village school systems in the state. Elementary schools in these systems including grades kindergarten through eight numbered 1386, 1492, and 180 respectively. The respective numbers of elementary teachers were 17,125, 25,485, and 2,708.\(^4\)

For purposes of this study data from teachers of arithmetic or number study in grades kindergarten through six was needed. As far as the writer was able to determine, no compilation of the number of such teachers employed in the public elementary schools of Ohio exists. An attempt was made, using available information, to approximate this number. When schools containing no teachers of grades kindergarten through six were taken from those listed in the Educational Directory the remaining numbers of schools were as follows: county, 1,339; city, 1,460; and exempted village, 178. The respective numbers of teachers in each type of school district were 16,450, 24,918, and 2,664. However, an unknown number of seventh-grade teachers, eighth-grade teachers, and teachers of grades kindergarten through six who did not teach arithmetic were included in these numbers.

The writer decided, after consultation with Dr. Desmond Cook,
Bureau of Educational Research and Service, College of Education, the

Ohio State University, and after consideration of the financial aspects of the study, that approximately 5 per cent of all public elementary school teachers in Ohio who taught arithmetic in grades kindergarten through six, would constitute a reasonable sample.

Since differing factors affecting teaching methodology such as rate of teacher pay, class size, and academic qualifications of teachers could be present in the three categories of public elementary schools, it was decided to select approximately 5 per cent of the teachers in each category for the total sample. For the purpose of selecting this 5 per cent sample, elementary schools in each of the three categories—county, city, and exempted village—were arranged in hierarchical order from largest to smallest in number of teachers. The schools included in the sample were then chosen by use of a table of random numbers.

Seventy-five county schools were chosen, using this table of random numbers. Names and addresses of principals of these schools were obtained from the Educational Directory. A letter (Appendix I, p. 144) was sent, November 16, 1962, to each principal, briefly explaining the study and requesting the school's mailing list of teachers of arithmetic in grades kindergarten through six. One follow-up request (Appendix I, p. 145) was mailed on December 16, 1962. Fifty-two of the principals sent mailing lists as a result of these two requests.

The writer solved the problem of obtaining the other twenty-three county school mailing lists by visiting the Ohio Department of

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5Ohio, State Board of Education of, loc. cit.
Education in Columbus and securing the names of teachers from the annual elementary school principals' reports. School addresses of teachers were used because home addresses were unavailable.

These seventy-five county schools contained, in the 1961-1962 school year, according to the Educational Directory, 923 teachers. However, this number was reduced to 736 after eliminating seventh-grade teachers, eighth-grade teachers, and those who did not teach arithmetic. Change in numbers of teachers employed from the 1961-1962 to the 1962-1963 school year also affected this total amount in an unknown direction.

Seventy-three city and eleven exempted village schools were chosen randomly. The same procedure for obtaining mailing lists was followed for these city and exempted village schools as that described for county schools.

Mailing lists of fifty-five of the seventy-three city schools were received from principals. Two principals declined to send lists and explained their reasons by letter. One of these principals explained that his school was situated in a mental hospital setting and was, therefore, atypical. The other declined to participate because he felt that his school neither could nor should take part in the study at the time of the request.

The original number of teachers in city schools was changed to an unknown degree by the change in the 1961-1962 school year teacher employment figures as compared with the 1962-1963 figures. The refusal

6Ohio, State Board of Education of, loc. cit., pp. 29-96.
of the two principals to participate in the study, the removal of seventh- and eighth-grade teachers, and the elimination of teachers who did not teach arithmetic reduced this original number. The total result of these adjustments was a reduction of the total from 1,374 to 1,130 teachers.

Seven mailing lists were received from principals of exempted village schools. When all eleven mailing lists were obtained the number of teachers was 205. This was an increase of one teacher over the number listed in the Educational Directory. Apparently the reason for this increase was that the number of additional teachers hired for the 1962-1963 school year exceeded the number of seventh- and eighth-grade teachers and teachers who did not teach arithmetic who were included in the original number.

A total of 2,071 questionnaires accompanied by an explanatory letter (Appendix I, p. 146) were mailed on January 6, 1963. This was 4.70 per cent, to the nearest one-hundredth of a per cent, of the original total of 44,032 teachers in the school population to be surveyed.

The drop in percentage below the desired 5 per cent level was probably due to the fact that the original total of teachers included an unknown number of seventh- and eighth-grade teachers and teachers who did not teach arithmetic. These teachers were not listed on principals' mailing lists. Teachers added in the 1962-1963 school year evidently did not equal the number eliminated for these reasons.

The breakdown of this total percentage into the three categories of schools was by county, 4.47 per cent; city, 4.54 per cent; and exempted village, 7.69 per cent.

The 7.69 per cent of teachers in exempted village schools surveyed is proportionately a considerably greater number than the numbers mailed to teachers in county and city schools. This was probably due, in part, to the fact that the proportion of exempted village school mailing lists secured from the Ohio Department of Education in Columbus was greater than the proportion of county and city lists obtained in this manner. These lists probably contained the names of several teachers who did not teach arithmetic. Principals could eliminate such teachers from lists compiled by them. However, the writer included all teachers since there was nothing in the Ohio Department of Education's records to indicate whether or not teachers were teaching arithmetic.

The writer decided that a reasonable return of questionnaires would be a percentage approaching 71 per cent. This percentage was listed by Shannon as the average of 204 doctoral dissertations at Teachers College, Columbia University. It was necessary to send a follow-up post card (Appendix I, p. 147) to 965 teachers in order to secure this reasonable return.

In the next chapter the data from these questionnaires will be tabulated and discussed.

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IV. TABULATION AND ANALYSIS OF THE DATA

In this chapter the sample of teachers to whom questionnaires were sent will be described briefly. Some general information concerning teacher respondents such as age, sex, school district location, and grade level taught will be presented and discussed. Then tabulations of data from the questionnaires and statements of significant findings will be made. Tabulations will be presented using numbers and percentages, since it appears to the writer that the nature of the data collected is such that conventional statistical tests for significance, such as the T-Test are inappropriate.¹

Questionnaires mailed and returned

As can be seen from Table 1, page 92, 2,063 teachers received questionnaires. An additional eight questionnaires were mailed to teachers in one city school but never reached the teachers because they were intercepted by the principal and returned. These 2,063 teachers taught in 156 elementary schools from three types of school districts: county, city, and exempted village. The numbers of schools in each classification were as follows: county, 75; city, 70; exempted village, 11. Methods used in the selection of these schools were described in Chapter III, pages 86-90.

### TABLE 1
THE DISTRIBUTION OF QUESTIONNAIRES MAILED TO TEACHERS AND RETURNED BY THEM

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Number of Schools</th>
<th>Number of Teachers</th>
<th>Number of Questionnaires Sent to Wrong Teachers</th>
<th>Number Returned</th>
<th>Incomplete by Usable</th>
<th>Kindergarten Teachers</th>
<th>Others</th>
<th>Number of Schools with 100% Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>75</td>
<td>736</td>
<td>5</td>
<td>544 or 74%</td>
<td>2</td>
<td>1</td>
<td>18 or 24%</td>
<td></td>
</tr>
<tr>
<td>City*</td>
<td>70</td>
<td>1122</td>
<td>8</td>
<td>710 or 63%</td>
<td>19</td>
<td>6</td>
<td>4 or 6%</td>
<td></td>
</tr>
<tr>
<td>Exempted Village</td>
<td>11</td>
<td>205</td>
<td>7</td>
<td>138 or 67%</td>
<td>3</td>
<td>2</td>
<td>2 or 18%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>156</td>
<td>2063</td>
<td>20</td>
<td>1392 or 67%</td>
<td>24</td>
<td>9</td>
<td>24 or 15%</td>
<td></td>
</tr>
</tbody>
</table>

*Principals of three additional city schools declined to have teachers in their schools participate in the study.*
Some of the 2,063 questionnaires were mailed to teachers who should not have been included in the sample. Names of these teachers were secured from the files of the Department of Education in Columbus, Ohio. It was impossible to determine from the information included in these files whether or not a particular teacher, listed as a grade school teacher, taught arithmetic. Twenty teachers who were included in the sample (column 4, Table 1) notified the writer that they did not teach arithmetic.

Thirty-three teachers returned questionnaires so incomplete as to be of no value to the study. Twenty-four of these questionnaires were returned by kindergarten teachers. Since arithmetic is largely incidental in kindergarten, these teachers felt that many of the questions on the questionnaire did not apply to their teaching situation. Nine other questionnaires were returned incomplete for unknown reasons.

Teachers from twenty-four schools (column 8, Table 1) returned all of their questionnaires in usable form. This amounted to 15 per cent of all schools in the three types of school districts. The county school systems had the largest number of schools with all teachers returning questionnaires. Teachers in schools surveyed in 24 per cent of such systems, 18 per cent of exempted village systems, and only 6 per cent of city systems returned all of their questionnaires.

A total of 1,392 of the questionnaires returned were considered usable. This amounted to 67 per cent of the 2,063 questionnaires mailed. Each of the 156 schools included in the sample was represented by at least one of these usable questionnaires. Percentages of returns were: county, 74 per cent; city, 63 per cent; exempted village, 67 per cent.
Age and sex of the responding teachers

A tabulation of age data from the questionnaires showed that teacher ages ranged from twenty to seventy-three years. Table 2, page 94 shows the number of teachers placed in each of three age categories. It may be noted from column 4 of this table that 235 county teachers were over forty-five years of age. This is 48 per cent of the county teachers who filled in the date of birth blank on the questionnaire. It may also be noted that only 110 or 23 per cent of county teachers were below thirty years of age.

TABLE 2

AGE AND SEX OF TEACHER RESPONDENTS
BY TYPE OF SCHOOL DISTRICT

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Age of Teachers</th>
<th>Sex of Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Below 30 (2)</td>
<td>Through 45 (3)</td>
</tr>
<tr>
<td>County</td>
<td>110</td>
<td>142</td>
</tr>
<tr>
<td>City</td>
<td>207</td>
<td>196</td>
</tr>
<tr>
<td>Exempted Village</td>
<td>45</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>362</td>
<td>366</td>
</tr>
</tbody>
</table>

This disproportionately large percentage of "old" teachers from county school districts responding to the questionnaire provided the writer with an opportunity to check the influence of the age factor upon teachers' arithmetic grouping practices. The greatest difference
in such practices between age groups listed in Table 2, page 94, and the average for all county school respondents (Table 4, column 16, p. 98) was only 2 per cent. Teachers above forty-five years of age showed this 2 per cent difference as an above average percentage of pupil grouping carried out by them. Thus, age appears to be an insignificant factor in determining whether or not a teacher will group pupils for arithmetic instruction.

It was found, as expected, that a large majority of the respondents were female. Males made up only 10 per cent of the total of those teachers who completed the blank on sex. The city schools had only 8 per cent men, the exempted village schools had 9 per cent, while the county schools had 13 per cent.

When the arithmetic grouping practices of male teachers were compared with such practices by female teachers a very slight difference was found. Thirty-one per cent of male teachers, as compared to 33 per cent of all teachers, indicated by their responses to the questionnaire that they practiced grouping. Thus, sex of the teacher has little or no bearing upon the question of whether or not a teacher will practice pupil grouping for arithmetic instruction.

**Number of respondents by grade level taught**

The numbers of usable questionnaires returned by teachers of grades kindergarten through six are shown by grade level taught and by type of school district in Table 3. All grade levels appear to be well represented except kindergarten. The proportion of kindergarten teachers in the schools included in the sample is unknown since such
### TABLE 3
NUMBER OF TEACHER RESPONDENTS BY GRADE LEVEL TAUGHT AND TYPE OF SCHOOL DISTRICT

<table>
<thead>
<tr>
<th>Type of School (1)</th>
<th>Grade Level Taught</th>
<th>Total (9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kindergarten (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>First (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third (5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fourth (6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fifth (7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sixth (8)</td>
<td></td>
</tr>
<tr>
<td>County</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>99</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>544</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>51</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td>119</td>
<td>119</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>108</td>
</tr>
<tr>
<td></td>
<td>89</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>710</td>
<td></td>
</tr>
<tr>
<td>Exempted Village</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>138</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>71*</td>
<td>239</td>
</tr>
<tr>
<td></td>
<td>238</td>
<td>228</td>
</tr>
<tr>
<td></td>
<td>209</td>
<td>213</td>
</tr>
<tr>
<td></td>
<td>194</td>
<td>1392</td>
</tr>
</tbody>
</table>

*Twenty-four additional kindergarten teachers returned incomplete questionnaires.
information was not always contained in mailing lists received from principals. However, it is known that many more incomplete questionnaires were returned by such teachers than by other teachers.

This greater proportion of kindergarten teachers returning incomplete questionnaires was probably due to the incidental nature of arithmetic instruction at the kindergarten level. Since instruction in arithmetic is conducted mostly in an informal manner at this level, it was assumed that kindergarten teachers would experience difficulty in answering some of the questions on the questionnaire. The write-in remarks by these teachers supported this assumption.

The results of this study are not likely to be as valuable to kindergarten teachers as to teachers of grades one through six, since only seventy-one kindergarten teachers (Table 3, column 2, p. 96) returned usable questionnaires.

Extent of intra-class grouping of pupils for arithmetic instruction

It was found from a compilation of the answers to question number fourteen on the questionnaire that 458, or 33 per cent of the teachers who answered the question, indicated that they grouped pupils for arithmetic instruction. Table 4, page 98, shows the numbers of teachers by grade levels and by type of school district who answered that they did or did not carry out such grouping in their classrooms.

An examination of Table 4, page 98, shows that teachers on two grade levels, kindergarten and second, were below the average of 33 per cent of teachers who indicated that they grouped pupils for arithmetic instruction.
TABLE 4

TEACHER RESPONSES, BY GRADE LEVEL TAUGHT AND TYPE OF SCHOOL DISTRICT, CONCERNING INTRA-CLASS GROUPING FOR ARITHMETIC INSTRUCTION

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Responses by Grade Level Taught</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kindergarten</td>
<td></td>
</tr>
<tr>
<td></td>
<td>First</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fifth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sixth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>Yes (2) No (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes (4) No (5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes (6) No (7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes (8) No (9)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes (10) No (11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes (12) No (13)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes (14) No (15)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes (16) No (17)</td>
<td></td>
</tr>
<tr>
<td>County</td>
<td>2 17% 10 83% 25 62 18 81 28 57 27 62 26 59 26 59</td>
<td>152 390</td>
</tr>
<tr>
<td></td>
<td>10 29% 71% 62 18 81 28 57 27 62 26 59 26 59</td>
<td>28% 72%</td>
</tr>
<tr>
<td>City</td>
<td>7 15% 41 85% 47 76 36 83 52 66 42 58 47 61 33 55</td>
<td>264 440</td>
</tr>
<tr>
<td></td>
<td>47 38% 62% 36 83 52 66 42 58 47 61 33 55</td>
<td>37% 62%</td>
</tr>
<tr>
<td>Exempted</td>
<td>2 29% 5 71% 6 22 6 14 7 17 5 14 8 12 8 12</td>
<td>42 96</td>
</tr>
<tr>
<td>Village</td>
<td>5 21% 79% 6 14 7 17 5 14 8 12 8 12</td>
<td>30% 70%</td>
</tr>
<tr>
<td>Total</td>
<td>11 16% 56 84% 78 63% 160 66% 60 178 87 140 74 134 81 132 67 126</td>
<td>458 926</td>
</tr>
</tbody>
</table>

County: 1st: 2, 17% 10, 83% 25, 62 18, 81 28, 57 27, 62 26, 59 26, 59 Total: 152, 390
City: 1st: 7, 15% 41, 85%, 47, 76 36, 83 52, 66 42, 58 47, 61 33, 55 Total: 264, 440
Exempted: 1st: 2, 29% 5, 71%, 6, 22 6, 14 7, 17 5, 14 8, 12 8, 12 Total: 42, 96
Village: 1st: 5, 21% 79%, 6, 14 7, 17 5, 14 8, 12 8, 12 Total: 30%, 70%
Only 16 per cent of kindergarten teachers answered that they grouped pupils for such instruction. This low percentage can be explained by the fact that, as many such teachers indicated by their write-in remarks on the questionnaires, arithmetic at the kindergarten level is largely incidental in nature. Thus, these teachers would not group pupils for arithmetic instruction.

Only 25 per cent, of all second grade teachers, said that they grouped pupils for arithmetic instruction. Second grade teachers in county schools showed a still lower percentage, 18 per cent, of teachers who employ such grouping. In examining the data the writer could find no specific reason for such low percentages. This would have been an excellent point of departure for some teacher interviews to attempt a determination of the real reasons for the failure of a majority of public elementary teachers to utilize intra-class grouping for arithmetic instruction. Lack of investigator time and inadequate finances prevented such interviews.

Teachers from county schools showed the least amount, 28 per cent, of pupil grouping for arithmetic instruction. Teachers from exempted village schools showed 30 per cent, while teachers from city schools showed the largest amount, 37.5 per cent.

It seems logical to attribute the higher percentage of grouping carried out in city schools to the higher academic qualifications of such teachers which are a result of higher salary schedules and higher minimum academic requirements for employment. These same factors would function in an opposite direction in county districts which generally have lower salaries and teachers with lower academic
qualifications. Academic qualifications and pupil grouping for arith­metric instruction are discussed further on page 105 of this chapter.

Teacher responses as to the relative importance of grouping for arithmetic instruction as compared with grouping for reading instruction

The first stated hypothesis of this study was that grouping for arithmetic instruction would be indicated by teachers to be relatively as important as grouping for reading instruction. It can be seen by reference to columns 3, 4, and 5 of Table 5, page 101, that this hypothesis was not supported.

Only 35 per cent of all teachers answering the question on the relative importance of grouping for arithmetic instruction as compared to the importance of grouping for reading instruction, chose the option that grouping for the two subjects was equally important. Five per cent indicated that grouping for arithmetic instruction was more important, while 60 per cent chose grouping for reading instruction as being more important.

It was decided, as explained in Chapter III of this study, to change the original wording of the question because it was feared that teachers would interpret the question as meaning for them to choose between the importance of reading as compared to the importance of arithmetic. The writer is not positive that rewording of the question made its meaning completely clear to all teacher respondents. The fact remains, however, that a sizable majority of teachers did choose grouping for reading instruction as being more important.
### Table 5

**Teacher Responses, by Type of School District, Concerning the Relative Importance of Grouping for Arithmetic Instruction as Compared to Grouping for Reading Instruction**

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Number of Teachers Answering Question (1)</th>
<th>Number and Percentage of Teachers Indicating that Grouping for</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2)</td>
<td>Reading is Relatively More Important (3)</td>
<td>Arithmetic is Relatively More Important (4)</td>
</tr>
<tr>
<td>County</td>
<td>516</td>
<td>321 or 62%</td>
<td>29 or 6%</td>
</tr>
<tr>
<td>City</td>
<td>659</td>
<td>382 or 58%</td>
<td>29 or 4%</td>
</tr>
<tr>
<td>Exempted Village</td>
<td>129</td>
<td>81 or 63%</td>
<td>4 or 3%</td>
</tr>
<tr>
<td>Total</td>
<td>1304</td>
<td>784 or 60%</td>
<td>62 or 5%</td>
</tr>
</tbody>
</table>
Table 6, page 103, shows the number of teachers who indicated that they grouped or did not group pupils for arithmetic instruction and how they checked the relative importance of grouping pupils for arithmetic instruction as compared to grouping pupils for reading instruction. As can be seen from column 2, Table 6, page 103, of those teachers who checked grouping for reading instruction as relatively more important than grouping for arithmetic instruction, only 22 per cent indicated that they grouped pupils for arithmetic instruction. Of those who checked that grouping pupils for arithmetic instruction was more important, 50 per cent indicated that they carried out such grouping. A slightly greater percentage, 52 per cent as compared to 48 per cent, of those who checked the two types of grouping as equally important said that they grouped pupils for arithmetic instruction.

It appears logical to the writer that grouping pupils for arithmetic instruction is relatively as important as grouping for reading instruction. Learning principles as taught in education courses in institutions of higher learning form the basis for this conclusion. While many teachers did not indicate that they believed this, those who did showed the highest incidence of grouping for instruction in arithmetic. This fact is consistent with the findings of this study relative to academic qualifications of teachers and such grouping. Those teachers with "high" academic qualifications also showed the highest incidence of pupil grouping for arithmetic instruction (Tables 8 and 9, pp. 106-107).
TABLE 6

TEACHERS' EMPLOYMENT OF PUPIL GROUPING FOR ARITHMETIC
INSTRUCTION AND THEIR INDICATIONS AS TO THE
RELATIVE IMPORTANCE OF SUCH GROUPING
WHEN COMPARED TO GROUPING FOR
READING INSTRUCTION

<table>
<thead>
<tr>
<th>Indicated Importance of Grouping (1)</th>
<th>Number and Percentage of Teachers Checking Who (2)</th>
<th>Do Not Group (3)</th>
<th>Total (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grouping for reading instruction is more important</td>
<td>173 or 22%</td>
<td>607 or 78%</td>
<td>780</td>
</tr>
<tr>
<td>Grouping for arithmetic instruction is more important</td>
<td>31 or 50%</td>
<td>31 or 50%</td>
<td>62</td>
</tr>
<tr>
<td>Grouping is equally important for arithmetic and reading instruction</td>
<td>237 or 52%</td>
<td>221 or 48%</td>
<td>458</td>
</tr>
<tr>
<td>Total</td>
<td>441 or 34%</td>
<td>859 or 66%</td>
<td>1300</td>
</tr>
</tbody>
</table>

Teachers' interest in arithmetic and their grouping of pupils for arithmetic instruction

A second hypothesis of this study was that a higher percentage of teachers who indicated a "very high" interest in arithmetic as a subject would group pupils for arithmetic instruction than would teachers who indicated "average" interest in arithmetic.

An examination of data in column 2, Table 7, page 104, suggests that this hypothesis can be accepted on the following basis. Other seemingly insignificant factors such as age, sex, and years of teaching experience varied no more than 2 per cent from the average of
### TABLE 7

**TEACHER INTEREST IN ARITHMETIC AS A SUBJECT AND USE OF PUPIL GROUPING FOR INSTRUCTION IN ARITHMETIC**

<table>
<thead>
<tr>
<th>Indicated Level of Interest in Arithmetic</th>
<th>Responses of Teachers as to Whether or Not They Group for Arithmetic Instruction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (2)</td>
<td>No (3)</td>
</tr>
<tr>
<td>Very high</td>
<td>237 or 39%</td>
<td>373 or 61%</td>
</tr>
<tr>
<td>A little above average</td>
<td>138 or 30%</td>
<td>321 or 70%</td>
</tr>
<tr>
<td>Average</td>
<td>75 or 26%</td>
<td>219 or 74%</td>
</tr>
<tr>
<td>A little below average</td>
<td>1 --</td>
<td>2 --</td>
</tr>
<tr>
<td>Very low</td>
<td>-- --</td>
<td>1 --</td>
</tr>
<tr>
<td>Total</td>
<td>451 or 33%</td>
<td>916 or 67%</td>
</tr>
</tbody>
</table>

33 per cent of all respondents who grouped pupils for arithmetic instruction. In this instance a total of 237 out of 610, or 39 per cent of teachers with "very high" interest in arithmetic, answered that they grouped pupils for arithmetic instruction. This is 6 per cent more than the average of 33 per cent. On the other hand, only seventy-five out of 294 or 26 per cent of teachers with "average" interest in arithmetic answered that they carried out such grouping of pupils. This is 7 per cent below average.
Teachers' academic qualifications and their grouping of pupils for arithmetic instruction

The third hypothesis of this study was that grouping for arithmetic instruction would be practiced to a greater extent by "highly qualified" teachers than by teachers of "low qualifications." "Highly Qualified" teachers are defined as those having five years of college or a master's degree. Teachers of "low qualifications" are defined as those with less than four years of college and no college degree.

This hypothesis, according to the results of a compilation of the answers to questions on the questionnaire concerning years of college completed and degrees earned, can be accepted.

An examination of Table 8, page 106, shows that "highly qualified" teachers with respect to years of college completed did practice grouping of pupils for arithmetic instruction to a greater extent than did teachers of "low qualifications" in this respect. It can be seen in column 2 of Table 8, page 106, that 43 per cent of those teachers having completed more than five years of college and 40 per cent of those having completed five years of college said that they practiced such grouping. Numbers of teachers in these two categories who carried out grouping were 10 and 7 per cent respectively above the average of 33 per cent. Only 26 per cent of teachers of "low qualifications" grouped pupils for arithmetic instruction. This was 7 per cent below the average. Thus, it is reasonable to conclude that a teacher of "high qualifications" is more likely to practice grouping pupils for instruction in arithmetic than is a teacher without such qualifications.
TABLE 8

TEACHERS' YEARS OF COLLEGE COMPLETED AND THE USE OF
PUPIL GROUPING FOR ARITHMETIC INSTRUCTION

<table>
<thead>
<tr>
<th>Years of College Completed</th>
<th>Responses of Teachers as to Whether or Not They Group for Arithmetic Instruction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (2)</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td>No (3)</td>
<td></td>
</tr>
<tr>
<td>More than 5</td>
<td>54 or 43%</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>71 or 57%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>101 or 40%</td>
<td>252</td>
</tr>
<tr>
<td></td>
<td>151 or 60%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>223 or 32%</td>
<td>707</td>
</tr>
<tr>
<td></td>
<td>484 or 68%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>53 or 26%</td>
<td>201</td>
</tr>
<tr>
<td></td>
<td>148 or 74%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>23 or 26%</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>66 or 74%</td>
<td></td>
</tr>
<tr>
<td>Less than 2</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>454 or 33%</td>
<td>1375</td>
</tr>
<tr>
<td></td>
<td>921 or 67%</td>
<td></td>
</tr>
</tbody>
</table>

Results with respect to degrees earned can be examined in column 2, Table 9, page 107. Fifty per cent of those teachers with the degree M. Ed. and 39 per cent of those with M. A. degrees indicated that they grouped pupils for arithmetic instruction, while only 28 per cent of those teachers with no degrees said that they carried out such grouping.

The number of teachers with M. Ed. degrees who said that they grouped pupils for arithmetic instruction was 17 per cent above the average of 33 per cent. Such teachers are usually required to take more education courses than teachers receiving an M. A. degree. Thus,
teachers with M. Ed. degrees should, and apparently do understand more thoroughly than teachers with M. A. degrees the necessity for pupil grouping to meet individual needs.

TABLE 9

DEGREES EARNED BY TEACHERS AND THE USE OF PUPIL GROUPING FOR ARITHMETIC INSTRUCTION

<table>
<thead>
<tr>
<th>Degrees Earned</th>
<th>Responses of Teachers as to Whether or Not They Group for Arithmetic Instruction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (2)</td>
<td></td>
</tr>
<tr>
<td>M. Ed.</td>
<td>27 or 50%</td>
<td>54</td>
</tr>
<tr>
<td>M. A.</td>
<td>28 or 39%</td>
<td>71</td>
</tr>
<tr>
<td>B. S.</td>
<td>213 or 32%</td>
<td>658</td>
</tr>
<tr>
<td>A. B.</td>
<td>68 or 39%</td>
<td>173</td>
</tr>
<tr>
<td>None</td>
<td>121 or 28%</td>
<td>426</td>
</tr>
<tr>
<td>Total</td>
<td>457 or 33%</td>
<td>1382</td>
</tr>
</tbody>
</table>

Teachers' years of teaching experience and their grouping of pupils for arithmetic instruction

An examination of Table 10, page 108, will show that there was no correlation between years of teaching experience and the practice of grouping pupils for instruction in arithmetic. No experience category listed in the table varied more than 1 per cent from the average of 33 per cent who carried out such grouping.

If grouping pupils for arithmetic instruction is to be promoted by educators as a desirable classroom practice, then teachers need
in-service training in teaching theory and methodology. Teacher experience alone does not result in an increased amount of such grouping.

### TABLE 10

**TEACHERS' YEARS OF EXPERIENCE AND THE USE OF PUPIL GROUPING FOR ARITHMETIC INSTRUCTION**

<table>
<thead>
<tr>
<th>Years of Teaching Experience</th>
<th>Responses of Teachers as to Whether or Not They Group for Arithmetic Instruction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (1)</td>
<td>No (2)</td>
</tr>
<tr>
<td>Less than 4</td>
<td>111 or 32%</td>
<td>241 or 68%</td>
</tr>
<tr>
<td>4 to 9</td>
<td>120 or 34%</td>
<td>238 or 66%</td>
</tr>
<tr>
<td>10 to 15</td>
<td>69 or 32%</td>
<td>148 or 68%</td>
</tr>
<tr>
<td>More than 15</td>
<td>155 or 33%</td>
<td>298 or 66%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>455 or 33%</td>
<td>925 or 67%</td>
</tr>
</tbody>
</table>

**Teachers' expressed reasons for not grouping pupils for arithmetic instruction**

The fourth hypothesis of this study was that a majority of those teachers who did not group pupils for arithmetic instruction would indicate that such grouping required too much teacher time for planning and correction work. A total of 926 such teachers responded to the questionnaire but only 190 or 21 per cent of these teachers (column 2, Table 11, p. 109) indicated that too much teacher time was required for planning and correction work. Thus, this hypothesis was not supported.
<table>
<thead>
<tr>
<th>Reasons for not Grouping</th>
<th>Number Checking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grouping requires more materials and textbooks than are available to me</td>
<td>355 or 37%</td>
</tr>
<tr>
<td>Grouping deprives the slow learner of stimulation from the fast learner</td>
<td>266 or 29%</td>
</tr>
<tr>
<td>Grouping requires too much teacher time for planning and correction work</td>
<td>190 or 21%</td>
</tr>
<tr>
<td>Grouping is not encouraged by my supervisor or principal</td>
<td>129 or 14%</td>
</tr>
<tr>
<td>Grouping increases disciplinary problems in the classroom</td>
<td>110 or 12%</td>
</tr>
<tr>
<td>Grouping is ineffective for arithmetic instruction</td>
<td>101 or 11%</td>
</tr>
<tr>
<td>Grouping causes the slow learner to feel inferior</td>
<td>95 or 10%</td>
</tr>
<tr>
<td>Grouping damages the slow learner's self-concept</td>
<td>48 or 5%</td>
</tr>
<tr>
<td>Grouping causes the fast learner to feel superior</td>
<td>42 or 5%</td>
</tr>
<tr>
<td>Grouping is undemocratic</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>434 or 47%</td>
</tr>
<tr>
<td><strong>Total Number of Checks</strong></td>
<td><strong>1774</strong></td>
</tr>
</tbody>
</table>
This does not mean that teacher time required for planning and correction work in connection with small group instruction is not an important teacher reason for not conducting such group instruction. Several writers on the subject as well as some teachers who made write-in comments on the questionnaires stressed the point that considerable time was required for this planning and correction work.

Reasons for not grouping pupils for arithmetic instruction were checked or written in on the questionnaire a total of 1,774 times. The most often checked reason—355 teachers checked it—was that grouping required more materials and textbooks than were available to the teacher. Second on the list with 266 teachers checking it was the reason that grouping deprived the slow learner of stimulation from the fast learner. Third on the list was the reason stated in the hypothesis that grouping required too much teacher time for planning and correction work.

Approximately twenty-five write-in reasons, two of which were written in many times, were given for not grouping pupils for arithmetic instruction. The reason written in most often, 203 times, was that the class time available for arithmetic instruction was insufficient for more than one group. If this reason had been offered on the questionnaire it probably would have been the most often checked reason. The other reason, with 151 teachers writing it in, was that the range of pupil differences in ability to learn arithmetic was not great enough to warrant grouping pupils for arithmetic instruction. Most of the teachers who used this reason also indicated that their classes were already grouped by ability.
Various other reasons were written in for not grouping pupils for arithmetic instruction. Some teachers wrote that grouping was not necessary. Other teachers wrote that their classrooms were too crowded for grouping. A few teachers said that they preferred to make only one presentation of the arithmetic topic and then help individuals as necessary. Four teachers reasoned that determining the proper placement of pupils in groups was too difficult. Four other teachers stated that immature pupils were unable to work without teacher guidance while a different group was being taught. Six teachers seemed to indicate a lack of knowledge of a successful plan of intra-class arithmetic ability grouping or a lack of confidence in their ability to carry out such a plan.

Four of the above reasons seem especially significant because of the number of teachers expressing them and probably should be given more attention by educators. Such attention could be given in Education courses and workshops for teachers.

Many teachers evidently feel that teaching materials and textbooks are available in insufficient quantities. This would provide a good point of departure for a study of the utilization of materials presently available to teachers and the selection of other useful but inexpensive materials.

A large number of teachers appear to be concerned about the slow learner's being deprived of stimulation from the fast learner. This possibly gives a hint as to how these teachers believe that learning takes place. The question then arises as to how important this stimulation from the fast learner really is to the slow learner.
A great number of teachers indicated that they believe more class time is required for the teaching of subgroups than is required for teaching the class as a whole. Their reasoning needs further exploration.

It is significant that many teachers feel relieved of the task of providing for individual differences in learning arithmetic when their school employs inter-class ability grouping. This point needs further attention from educators. A mere reduction of individual differences in learning ability does not lessen the teacher's responsibility to help each pupil make his maximum amount of progress.

**Teachers' expressed reasons for grouping pupils for arithmetic instruction**

Reasons for grouping pupils for arithmetic instruction checked by teachers and the number of teachers checking each reason can be seen in Table 12, page 113.

Individualization of instruction was the most often checked reason. The 341 teachers who checked this reason represent 74 per cent of the 458 teachers who said that they grouped pupils for arithmetic instruction. This seems to indicate that many of these teachers are concerned with the individualization of instruction in arithmetic. A further indication of this concern may be seen in the number of provisions for individual differences made by these teachers (see p. of this chapter).

Judging from the second most often checked reason, a majority of teachers who group pupils for arithmetic instruction appear
<table>
<thead>
<tr>
<th>Reasons for Grouping</th>
<th>Number Checking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grouping aids in individualizing instruction</td>
<td>341 or 74%</td>
</tr>
<tr>
<td>Grouping helps build the slow learner's self-concept</td>
<td>308 or 67%</td>
</tr>
<tr>
<td>Grouping is effective in increasing pupils' arithmetic achievement scores</td>
<td>181 or 40%</td>
</tr>
<tr>
<td>Grouping makes teaching arithmetic less difficult</td>
<td>122 or 27%</td>
</tr>
<tr>
<td>Grouping decreases disciplinary problems</td>
<td>80 or 17%</td>
</tr>
<tr>
<td>Grouping is encouraged by my supervisor or principal</td>
<td>74 or 16%</td>
</tr>
<tr>
<td>Other</td>
<td>101 or 22%</td>
</tr>
<tr>
<td>Total Number of Checks</td>
<td>1207</td>
</tr>
</tbody>
</table>
interested in building the slow learner's self-concept. This interest probably developed after many observations of situations in which the slow learner met with frustration in a learning task that was designed for a higher learning level than the level of which he was capable.

Several write-in reasons for grouping pupils for arithmetic instruction were listed by teachers. However, these reasons were relatively insignificant when judged by the number of teachers proposing them. The most often proposed reason was written in only twenty-five times. This reason was that grouping permits the pupil to work on his own level. Seventeen teachers indicated that grouping permits the fast group of pupils to proceed at a faster rate. Fourteen teachers wrote in that grouping helps the teacher maintain or create interest. Nine teachers stated that grouping helps give the pupil a feeling of achievement while six other teachers said that grouping gives the pupil self-confidence and a feeling of belonging. No other reason was proposed by more than four teachers.

Criteria used by teachers as a basis for placing pupils in groups for arithmetic instruction

As can be seen from Table 13, page 115, scores on arithmetic tests were most often checked as criteria for placing pupils in groups for arithmetic instruction. Scores on teacher-made tests were checked by 289 teachers and arithmetic achievement test scores were checked by 229 teachers. Arithmetic grades and IQ were checked by 218 and 108 teachers, respectively.

Many teachers, 111 to be exact, wrote in that they used teacher judgment from observations of pupils doing arithmetic work as an
additional basis for grouping pupils for arithmetic instruction. Fifteen teachers said that they used oral discussion, drill, and problem solving as bases for such grouping. A basis used by ten teachers was pupil interest in arithmetic.

### TABLE 13

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Number Checking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores on teacher-made tests</td>
<td>289 or 63%</td>
</tr>
<tr>
<td>Arithmetic achievement test scores</td>
<td>229 or 50%</td>
</tr>
<tr>
<td>Arithmetic grades</td>
<td>218 or 48%</td>
</tr>
<tr>
<td>IQ</td>
<td>108 or 24%</td>
</tr>
<tr>
<td>Other</td>
<td>142 or 31%</td>
</tr>
<tr>
<td>Total Number of Checks</td>
<td>986</td>
</tr>
</tbody>
</table>

An analysis of these criteria reveals that teacher judgment plays the most important role in determining into which group a particular pupil will be placed. This seems reasonable since teacher judgment is used in deciding which items will be included in teacher-made arithmetic tests, in assigning arithmetic grades, and in assigning significance to pupil behavior observed during the performance of arithmetic work in the classroom.
The fifth hypothesis set forth in this study was that a majority of those teachers who did group pupils for arithmetic instruction would use three groups. This hypothesis was not supported. As can be seen from an examination of Table 14, page 116, a majority, 299 out of 458, of such teachers indicated that they used only two groups. Several teachers, forty-three to be exact, did not answer this question. Other teachers wrote in the word "varies."

<table>
<thead>
<tr>
<th>Number of Pupil Groups</th>
<th>Number Checking</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>2</td>
<td>299 or 72%</td>
</tr>
<tr>
<td>3</td>
<td>95 or 23%</td>
</tr>
<tr>
<td>4</td>
<td>12 or 3%</td>
</tr>
<tr>
<td>More than 4</td>
<td>9 or 2%</td>
</tr>
<tr>
<td>Total</td>
<td>415</td>
</tr>
</tbody>
</table>

In formulating this fifth hypothesis the writer reasoned that arithmetic grouping practices with respect to the number of groups utilized would follow the pattern established in grouping for reading instruction. For reading instruction it is common practice to use three pupil groups.
It appears that under the conditions that prevail in many elementary classrooms today, most teachers who group pupils are unable or unwilling to give the necessary time to forming and teaching more than two pupil arithmetic groups. If conditions were different, that is, if classes were smaller and suitable teaching materials were plentiful, many more teachers could be expected to move away from the class-as-a-whole method of instruction toward the formation of two, three, and four pupil instructional groups. Of course, the ideal arrangement appears to be teaching arithmetic to each pupil individually.

**Division of teacher time between arithmetic instructional groups**

The sixth hypothesis of this study stated that teachers who grouped pupils for arithmetic instruction would spend a greater portion of their time instructing their "fast" groups than they would spend instructing their "slow" groups. According to the answers given by teachers this hypothesis was not supported (Table 15, p. 118). Two hundred and twenty-two, or 55 per cent, of the 401 teachers answering the question said that they spent equal time with all groups. One hundred and forty-six of the remaining teachers said that they spent most time with their "slow" groups, while only thirty-three teachers said that they spent most time with their "fast" groups.

In proposing this hypothesis the writer reasoned that since most teachers prefer to teach a "fast" class as compared to a "slow" class they would prefer to teach their "fast" arithmetic groups and would, therefore, spend more time with this type of group than with other
groups. Apparently this reasoning contained certain unknown fallacies or teachers would not admit that they spent more time with their "fast" groups.

TABLE 15

DIVISION OF TEACHER TIME BETWEEN ARITHMETIC INSTRUCTIONAL GROUPS

<table>
<thead>
<tr>
<th>Division of Time Options Chosen by Teachers</th>
<th>Number Checking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal time with all groups ..................</td>
<td>222 or 55%</td>
</tr>
<tr>
<td>Most time with slow group ....................</td>
<td>146 or 36%</td>
</tr>
<tr>
<td>Most time with fast group ....................</td>
<td>33 or 8%</td>
</tr>
<tr>
<td>Total Number of Teachers .....................</td>
<td>401</td>
</tr>
</tbody>
</table>

Availability of arithmetic textbooks and workbooks to teachers and the practice of grouping pupils for arithmetic instruction

An examination of Table 16, page 119, reveals that 164 out of 401 or 41 per cent of the teachers who indicated that they had more than one series of textbooks available in quantities of at least five said that they grouped pupils for arithmetic instruction. This can be compared with the average of 35 per cent of all teachers answering the question as to availability of textbooks who indicated that they carried out such grouping. On the other hand only 32 per cent of teachers indicating that they had one textbook available also checked that they grouped pupils for arithmetic instruction.

These figures seem to indicate that a teacher with more than one series of textbooks available to him for arithmetic instruction
1

will be more likely to group pupils for such instruction than will a teacher with only one series of textbooks available.

**TABLE 16**

**TEXTBOOKS AVAILABLE TO TEACHERS FOR ARITHMETIC INSTRUCTION**

<table>
<thead>
<tr>
<th>Number of Textbooks Available in Quantities of at Least Five (1)</th>
<th>Number and Percentage of Teachers Who Group (2)</th>
<th>Do Not Group (3)</th>
<th>Number of Teachers Answering (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>228 or 32%</td>
<td>479 or 68%</td>
<td>707</td>
</tr>
<tr>
<td>More than 1</td>
<td>164 or 41%</td>
<td>237 or 59%</td>
<td>401</td>
</tr>
<tr>
<td>Total</td>
<td>392 or 35%</td>
<td>716 or 65%</td>
<td>1108</td>
</tr>
</tbody>
</table>

Table 17, page 120, shows information concerning the availability of workbooks. It may be noted from this table that 42 per cent of those teachers having more than one series of workbooks available in quantities of at least five indicated that they grouped pupils for arithmetic instruction. This percentage may be compared to the average of 33 per cent of all teachers who group pupils for such instruction. Thus, it appears that teachers with more than one series of workbooks available to them will be more likely to group pupils for arithmetic instruction than will teachers who have available no workbooks or only one series of workbooks.

A majority, 54 per cent, of all teachers answering the question as to availability of workbooks reported that no workbooks were available to them in quantities of at least five. This probably
either reflects the poor financial condition of many school districts
or the distaste of teachers and administrators for arithmetic work-
books.

TABLE 17
WORKBOOKS AVAILABLE TO TEACHERS
FOR ARITHMETIC INSTRUCTION

<table>
<thead>
<tr>
<th>Number of Workbooks Available in Quantities of at least Five (1)</th>
<th>Number and Percentage of Teachers Who</th>
<th>Number of Teachers Answering (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group (2)</td>
<td>Do Not Group (3)</td>
</tr>
<tr>
<td>1 or less</td>
<td>365 or 32%</td>
<td>769 or 68%</td>
</tr>
<tr>
<td>More than 1</td>
<td>62 or 42%</td>
<td>87 or 58%</td>
</tr>
<tr>
<td>Total</td>
<td>427 or 33%</td>
<td>856 or 67%</td>
</tr>
</tbody>
</table>

Use of textbooks and workbooks by teachers who group pupils for arithmetic instruction

Table 18, page 121, shows the answers of teachers who group pupils for arithmetic instruction to two questions concerning the use of textbooks with pupil groups. Eighty-three per cent of these teachers answered "yes" to the first question. This shows that the use of the same textbook with all pupil arithmetic groups is fairly common practice.

These same teachers show by their answers to the second question that 73 per cent of them would use a different textbook with each pupil group if satisfactory textbooks were available to them. Thus, many teachers give further evidence of a scarcity of arithmetic
textbooks or at least express their desire to have more textbooks available to them.

**TABLE 18**

**USE OF TEXTBOOKS BY TEACHERS WHO GROUP PUPILS FOR ARITHMETIC INSTRUCTION**

<table>
<thead>
<tr>
<th>Questions</th>
<th>Number of Teachers Answering</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Do you use the same textbook with all groups?</td>
<td>Yes (2) 32 or 83%</td>
<td>389</td>
</tr>
<tr>
<td></td>
<td>No (3) 65 or 17%</td>
<td></td>
</tr>
<tr>
<td>(2) Would you use a different textbook with each group if satisfactory textbooks were available to you?</td>
<td>Yes (2) 265 or 72%</td>
<td>364</td>
</tr>
<tr>
<td></td>
<td>No (3) 99 or 27%</td>
<td></td>
</tr>
</tbody>
</table>

Teachers' answers to two questions concerning the use of workbooks with pupil groups for instruction in arithmetic are shown in Table 19, page 122. As can be seen from the table, 61 per cent of the teachers answering the first question say that they do not use workbooks. However, answers to the second question show 62 per cent saying they would use a different workbook with each group if satisfactory workbooks were available to them. Thus, while arithmetic workbooks are not as much in demand by teachers as are arithmetic textbooks, a large number of teachers express a desire to have more workbooks available to them.
<table>
<thead>
<tr>
<th>Questions (1)</th>
<th>Answers (2)</th>
<th>Answers (3)</th>
<th>Total (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you use the same workbook with all groups?</td>
<td>Yes: 118 or 28%</td>
<td>No: 43 or 10%</td>
<td>Do not use workbooks: 254 or 61%</td>
</tr>
<tr>
<td>Would you use a different workbook with each group if satisfactory workbooks were available to you?</td>
<td>Yes: 236 or 62%</td>
<td>No: 40 or 10%</td>
<td>Do not wish to use a workbook: 105 or 28%</td>
</tr>
</tbody>
</table>
Teachers' provisions for pupil individual differences in learning arithmetic

The 1,392 teachers returning usable questionnaires checked the twelve provisions for pupil individual differences in learning arithmetic 6,696 times. A count of the number of times the various write-in provisions were listed by these teachers came to another 206. The total number of times all provisions were checked or written in was 6,902. This was an average of 5.0 provisions per teacher made by all teachers answering the questionnaire. Teachers who said that they grouped pupils for instruction in arithmetic checked an average of 5.8 provisions per teacher, while teachers who said that they did not group pupils for such instruction checked only an average of 4.6 such provisions per teacher.

If these teachers gave a true account of the numbers of provisions for individual differences carried out by them, it appears that teachers who group pupils for arithmetic instruction are more concerned about individual differences than are those teachers who do not group for such instruction. This is consistent with the fact that teachers who group checked most often "Grouping aids in individualizing instruction" as a reason for their grouping of pupils (p. 153).

The number and percentage of teachers checking each of the twelve provisions for individual differences listed on the questionnaire can be seen in Table 20, page 124.

Five of these provisions were checked by at least 7 per cent more of those teachers who said that they grouped pupils than by the
<table>
<thead>
<tr>
<th>Provisions</th>
<th>Number and Percentage of Teachers Checking Who</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group (2)</td>
<td>Do Not Group (3)</td>
</tr>
<tr>
<td>Prove individual help for pupils at their desks</td>
<td>391 or 85%</td>
<td>746 or 81%</td>
</tr>
<tr>
<td>Provide individual help for pupils at teacher's desk</td>
<td>330 or 72%</td>
<td>642 or 69%</td>
</tr>
<tr>
<td>Permit individuals to help each other</td>
<td>276 or 60%</td>
<td>519 or 56%</td>
</tr>
<tr>
<td>Prepare and duplicate special exercises for individuals</td>
<td>324 or 71%</td>
<td>453 or 49%</td>
</tr>
<tr>
<td>Give individual homework assignments to pupils</td>
<td>264 or 58%</td>
<td>418 or 45%</td>
</tr>
<tr>
<td>Give individual classwork assignments to pupils</td>
<td>302 or 66%</td>
<td>348 or 38%</td>
</tr>
<tr>
<td>Assign fast learners to help the slow learners</td>
<td>210 or 46%</td>
<td>371 or 40%</td>
</tr>
<tr>
<td>Assign fewer problems to the slow learners</td>
<td>220 or 48%</td>
<td>222 or 24%</td>
</tr>
<tr>
<td>Keep pupils after school and give them individual help</td>
<td>126 or 27%</td>
<td>234 or 25%</td>
</tr>
<tr>
<td>Issue each pupil a textbook that matches his level of achievement</td>
<td>79 or 17%</td>
<td>60 or 6%</td>
</tr>
<tr>
<td>Issue each pupil a workbook that matches his level of achievement</td>
<td>57 or 12%</td>
<td>80 or 9%</td>
</tr>
<tr>
<td>Assign programmed work on a teaching machine</td>
<td>10 or 2%</td>
<td>14 or 2%</td>
</tr>
<tr>
<td>Other</td>
<td>70 or 15%</td>
<td>136 or 15%</td>
</tr>
<tr>
<td>Total Number of Checks</td>
<td>2659</td>
<td>4243</td>
</tr>
</tbody>
</table>

*See page 91 for reason for using percentages.
average of all teachers who checked the provisions on the questionnaire. First of the five, in percentage of times checked, was give individual classwork assignments to pupils. Second was assign fewer problems to the slow learners. Third was prepare and duplicate special exercises for individuals. Fourth was give individual homework assignments to pupils. Last of the five was issue each pupil a textbook that matches his level of achievement.

A study of these five provisions reveals nothing that puts them in a class by themselves. The fact that teachers who group pupils checked a greater total number of all provisions than did other teachers is the significant finding concerning provisions for individual differences in learning arithmetic.

Several write-in provisions of some possible interest to readers of this report were listed by teachers. The one item most often listed, however, was not a provision for individual differences but an excuse for not using more of the provisions set forth in the questionnaire. Forty-seven teachers made a note to the effect that since their classes were already grouped by ability and, therefore, possessed approximately equal arithmetic abilities, it was unnecessary to carry out as many provisions for individual differences as would otherwise be the case.

Thus, it appears that when a school employs inter-class ability grouping, teachers believe that provision for individual differences becomes less important. This same line of thinking appeared when teachers were asked why they did not group pupils for arithmetic instruction (p. 152). Such reasoning does not seem justified since
A teacher's function should be to help pupils progress at their maximum rate regardless of the level from which they start.

Thirty-three teachers wrote in that they made extensive use of the chalkboard as a means of diagnosing individual difficulties in arithmetic so that the proper help could be given individuals. Twenty-one teachers said that they gave individual help to pupils at recess or during the noon hour. Eighteen teachers mentioned the use of arithmetic games with individuals. Flash cards were listed as being used by fifteen teachers. More arithmetic work from the fast learner was stated as being expected by thirteen teachers. Ten teachers said that they asked parents to help individual pupils at home.

A group of five other provisions for individual differences in learning arithmetic were listed by at least five teachers. One of these was in general terms mentioning only enrichment activities. Another was to give extra credit for extra work. The other three dealt with the slow learner. Teachers mentioning these three provisions would give the slow learner more time on arithmetic work, extra drill on the basic arithmetic processes, and arithmetic work with concrete objects.

Availability of time for preparation of teaching materials

One of the provisions for individual differences listed on the questionnaire was prepare and duplicate special exercises for individuals. This provision requires considerable teacher time for material preparation. Question number twenty-three on the questionnaire sought to determine whether or not teachers who said that they grouped pupils
for arithmetic instruction felt that they had sufficient time in which to prepare such materials. The 413 teachers responding to the question were about evenly divided with respect to the way they answered it. Fifty-one per cent said that they had sufficient time as compared to 49 per cent who said that they did not have enough time. Several write-in comments on the question were to the effect that this work was done at home and after school hours at school.

A summary of the findings of this chapter is included in the general summary of this report in the first part of the following and final chapter. Also included in the final chapter will be conclusions reached by the writer and recommendations made to elementary school educators and arithmetic textbook authors.
V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

There is an ever increasing need for persons with well developed arithmetical concepts and skills in today's world. Elementary school educators should be alert to ways of improving the methodology of arithmetic instruction in order to better meet this greater need.

While the importance of the teacher himself should not be overlooked or underestimated, other factors in the teaching-learning situation such as social climate, quality and quantity of teaching materials, and organization of pupils for learning experiences in the classroom are important too. This study has dealt with the factor of classroom organization of pupils for the study of arithmetic.

Administrators usually form classes by assigning pupils to them on either a random basis or by general ability as determined by intelligence tests. Once pupils are assigned to a class the teacher must choose a plan of intra-class organization to use with his class.

Such organizational plans constitute a continuum ranging from the class-as-a-whole procedure to individualized instruction. Whatever the plan of intra-class organization, provisions must be made for pupil differences in arithmetic ability and achievement. Such differences are in all probability as great as pupil differences in ability to learn to read, spell, write, or perform physical feats.
The problem for which a solution was sought in this study was, what should be the approved plan of intra-class organization for instruction in arithmetic in the elementary school? The arithmetic grouping practices in use by teachers in the elementary schools of Ohio were determined and these practices were compared with what research findings collectively indicated concerning such arithmetic grouping practices. A solution to the problem was sought in order for the writer to be able to make recommendations to Ohio's elementary school educators concerning the improvement of such practices.

In order to gain information necessary to the solution of the problem, a review of the related research was made and data on arithmetic grouping practices was obtained from teachers in grades kindergarten through six by means of a questionnaire prepared by the writer.

The sample included 2,063 teachers in 156 elementary schools in Ohio's three types of public school districts. These three types of school districts are: county, city, exempted village. Usable questionnaires were returned by 1,392 or 67 per cent of these teachers. Percentages of returns by teachers in the three types of school districts were: county, 74; city, 63; exempted village, 67.

It was found from a compilation of age and sex data from the questionnaires that ages ranged from twenty to seventy-three years and that 10 per cent of the teachers filling in the blank on sex were male. A high percentage, 48 per cent, of county school teachers were over the age of forty-five. A higher than average percentage, 13 per cent as compared to 8 per cent for city and 9 per cent for exempted village schools, of county school teachers returning questionnaires
were males. No significance could be attached to either teacher sex or age with respect to how questions on the questionnaire were answered.

All grade levels, with the possible exception of kindergarten, were well represented according to numbers of teachers from each grade level who returned questionnaires. Kindergarten teachers returned only 71 usable questionnaires while teachers from grades one through six returned 239, 238, 228, 209, 213, and 194 such questionnaires respectively.

An attempt was made to answer the sixteen questions listed in Chapter 1 and also to test the six hypotheses stated in that chapter. Findings from the questionnaire responses with regard to each of these hypotheses and questions will now be summarized.

1. To what extent is grouping of pupils for arithmetic instruction practiced in Ohio's public elementary schools? The answer to this question is, according to teacher responses to the question of whether or not they carried out such grouping, approximately 33 per cent or one out of every three teachers. Percentages of teachers by type of school district who reported pupil grouping for arithmetic instruction were: county, 28; city, 37%; exempted village, 30. Only 16 per cent of kindergarten teachers and 25 per cent of second grade teachers reported such grouping.

2. Is grouping for arithmetic instruction considered by teachers to be relatively as important as grouping for reading instruction? The answer to this question is "no" according to responses of teachers to question number fifteen on the questionnaire. Only 35 per cent of the 1,304 teachers answering the question indicated that
grouping was equally important for both subjects. Thus, the first hypothesis of this study was not supported since it stated that grouping for arithmetic instruction would be indicated by teachers to be relatively as important as grouping for reading instruction.

One noteworthy item of information was found in connection with this question. Those teachers who said that grouping was equally important for reading and arithmetic instruction reported a higher percentage of grouping than did teachers who said that grouping for either arithmetic or reading was more important. This seems to indicate that teachers who are aware of the purpose of grouping, which is to provide for individual needs in both subjects, follow through with an attempt to fulfill those needs.

3. What is the relationship between teachers' interest in arithmetic and their arithmetic grouping practices? The second hypothesis of this study was that a higher percentage of teachers who indicated a "very high" interest in arithmetic as a subject would group pupils for arithmetic instruction than would teachers who indicated "average" interest in arithmetic. This hypothesis was supported since 39 per cent of those teachers reporting a "very high" interest in arithmetic as a subject said they grouped pupils for arithmetic instruction, while only 26 per cent of those teachers reporting "average" interest in arithmetic reported such grouping.

4. What is the relationship between teachers' academic qualifications and their arithmetic grouping practices? The third hypothesis of this study was that grouping for arithmetic instruction would be practiced to a greater extent by "highly qualified" teachers than by
This hypothesis was accepted on the basis of teachers' answers to the question of whether or not they grouped pupils for arithmetic instruction, their attainment of college degrees, and their years of college completed. Percentages of teachers with college degrees reporting grouping for arithmetic instruction were: M. Ed., 50 per cent; M. A., 39 per cent; A. B., 39 per cent; and B. S., 32 per cent. Only 28 per cent of those with no degree reported grouping. Percentages of teachers in five categories with respect to years of college completed who reported grouping for instruction in arithmetic were: More than five, 43 per cent; five, 40 per cent; four, 32 per cent; three, 26 per cent; and two, 26 per cent.

5. What is the relationship between teachers' years of experience and their arithmetic grouping practices? According to the answers of teachers to questions pertaining to their years of teaching experience and their practice or non-practice of pupil grouping for arithmetic instruction no apparent relationship exists.

6. What reasons do teachers give for not grouping pupils for arithmetic instruction? The fourth hypothesis of this study pertained to this question. It was that a majority of those teachers who did not group pupils for arithmetic instruction would indicate that such grouping required too much teacher time for planning and correction work. This hypothesis was not supported by the data. Six of the chief reasons checked on the questionnaire in order of frequency were:

a. Grouping requires more materials and textbooks than are available to me.
b. Grouping deprives the slow learner of stimulation from the fast learner.

c. Grouping requires too much teacher time for planning and correction work.

d. Grouping is not encouraged by my supervisor or principal.

e. Grouping increases disciplinary problems in the classroom.

f. Grouping is ineffective in the classroom.

The two chief write-in reasons were class time available for arithmetic instruction is insufficient for the instruction of more than one arithmetic group and the range of pupil differences in arithmetic ability is not great enough to warrant use of more than one group.

7. What reasons do teachers give for grouping pupils for arithmetic? The four chief reasons in order of frequency checked were:

a. Grouping aids in individualizing instruction.

b. Grouping helps build the slow learner's self-concept.

c. Grouping is effective in increasing pupils' arithmetic achievement scores.

d. Grouping makes teaching arithmetic less difficult.

8. On what basis are pupils placed in groups for arithmetic instruction? Bases from the questionnaire in order of frequency checked were:

a. Scores on teacher made arithmetic tests.

b. Arithmetic achievement test scores.

c. Arithmetic grades.

d. IQ.
An important write-in reason was use of teacher judgment after classroom observations of pupils doing arithmetic work.

9. Into how many groups do teachers who group pupils for arithmetic instruction usually divide their classes? The fifth hypothesis of this study was that a majority of those teachers who did group pupils for arithmetic instruction would use three groups. The data failed to support this hypothesis. Number of groups used in order of frequency were: two, three, four, and more than four.

10. How do teachers who say that they group pupils for arithmetic instruction divide their teaching time between groups? The final hypothesis of this study was that teachers who grouped pupils for arithmetic instruction would spend a greater portion of their time instructing their "fast" groups than they would spend instructing their "slow" groups. According to answers given by teachers this hypothesis cannot be accepted. Divisions of time in order of frequency checked were: equal time with all groups, most time with slow group, and most time with fast group.

11. How many different series of arithmetic textbooks and workbooks are available to teachers of elementary school arithmetic? Teachers having only one series of textbooks available numbered 708; those having two numbered 270; three, 51; four, 19; and more than four, 62. A total of 607 teachers reported that no workbooks were available to them in quantities of five. Four hundred and forty-seven reported one available, 59 reported two, 18 reported three, 10 reported four, and 62 reported more than four.
12. Do teachers who group pupils for arithmetic instruction use the same arithmetic textbooks and workbooks with all groups? Eighty-three per cent of the teachers answering the questions on the questionnaire pertaining to textbooks indicated that they did use the same textbook with all groups; however, 73 per cent indicated that they would use a different textbook with each group if satisfactory textbooks were available. Only 28 per cent of the teachers answering the questions on the questionnaire said that they used the same workbook with all groups. Sixty-one per cent of all teachers said that they had no workbooks available to them. Sixty-two per cent indicated a desire to use a different workbook with each group if satisfactory workbooks were available to them.

13. What provisions do teachers make for pupil differences in learning arithmetic? Nine of the most frequently checked provisions in order of frequency checked were:

   a. Provide individual help for pupils at their desks.
   b. Provide individual help for pupils at teacher's desk.
   c. Permit individuals to help each other.
   d. Prepare and duplicate special exercises for individuals.
   e. Give individual homework assignments to pupils.
   f. Give individual classwork assignments to pupils.
   g. Assign fast learners to help slow learners.
   h. Assign fewer problems to the slow learners.
   i. Keep pupils after school and give them individual help.

14. Do teachers who group pupils for arithmetic instruction indicate that they have sufficient time in which to prepare and
duplicate needed special exercises for groups or individuals? Fifty-one per cent of such teachers checked that they had ample time; however, several teachers made write-in comments to the effect that such work was performed at home and at school after school hours.

15. What do research findings collectively indicate concerning grouping pupils for arithmetic instruction? Writings pertaining to this question were examined that dealt with both inter-class and intra-class grouping.

Inter-class ability grouping is common practice in England but the extent of its use in the United States is unknown. Opinions of educators are divided with respect to the desirability of inter-class ability grouping with a majority indicating that this type of grouping, in and of itself, makes no difference in determining the effectiveness of a program of instruction in the elementary school.

Eighteen studies of inter-class ability grouping were examined. Nine of the studies were favorable to such grouping, two were unfavorable, while seven were neutral. Thus, the combined results of these studies give some support to the practice of such grouping.

Intra-class ability grouping for instruction in arithmetic appears from the writings of educators to be approved practice. Brueckner\(^1\) attempted to determine by questionnaire the extent of the practice of this type of grouping in the elementary classrooms of the

United States. He found that approximately 50 per cent of such class-
rooms were divided into two or more arithmetic ability groups. In a
study limited to the state of Tennessee, Johnston\(^2\) found general
failure to establish pupil groups for arithmetic instruction.

Intra-class organizational practices reported in professional
journals constitute a continuum ranging from the class-as-a-whole pro-
cedure to completely individualized instruction. The fourteen studies
of such grouping examined strongly indicated that more favorable
achievement results can be expected from arithmetic teaching as group-
ing practices move toward the individualized end of the continuum.

16. What criteria have been established by professional elementary
school educators as bases for evaluation of intra-class organization
for instruction in arithmetic?

A list of nine criteria was compiled from the writings of
professional elementary school educators. These criteria are:

a. A combination of subjective and objective criteria
should be used as bases for establishing pupil groups.
b. Any plan of pupil grouping should be established for a
purpose.
c. Flexibility in grouping should be maintained so that
each pupil can work with the group which will most
appropriately serve his needs, interests, and abilities.
d. Pupil grouping should provide for individual differences.

\(^2\)A. Montgomery Johnston, "A Survey of Teaching Practices-
Arithmetic in Tennessee in the First through Eighth Grades," The
e. Pupil grouping should minimize loss of self-respect on the part of the "slow" pupils.

f. Intra-class grouping should not break up the unity of the total class group.

g. Pupil grouping should be accompanied by proper selection of content, methods, and materials.

h. Pupil grouping should encourage desirable interaction between pupils.

i. Pupil grouping should not make unreasonable demands for performance not yet justified by the maturity level of the pupils.

Conclusions

It appears reasonable to draw certain conclusions from the findings of the study, an examination of the related research, and a consideration of criteria established from the written opinions of professional educators. These conclusions are:

1. The practice of grouping pupils for instruction in arithmetic within the elementary school classroom is sufficiently widespread, one out of three teachers group, to merit further clarification of its contribution to the teaching-learning situation.

2. Intra-class grouping of pupils for arithmetic instruction is desirable as a means of aiding the individualization of such instruction.
3. A majority of the teachers who group pupils for arithmetic instruction believe that such grouping aids them in individualizing instruction in arithmetic.

4. Teachers with "high" academic qualifications have a better understanding of learning principles as taught in institutions of higher learning and, therefore, see a greater need to individualize arithmetic instruction than do teachers with "low" academic qualifications.

5. Teachers with a "very high" interest in arithmetic as a subject are more likely to group pupils for arithmetic instruction than are teachers without such an interest.

6. The slow learner's self-concept is a major concern of a majority of those teachers who group pupils for arithmetic instruction.

7. The major factors that appear to contribute to a teacher's decision to use intra-class grouping for instruction in arithmetic are availability of teaching materials for use by subgroups, awareness of the existence in his classroom of a wide range of pupil differences in arithmetic learning ability, teacher's interest in arithmetic as a subject, and availability of teacher time for lesson planning for subgroups.

8. Teachers who group pupils for arithmetic instruction tend to make more provisions for pupil differences in learning arithmetic than do teachers who do not group.

9. It is common practice for teachers who group pupils for arithmetic instruction to use the same arithmetic textbook with all pupil
groups because suitable textbooks for more than one group generally are unavailable to teachers.

10. Many teachers do not feel that they have sufficient teaching materials available to permit them to provide materials for pupil groups in arithmetic.

11. When a school employs inter-class ability grouping, some teachers in the school believe that the problem of individualizing instruction in arithmetic is minimized to the extent that a need to subgroup pupils does not exist.

12. Many teachers believe that more class time is required to teach subgroups than is required to teach the class-as-a-whole.

13. Grouping for arithmetic instruction is relatively as important as grouping for reading instruction but a majority of Ohio's public elementary school teachers do not have the professional understandings necessary to reach this conclusion.

14. Most teachers who group pupils for arithmetic instruction use only two groups.

15. Inter-class ability grouping of pupils probably results in slightly better arithmetic achievement than does random grouping.

Recommendations

The conclusions reached in this study were made after consideration of the findings of experimental studies, the findings of this survey, and the criteria established from the written opinions of professional educators. Keeping these considerations in mind and drawing upon the writer's own personal experience in teaching
arithmetic in an elementary school classroom, certain recommendations to educators in teacher training institutions were formulated. These recommendations are made with the belief that their implementation will result in future elementary school teachers better prepared to teach arithmetic to their pupils:

1. Pupil grouping for arithmetic instruction should be encouraged as an aid in individualizing instruction.

2. The major purpose of pupil grouping, to aid in the individualization of instruction, should be fully explained to teachers.

3. Teachers should be taught that it is important to teach arithmetic to each pupil at his level of understanding and thus, help him to progress at his maximum rate whether or not a wide range of pupil arithmetic abilities exist in a particular classroom.

4. The teacher should be apprised of the fact that it is desirable to individualize instruction in arithmetic, but that this requires a considerable amount of teacher time and should be carried out only to the point where the total program will not suffer.

5. The new teacher should be encouraged to use only two groups until he becomes acquainted with the problems of teaching in general and the problems of pupil grouping in particular.

6. The increased demand of pupil grouping on teacher time should be explored fully and explained to teachers.

7. Since many teachers indicate that they believe more class time is required for pupil groups than for the class-as-a-whole procedure, this idea should be explored and clarified.
8. Specific attention should be given to the problem of selecting arithmetic teaching materials for pupil subgroups.

9. Teachers should be encouraged to explain the idea of individual differences to their pupils so that pupils will not feel that they are being stigmatized by not always being in the top group.

10. The confused situation that still exists with respect to inter-class ability grouping and arithmetic instruction should be the subject of further experimentation in order to better clarify this situation.

11. There is a need for, and something should be done to obtain, more well conducted and well controlled experimentation with intra-class grouping for instruction in arithmetic.

In order to improve the teaching of arithmetic elementary school administrators should consider the following list of recommendations. These recommendations could be implemented by administrators in the in-service training of groups of teachers and in helping individual teachers:

1. Teachers should be encouraged to try arithmetic grouping first on a limited basis and then as it appears advisable.

2. Teachers should be given help in obtaining suitable arithmetic teaching materials for pupil grouping.

3. Teachers should be encouraged to exchange ideas on the utilization of pupil grouping for the teaching of arithmetic.

4. Teachers should be encouraged to emphasize the importance of maximum pupil growth in arithmetic and to de-emphasize the importance of pupils being in the top group.
5. Parents should be helped to understand the purpose of intra-
class pupil grouping for instruction in arithmetic.

6. Teachers should be given clerical help with routine duties
whenever possible so that more teacher time will be available for the
planning and preparation of arithmetic subgroup activities.

The following recommendations should be considered by the authors
of elementary school arithmetic textbooks and workbooks in order to
increase the availability of such textbooks and workbooks suitable for
use with subgroups:

1. Since individual differences in ability to learn arithmetic
exist to varying degrees in all classrooms with pupils in the same
chronological age groups, the problem of preparing more textbooks and
workbooks to be used to provide for such differences should be given
further attention.

2. Since slow pupils in the same chronological age groups with
fast pupils must maintain their self respect, it appears inadvisable
to assign lower grade textbooks and workbooks to these slow pupils;
therefore, similarly appearing textbooks and workbooks that contain
the same subject matter presented on different ability levels should
be designed.

3. Textbooks and workbooks should be designed to save the
teacher's time, to a greater extent than is presently being done, thus
permitting him to give more individual help to pupils. This appears
feasible if the teacher has a guide to help him present the topic for
study to all groups and has materials for use at different levels to
give pupil groups or individuals.
APPENDIX I

November 16, 1962

Dear

With the cooperation of the Department of Education, Ohio State University, I am conducting a study of intra-class grouping practices in the teaching of arithmetic. This study is being made in the elementary schools of Ohio.

As you know, professional workers in the field of education realize the importance of good intra-class organization in the teaching of arithmetic concepts and skills to students. The purpose of this study is to gain information that will be of use to educators in determining the most appropriate forms of such intra-class organization. Your cooperation in this phase of the study is needed and I am asking your assistance.

The only reward I can offer you is the opportunity to share information gained about the many worthwhile intra-class organizations now in use. Therefore, a summary of the findings will be sent to each cooperating school.

Your school is one of 159 schools drawn, by random sampling procedures, from the Education Directory of the State Department of Education. None of these schools will be identified in the study.

Will you please send me a current list of the names and addresses of all your teachers who teach arithmetic to pupils in grades kindergarten through six? Each teacher on the list will be sent a questionnaire, a copy of which is enclosed for your inspection.

Your prompt attention to this matter will be greatly appreciated. A self-addressed envelope is enclosed for your convenience.

Thank you,

Emery Brewer
December 16, 1962

Dear Principal,

You received a letter from me dated November 16, 1962. In that letter I requested a list of the names and addresses of teachers in your school who teach arithmetic to students in grades kindergarten through six. Your list has as yet not been received by me.

I realize that you are probably very busy with your many school duties and it is not my wish to add to your workload. However, it is extremely important to the results of the study being made by me that I have your list.

Approximately one-half of the principals contacted, sent only a list of teacher's names and suggested that all mail be sent to the school address. This is satisfactory with me if it is more convenient for you.

Thanks for your time and effort in this matter.

Sincerely,

Emery Brewer
Room 207
Arps Hall
1945 North High Street
Columbus 10, Ohio
January 6, 1963

Dear Teacher:

As a professional person you are no doubt aware of the importance of intra-class organization for instruction.

In cooperation with the Department of Education, Ohio State University, I am conducting a study of intra-class grouping practices in the teaching of arithmetic. Arithmetic, as defined in this research, includes number study in kindergarten and the primary grades. The study is being made in the elementary schools of Ohio.

You are one of 2,426 elementary-school teachers whose schools were drawn by random sampling procedures from the Education Directory of the State Department of Education. Neither you nor your school will be identified in the study.

The purpose of this study is to gain information that will be of use to educators in determining the most appropriate forms of intra-class organization. Your cooperation in this phase of the study is greatly needed. I will appreciate your assistance and will express my gratitude by sending to your school faculty a summary of the findings.

Will you please fill out the enclosed questionnaire and return it to me in the self-addressed envelope? Your prompt attention to this matter will be greatly appreciated.

Thank you,

Emery Brewer
January 26, 1963

Dear Teacher:

You received a questionnaire from me January 6, 1963, entitled, "The Status of Grouping Practices in Elementary Arithmetic." Your completed questionnaire has not been received by me as of this date.

Being a full-time elementary school teacher myself, I am fully aware of the excessive demands made upon your time. It is not my wish to add to your workload. However, it is extremely important to the result of the study being made, and to me personally, that your answers to the questions on the questionnaire be included.

I trust I will hear from you soon. Thank you,

Emery Brewer
APPENDIX II

THE STATUS OF GROUPING PRACTICES IN ELEMENTARY ARITHMETIC

Name________________________ Date of Birth_________ Sex: Male_____ Female_____

School______________________ City or Town__________ County________

Encircle your response to items one through ten.

1. Grade level or levels on which you teach arithmetic: K, 1, 2, 3, 4, 5, 6.

2. Years of college completed: Less than 2, 2, 3, 4, 5, More than 5.

3. Degrees earned: AB, BS, MA, M.Ed, CSE, Ed.D, Ph.D

4. Years of teaching experience: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, More than 15.

5. Classes to which you teach arithmetic: 1, 2, 3, 4, More than 4.

6. Average daily class time devoted to arithmetic per class of pupils in minutes: Less than 30, 30, 40, 45, 50, 60, More than 60.

7. Number of arithmetic textbooks available to you in quantities of at least five: 1, 2, 3, 4, More than 4.

8. Number of workbooks available to you in quantities of at least five: 1, 2, 3, 4, More than 4.

9. Part of arithmetic class time spent in formal whole-class instruction by you: 1/4, 1/3, 1/2, 2/3, 3/4, Whole period.

10. Part of arithmetic class time spent helping individuals: 1/4, 1/3, 1/2, 2/3, 3/4, Whole period.

11. Check the provisions, if any, that you make for pupil differences in learning arithmetic:

  _ _ _ _ _ Issue each pupil a textbook that matches his level of achievement
  _ _ _ _ _ Issue each pupil a workbook that matches his level of achievement
  _ _ _ _ _ Prepare and duplicate special exercises for individuals
  _ _ _ _ _ Give individual homework assignments to pupils
  _ _ _ _ _ Give individual classwork assignments to pupils
  _ _ _ _ _ Provide individual help for pupils at my desk
  _ _ _ _ _ Provide individual help for pupils at their desks
  _ _ _ _ _ Keep pupils after school and give them individual help
  _ _ _ _ _ Permit individuals to help each other
  _ _ _ _ _ Assign fast learners to help the slow learners
  _ _ _ _ _ Assign fewer problems to the slow learners
  _ _ _ _ _ Assign programmed work on a teaching machine
  _ _ _ _ _ Other, (please explain) ________________________________
12. Check the item most accurately indicating your interest in arithmetic:

A little above     A little below
Very high average Average average Very low

13. Do you group pupils for reading instruction? Yes No

14. Do you group pupils for arithmetic instruction? Yes No

15. Check the relative importance of grouping for arithmetic instruction as compared to grouping for reading instruction. Grouping for: reading is more important arithmetic is more important reading and arithmetic is equally important

16. If you do not group pupils for arithmetic instruction, check your reason or reasons below. Grouping:

___ is undemocratic
___ causes the slow learner to feel inferior
___ causes the fast learner to feel superior
___ damages the slow learner's self-concept
___ requires too much teacher time for planning and correction work
___ deprives the slow learner of stimulation from the fast learner
___ is ineffective for arithmetic instruction
___ requires more materials and textbooks than are available to me
___ increases disciplinary problems in the classroom
___ is not encouraged by my supervisor or principal
___ other, (please explain) ____________________________

ANSWER NO MORE QUESTIONS IF YOU DO NOT GROUP

17. If you group for arithmetic, into how many groups do you divide your class or classes? Encircle the correct number: 2, 3, 4, more than 4.

18. How do you divide your teaching time between groups? Check one: Most time with: fast group slow group Equal time with all groups

19. Do you use the same textbook with all groups? Yes No

20. Do you use the same workbook with all groups? Yes No

21. Would you use a different textbook for each group if satisfactory textbooks were available to you? Yes No

22. Would you use a different workbook for each group if satisfactory workbooks were available to you? Yes No

23. Do you have sufficient time in which to prepare and duplicate needed special exercises for groups or individuals? Yes No
24. Check the item or items that you use as a basis for placing pupils in arithmetic groups:
   ___ arithmetic achievement scores
   ___ scores on teacher made tests
   ___ arithmetic grades
   ___ IQ
   ___ Other, (please explain) _________________________

25. Check your reason or reasons for grouping for arithmetic instruction. Grouping:
   ___ aids in individualizing instruction
   ___ makes teaching arithmetic less difficult
   ___ decreases disciplinary problems
   ___ helps build the slow learner's self-concept
   ___ is effective in increasing pupil's arithmetic achievement scores
   ___ is encouraged by my supervisor or principal
   ___ other, (please explain) _________________________
THE STATUS OF GROUPING PRACTICES IN ELEMENTARY ARITHMETIC

Name_________________ Date of Birth__________ Sex: Male_ Female__

School________________ City or Town_____________ County__________

Encircle your response to items one through ten.

1. Grade level or levels on which you teach arithmetic: K, 1, 2, 3, 4, 5, 6.

2. Years of college completed: Less than 2, 2, 3, 4, 5, More than 5.

3. Degrees earned: AB, BS, MA, M.Ed, CSE, Ed.D, Ph.D

4. Years of teaching experience: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, More than 15.

5. Classes to which you teach arithmetic: 1, 2, 3, 4, More than 4.

6. Average daily class time devoted to arithmetic per class of pupils in minutes: Less than 30, 30, 35, 40, 45, 50, 55, 60, More than 60.

7. Number of arithmetic textbooks available to you in quantities of at least five: 1, 2, 3, More than 4.

8. Number of workbooks available to you in quantities of at least five: 0, 1, 2, 3, 4, More than 4.

9. Part of arithmetic class time spent in formal whole-class instruction by you: 1/4, 1/3, 1/2, 2/3, 3/4, Whole period.

10. Part of arithmetic class time spent helping individuals: 1/4, 1/3, 1/2, 2/3, 3/4, Whole period.

11. Check the provisions, if any, that you make for pupil differences in learning arithmetic:

   ___ Issue each pupil a textbook that matches his level of achievement
   ___ Issue each pupil a workbook that matches his level of achievement
   ___ Prepare and duplicate special exercises for individuals
   ___ Give individual homework assignments to pupils
   ___ Give individual classwork assignments to pupils
   ___ Provide individual help for pupils at my desk
   ___ Provide individual help for pupils at their desks
   ___ Keep pupils after school and give them individual help
   ___ Permit individuals to help each other
   ___ Assign fast learners to help the slow learners
   ___ Assign fewer problems to the slow learners
   ___ Assign programmed work on a teaching machine
   ___ Other, (please explain) ____________________________
12. Check the item most accurately indicating your interest in arithmetic: Very high____ A little above average____ Average____
A little below average____ Very low____
13. Do you group pupils for reading instruction? Yes___ No____
14. Do you group pupils for arithmetic instruction? Yes___ No____
15. With the understanding that skill in reading is more important to most pupils than skill in arithmetic, check the relative importance of grouping for arithmetic instruction as compared to grouping for reading instruction. Grouping for: reading is more important____ arithmetic is more important____ reading and arithmetic is equally important____
16. If you do not group pupils for arithmetic instruction, check your reason or reasons below. Grouping:
   ___ is undemocratic
   ___ causes the slow learner to feel inferior
   ___ causes the fast learner to feel superior
   ___ damages the slow learner's self-concept
   ___ requires too much teacher time for planning and correction work
   ___ deprives the slow learner of stimulation from the fast learner
   ___ is ineffective for arithmetic instruction
   ___ requires more materials and textbooks than are available to me
   ___ increases disciplinary problems in the classroom
   ___ is not encouraged by my supervisor or principal
   ___ other, (please explain) ________________________________

ANSWER NO MORE QUESTIONS IF YOU DO NOT GROUP

17. If you group for arithmetic, into how many groups do you usually divide your class or classes? Encircle the correct number: 2, 3, 4, more than 4.
18. How do you divide your teaching time between groups? Check one:
   Most time with: fast group____ slow group____ Equal time with all groups____
19. Do you use the same textbook with all groups? Yes____ No____
20. Do you use the same workbook with all groups? Yes____ No____
   Do not use workbooks____
21. Would you use a different textbook for each group if satisfactory textbooks were available to you? Yes____ No____
22. Would you use a different workbook for each group if satisfactory workbooks were available to you? Yes____ No____
   Do not wish to use a workbook____
23. Do you have sufficient time in which to prepare and duplicate needed special exercises for groups or individuals? Yes___
   No____

24. Check the item or items that you use as a basis for placing pupils in arithmetic groups:
   ___ arithmetic achievement scores
   ___ scores on teacher made tests
   ___ arithmetic grades
   ___ IQ
   ___ Other, (please explain) ______________________________

25. Check your reason or reasons for grouping for arithmetic instruction. Grouping:
   ___ aids in individualizing instruction
   ___ makes teaching arithmetic less difficult
   ___ decreases disciplinary problems
   ___ helps build the slow learner's self-concept
   ___ is effective in increasing pupil's arithmetic achievement scores
   ___ is encouraged by my supervisor or principal
   ___ other, (please explain) ______________________________
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Swenson, Esther J. "Rate of Progress in Learning Arithmetic," The Mathematics Teacher, 48 (February, 1955), pp. 70-76.


I, Emery Brewer, was born at Scranton, Kentucky, May 25, 1924. I received my elementary-school education in the public schools of Menifee County, Kentucky, and my secondary education at Ezel High School, Ezel, Kentucky. My first two years of undergraduate training were obtained at Lees Junior College, Jackson, Kentucky. After military service in World War II, I entered the University of Kentucky and completed my undergraduate training in 1947. I returned to the University of Kentucky in 1951 and received my Master of Arts degree in 1952.

My teaching experience includes one year in a one-room elementary school in Menifee County, Kentucky; four years in Frenchburg High School, Frenchburg, Kentucky; and five and one-half years in U. S. Grant Elementary School, Dayton, Ohio. I have also taught three semesters of night classes in the Dayton and Middletown Academic Centers for Miami University, Oxford, Ohio.

I first enrolled in the Graduate School of The Ohio State University in the Summer Quarter of 1960.