WISCONSIN STATE COLLEGE AT LA CROSSE
GRADUATE SCHOOL

Candidate: Alter Johnson

I recommend acceptance of this seminar paper to the Graduate School in partial fulfillment of this candidate's requirements for the degree Master of Science. The candidate has completed his oral seminar report.

7/28/64
Date

S. J. Young
Seminar Paper Advisor

This seminar paper is approved for the Graduate School:

July 28, 1964
Date

James B. Richardson
Dean, Graduate School
A REPORT OF AN EXPERIMENT IN
INDIVIDUALIZING ARITHMETIC
INSTRUCTION IN THE FIFTH GRADE
AT CAMPUS SCHOOL

BY
ALTA VERL MACKEY JOHNSON

ABSTRACT

Statement of the problem. This was an experiment in individualizing arithmetic to (1) identify problems involved, (2) to measure children's progress, and (3) to arrive at some conclusions concerning the value of individualizing instruction in arithmetic.

Methods and procedure used. The experiment was carried out with the Fifth Grade at Campus School at Wisconsin State University. An achievement test was given before and after the experiment. Records were kept by the children and teacher.

Summary of findings. During the seven months of the experiment the mean grade equivalent changed from 5.7 to 6.9. The range of difference among the twenty-six children decreased.
A REPORT OF AN EXPERIMENT IN
INDIVIDUALIZING ARITHMETIC INSTRUCTION
IN THE FIFTH GRADE AT CAMPUS SCHOOL

A Seminar Paper
Presented to
Dr. B. J. Young, Professor
Education 436, Seminar: Problems of Teaching (Elementary)
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In Partial Fulfillment
of the Requirements for the Degree
Master of Science in Teaching
(Elementary)

by
Alta Verl Mackey Johnson
July, 1964
ACKNOWLEDGMENTS

A very special thanks goes to the Fifth Grade Class at Campus School (1963-1964) for their exciting enthusiasm towards individualized instruction. The experiment was begun at their request and was successful because of their cooperation in solving problems involved, their perseverance in daily work, and the wonderful spirit of happiness which prevailed throughout the project.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. THE PROBLEM AND DEFINITIONS OF TERMS USED</td>
<td>1</td>
</tr>
<tr>
<td>The Problem</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>1</td>
</tr>
<tr>
<td>Importance of the Study</td>
<td>1</td>
</tr>
<tr>
<td>Definitions of Terms Used</td>
<td>2</td>
</tr>
<tr>
<td>Statements of Assumptions and Limitations</td>
<td>3</td>
</tr>
<tr>
<td>II. REVIEW OF RESEARCH</td>
<td>5</td>
</tr>
<tr>
<td>On Individualized Instruction</td>
<td>5</td>
</tr>
<tr>
<td>Recent Experiments in Individualized Arithmetic</td>
<td>10</td>
</tr>
<tr>
<td>Summary of Research</td>
<td>12</td>
</tr>
<tr>
<td>III. THE EXPERIMENT</td>
<td>13</td>
</tr>
<tr>
<td>Procedure of Experiment</td>
<td>13</td>
</tr>
<tr>
<td>The Beginning</td>
<td>13</td>
</tr>
<tr>
<td>Development</td>
<td>19</td>
</tr>
<tr>
<td>IV. SUMMARY AND CONCLUSIONS</td>
<td>22</td>
</tr>
<tr>
<td>Summary</td>
<td>22</td>
</tr>
<tr>
<td>Conclusions</td>
<td>22</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>24</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>26</td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>27</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>28</td>
</tr>
</tbody>
</table>
CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

I. THE PROBLEM

Statement of the problem. From January through May, 1964, the Campus School Fifth Grade, Wisconsin State University at La Crosse, experimented in individualized instruction. This is a report of that experiment. The author hoped to identify some of the problems encountered when arithmetic instruction is individualized, to measure children's progress in arithmetic during the experiment, and to attempt reaching some conclusions concerning the value of individualizing instruction in mathematics.

Importance of the study. At the present time practically anyone who has prepared for a teaching career has heard much about the individual differences among children and the varying needs of each child. Those who are now emerging from colleges and entering into teaching careers are, no doubt, quite fortified with methods and techniques to help fulfill their obligations to today's children. Grouping has likely been one of the most commonly used methods whereby a teacher could approach children who have similar problems. Many acceptable and worthwhile techniques have been worked out to meet some of the individual needs within a large group
situation. More and more teachers are realizing the near "impossibility" of getting perfect grouping for no two children are alike.

Since tests and studies plus observation can readily reveal the wide range in a classroom, teachers have become increasingly aware of the problems before them. Many teachers have turned to a completely individualized approach in the area of reading; some have experimented with a similar technique in arithmetic. Long before this author had heard of the term "individualized arithmetic," she had done some small scale work in that area in a rural school. This experience was enough to point out that there would be much work and many problems involved if this were to be done on a larger scale.

This paper is expected to be of value for its identification of problems in individualizing arithmetic, for its measurement of child growth during the experiment, and for the conclusions concerning the study. However, the experiment itself held its greatest importance at the time it was being carried out for it was organized as a means to fulfill the needs of a "particular situation." In this case the children requested individualized arithmetic.

II. DEFINITIONS OF TERMS USED

In this paper the term individualized will mean the
situation in which teacher and pupil will work on a one to one relationship much of the time. The child will progress at his own rate of speed and may or may not cover the same material as the other children in his room. From time to time the child may be involved in a group situation. This author maintains that if the group situation has arisen from the combined needs of the children then group instruction is merely a ramification of the individualized approach.

III. STATEMENTS OF ASSUMPTIONS AND LIMITATIONS

There are factors which limit the usefulness of this experiment in individualized arithmetic. Although each child's individual progress was measured, only one group of children was used. Since there was no control group this method of instruction could not be proven to be any better than any other given method. This experiment was begun through popular request and pressure from the children. Results presumably could be very different if the experiment had been instigated by the teacher.

The only test used was the Iowa Basic Skills Test Form I. A study of this test reveals that the test may not measure top achievement of fifth grade children.

According to research it would seem logical to assume that the range of differences would widen as a result of the
individualized approach in arithmetic.¹

CHAPTER II

REVIEW OF RESEARCH

I. ON INDIVIDUALIZING INSTRUCTION

For many years parents and teachers have been aware of the great differences among children. It has been agreed upon that the schools must in some way try to fulfill the needs of each child in order to help him take his place in society. In recent years there have been strides made in individualizing work especially in the area of reading but the progress has not been so rapid in arithmetic and in some of the other areas. According to Dr. John Mc Lain:

There are several forces causing the movement toward the individualization of instruction. Some of these forces have to do with the changing needs of our society. Other forces are related to the increasing knowledge about individual differences and ability to deal with them.² Dr. Mc Lain goes on to say that mobility of population presents another need for individualization of instruction and although this mobility was once believed to be a farm worker's problem, it has become much broader and more widespread. Automation is adding complexity to the problem of changing schools and being out of school at various times in order to vacation with

the family.

The aforementioned reasons for individualizing may seem external as far as the child is concerned; however research regarding the teaching of arithmetic strongly substantiates the needs for individual attention in the arithmetic area. According to research, readiness for arithmetic is not a dichotomous state - not a matter of being ready or not ready but instead a matter of degree of readiness. Since arithmetic is considered to be a highly systematic and sequential discipline, it is imperative to view readiness as prerequisite learnings.³

Further, Glennon defines the objectives of arithmetic in three major categories:

The cognitive category (which includes subject matter understandings, concepts, and facts), the affective theory (which includes attitudes, appreciations, and other emotional factors in the learning process), and the psychomotor category (which includes skills and abilities which require both mind and muscles).⁴

Borakat studied factors underlying the mathematical abilities of grammar school pupils and found that:

(a) Emotional instability correlated most highly with inaccuracy of computation, (b) innate intelligence appeared to contribute the largest part of mathematical attainment, and (c) there is ample evidence that a specialized factor


⁴Ibid., p. 25.
in mathematical ability exists, its components being allied to mechanical computation and rote memory.\(^5\)

The point is made, also, that readiness for new learnings is greatly affected by the quality of related learnings that has taken place previously. It is suggested that when taught meaningfully, certain fraction concepts and skills could be taught successfully on the second grade level. So readiness is a function of quality of experiences as well as amount and variety of experience.

Teachers must take these wide differences into consideration. The problem of how to attack them in an ordinary classroom becomes inevitable.

The Casis School Faculty in its bulletin concerning individual differences states:

If a school faculty is sincere in wishing to do the best it can in meeting individual differences in arithmetic, there should be some school wide plans whereby a teacher may deviate from teaching a heterogeneous group of achievers by conventional "class as a whole" procedures by which all pupils are taught the same topics at the same time and all are expected to do the same amount of work and attain equal proficiency.\(^6\)

Although the suggestions for meeting the individual differences do include various types of grouping, the topic of completely individualized instruction is also discussed.


\(^6\)Frances Flournoy and Henry J. Otto (The Casis School Faculty) "Meeting Individual Differences in Arithmetic," Austin: University of Texas, Publication No. 11, 1959, p. 12.
The Casis Faculty mentions that it is very possible to have thirty pupils working on thirty different assignments at thirty different levels of achievement.

It is interesting to note that an individual instruction plan was initiated by Frederic L. Burk in the training school of the San Francisco State Teacher's College in 1913. Its use in public schools was begun in Winnetka, Illinois in 1919 and was later used in some Chicago schools. It became widely publicized as the Winnetka Plan. This plan consisted of carefully prepared self-teaching materials organized in such a way that a child could move forward with a minimum of help from the teacher. Since there is much organization of materials involved, many teachers have not cared to participate in such a program.

The point is brought out that motivation of the slow learner may be more difficult when there is not a group situation. According to Flournoy and Otto, research has not produced enough evidence to state how much and in what directions individualized instruction effects motivation and ultimate achievement.\(^7\)

Likely many teachers who realize the extent of differences among children fear this range because of academic problems which ensue from such a situation and because it may

\(^7\)Ibid., p. 14.
be used by others as a criterion of teaching and may reflect unfavorably. Such teachers think of diversity as a handicap rather than a resource. There exists, however, some belief that this range of differences which definitely widens as boys and girls advance scholastically is a true indication that children have been taught with wisdom, rather than with carelessness.  

Laura K. Eads suggests that it is truly a mistake to group slow children in such a way that they gain very special attention and time to bring them up to grade level. She challenges with such questions as:

(1) Can or should slow children be pushed or motivated to do grade work when they are not yet ready intellectually or emotionally for such work? (2) Do children learn when they are continuously made aware of their deficiencies, their failure, their stupidity? (3) Is grade work for these children? (4) How long does such learning last? (5) Is this the best use of a competent teacher's time and effort? (6) What happens to the other children, those who could move forward if the teacher's time and energy were not expended in working with those who cannot achieve grade norms?

Laura Eads definitely agrees with Ann Ess Morrow in her ideas concerning the widening of differences as soon as a teacher works toward the growth of all children. She emphasizes that a series of effective teachers creates ever wider differences as children move through the grades. She goes so

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8Morrow, *loc. cit.*

far as to say that to decrease differences there must be obstacles to learning, and no teacher would intentionally create such obstacles.\textsuperscript{10}

II. RECENT EXPERIMENTS IN INDIVIDUALIZED ARITHMETIC

Walter Whitaker of the Culver City Unified Schools, Culver City, California feels that the nontraditional individualized approach to arithmetic instruction can help make the maximum use of the psychological basis of learning and at the same time avoid the traps of group teaching. He feels the key to this type of instruction is centered upon the teacher's wanting to give each child the most education possible.\textsuperscript{11}

Mr. Whitaker carried out an individualized program in a sixth grade class in Washington School, Culver City Unified School District, California. He selected a wide range of source materials to give each child a chance to learn at his own level of achievement. He used several series of textbooks with two to five copies of each text for each grade level. Workbooks were used as needed for reinforcement.

He initiated his experiment by placing his best pupils

\textsuperscript{10}Ibid.

\textsuperscript{11}Walter Whitaker, "Why Not Individualize Arithmetic?" The Arithmetic Teacher, II (December, 1960), p. 400.
into the individualized work first. The children began with a fundamental review and after completion of this work were put into material equal to their achievement. Each child checked his work and analyzed his errors as he proceeded and then made appointments for help with the teacher. Achievement was tested through achievement tests found in the textbooks, oral questioning, and group testing. Mr. Whitaker felt that the results in terms of children's attitude and class control were gratifying.\textsuperscript{12}

In Mr. Eugene Keffer's article on "Individualizing Arithmetic Teaching," the point is made that even with basic individualization, the entire class may occasionally be taught the same principle. He feels that the children should keep their problems in a spiral notebook so a teacher can occasionally spot check and that written tests in problem solving and computation should be given at the end of each unit or chapter.\textsuperscript{13}

An experiment was carried out in a sixth grade in a small rural school in Oak Hill, Florida. Frank Sganga felt that through his experiment each child received recognition and identity, the children learned to think for themselves,


\textsuperscript{13}Eugene Keffer, "Individualizing Arithmetic Teaching," \textit{The Arithmetic Teacher}, VIII (May, 1961).
discipline problems disappeared, and that there was a great advantage for children who had been absent for any period of time.\textsuperscript{14}

III. SUMMARY OF RESEARCH

In summary of the research presented it follows that there is a swing toward individualization due to changing needs of society and increased knowledge of individual differences. Since readiness for any specific learning is dependent upon many previous learnings, children in any given classroom would have a wide range of degree of readiness. Many educators have been aware of the need for individualizing arithmetic instruction for at least fifty years, yet because of the unique organization involved not many have actually turned to individualization as a means of meeting the arithmetic needs. It is suggested that range of differences widens as children advance scholastically.

As reflected in this chapter's reporting there have been several successful experiments in individualized arithmetic carried out. Basically the experiments reported are similar; yet each is understandably different from the others according to children, situations, and teachers involved.

\textsuperscript{14}Frank Sganga, "An Experiment with Individualized Arithmetic," \textit{The Instructor}, (February, 1960), pp. 52, 88.
CHAPTER III

THE EXPERIMENT

I. PROCEDURE OF EXPERIMENT

The experiment in individualized arithmetic was carried on with one group - the fifth grade at Campus School. The Iowa Basic Skills Test had been administered a short time before the experiment began and again at the close of the school term. A record of each child's arithmetic grade placement plus the range of differences was tabulated both times. (See Appendix C, page 28) Records were kept of problems encountered, of children's needs, of children's daily progress, and of the children's periodic progress as measured by various testing devices.

II. THE BEGINNING

As school opened in September, 1963, records of the twenty-six new fifth grade children were studied to determine possibilities of grouping in arithmetic. It was decided that the children should be handled in one large group until more concrete evidences for grouping might develop. After about two months of school the Iowa Basic Skills Test Form I was administered. It was found that the total arithmetic score as was measured by the Iowa Basic Skills Test held a range from 4.2 to 7.4 with a mean of 5.8. The range in arithmetic
concepts was from 4.5 to 7.7 and in problem solving from 3.6 to 7.8. Scores refer to grade equivalent; that is, 4.2 means fourth grade two months.

The children who were lowest in concepts were not consistently the lowest in problem solving. Even among children with the same test results problems confronting the individuals were very different. For example two children who have the same scores in arithmetic may be extremely different in reading and writing abilities. One may understand fractions while the other does not; yet the second may bring up his score through greater understanding of division. As stated by Glennon in his summary of research, "No two children in any grade are at the same level of development in their control over all aspects of number work."\(^{15}\)

It was decided that the children would remain in one large group until the teacher could observe each child's production more carefully to help determine his potentiality and level of achievement.

Soon there were found to be eight children, about thirty per cent, who consistently needed additional help and were often lax in producing the definite assignment for the day. It was decided, therefore, that there would be two groups—one containing eight children and the other eighteen who would

\(^{15}\)Glennon, *op. cit.*, p. 30.
continue at a faster pace. As might be expected when many aspects of a child’s learning are taken into consideration, the eight chosen for the lower group were not the eight lowest in test rank. (See Appendix C, page 28)

Joseph W. Kennedy and John R. Mayor state in their article "Individual Differences and Mathematics":

Some of the differences in learning of mathematics are due to differences in reading ability, and poor readers will be limited in their ultimate attainment in mathematics, as well as in other subjects. Some of the trouble with "story problems" is undoubtedly due to reading difficulties, but poor readers also have trouble understanding directions and explanations in the text and may not grasp symbolic language as easily as good readers. As in other subjects, certain organic irregularities, if unknown or corrected, may cause individual differences or aggravate them. Poor hearing and seeing may prevent the student's learning in any area. The extensive use of the blackboard in mathematics makes good vision especially important. Illegible writing may be due to the student's non-mastery of writing skills due to organic difficulties. Poorly made numbers and letters may prevent good work.

The above quotation is certainly applicable when evaluating the placement of child A whose test score was 6.3. This particular child was an exceptional reader and was very alert in the field of politics and many other areas in which reading is important. He possessed an excellent understanding of arithmetic concepts. His writing was almost illegible, and he seemed to detest putting anything in writing. Since he was at first not willing to produce daily written work, he

was placed in the lower group.

After a short period of time, one child who showed greater production than the others in the lower group was moved to the higher group. The groups worked comfortably until shortly before mid year when two boys in particular showed great desire to be in the upper group. By this time, of course there was a considerable gap in the work accomplished by the two separate groups. Realizing, though, the importance of self concept to the child in his learning situation, the teacher discussed with the children how the group of seven might individualize their work so that those who were really ambitious and interested could work themselves into the upper group.

It was agreed that the teacher would provide a chart with the names of the seven children listed down the side column and page numbers indicated across the top. When the child completed the work assigned in a particular box (See Appendix A, page 26), the paper was checked by the teacher. Either teacher or child recorded in the proper box the identification of the errors. The children then corrected the errors. When the paper was accepted by the teacher the child colored in the space to show the completion. It was discussed and agreed that the children would need to shoulder the responsibility of asking for help when needed. For a time it seemed that the seven children went "wild". It was difficult to keep
the arithmetic books out of sight during reading, science, and other subjects. No longer was the teacher prodding, but instead the children were pressuring the teacher for help early mornings, at noon, and after school. Although the papers were coming thick and fast, there were only seven children in the production line so the teacher managed to keep up with paper checking.

Undoubtedly enthusiasm is contagious. As the larger section of nineteen children watched the great fun of their classmates, they began to pressure the teacher to let them individualize. At first the teacher made it clear that there would be many more problems involved if twenty-six children were working at different paces. The children insisted that it could be made to work as smoothly as the individualized reading program. This group of children had been doing individualized reading during third and fourth grades. They were continuing individualized reading in fifth grade also. It was agreed that the problems should be discussed, solutions offered, and if the solutions seemed acceptable, the whole class would try the individualized system.

Following are the problems which were listed by the children and their teacher:

1. How could the teacher possibly check the papers if they were produced at a speed similar to the production in the group which was already individualizing?

2. If the children did help check papers, then could the teacher really know how each child was progressing and where he needed help?
3. How could the children keep records to show their progress so that all children would be required to show some record of progress?
4. How would the children know what units to work next?
5. What kind of records would the teacher need?
6. When would necessary classes be taught?

Each of these points was thoroughly discussed and possible solutions were evaluated. As a result the guideposts for this fifth grade's individualized arithmetic program were set up. The teacher and pupils decided that:

1. The teacher would ditto a record sheet for each child with the page numbers in each square and a test square following every few pages. (See Appendix A, page 26)
2. The teacher would ditto answers for the work pages and file them in labeled folders.
3. Each child would use a ditto sheet to check his answers as soon as work on a given problem or unit was completed. If he had errors he should record the numbers of the examples in the proper box. If the paper was worked correctly or when corrections were finally made, the boxes were to be colored.
4. When a child came to the box labeled "test" he would ask the teacher for the test after page 212, for example. The teacher was to make these tests ahead of time and have them on file.
5. When the test was completed, it must be given to the teacher to check.
6. The teacher would keep a chart with the names of the children and test pages with a box for comments concerning test results. (See Appendix B, page 27)
7. Any errors on the test must be corrected and the paper must again be handed to the teacher.
8. The children must make sure that they ask for help when they need it.

The individualized program began and pencils really flew. The most noticeable change was that the children now assumed complete responsibility for things they needed to know. One of the fastest children who previously never needed any
help other than regular class introductions to a new concept now needed to go to the teacher for help as he worked more challenging problems at his own speed.

III. DEVELOPMENT

Were the children honest in paper checking? A few children went to the teacher to complain of answers that did not check out with the answer sheet. This small number was commendable for occasionally there were unintentional errors in the dittoed answer sheets. The teacher complimented the children on going to her when they disagreed. Whenever a child seemed to have great difficulty with a test, it was suggested that the test be put aside until additional work was done in that area.

When any individual asked for help that others were suspected of needing, the teacher would announce the topic to the class, for example "If anyone else needs help in changing measures, now is a good time." This procedure saved some repetition for the teacher and yet afforded certain children many opportunities to review together the same concept. Many children attached themselves to three or four different groups for instruction in one concept which they found difficult. Some very considerate children would suggest that since they were almost to a given new material, they could just as well join someone who was already receiving the help. Children
were always praised for asking for help.

On the especially busy days it was necessary to put a schedule of conferences on the board so as to give those in greatest need help first. It was not uncommon to have children who were free to do so to offer to wait until after school if others needed help more urgently. The children who lunged way out ahead often offered their services to others in difficulty. This was thoroughly discussed so that no one child would spend an excessive amount of time helping others. Although the teacher had expected that the slower children might lose interest when not motivated by the total group situation, this was not found to be true in this particular situation.

Occasionally children would pit themselves against each other in a friendly spirit of competition. For example, two little girls took their texts along to Scout Camp over the weekend. They wanted to work enough to keep any boys from getting ahead. One by one the children finished the text and then wrote a very complete "end-of-the-book" test. This test over the entire material studied during the term helped to spot weaknesses for those who finished. These children chose supplementary materials from which to work and helped to decide on the specific assignments to do. Those who did not need any additional practice on items presented in the basic text chose other areas of study from supplementary texts. A few children
gained considerable proficiency in adding, subtracting, and multiplying decimals. They advanced into simple percentages which could be figured by the already learned ratio method.

Many children did not complete the textbook but no one was far from finished. At the end of the year the Iowa Basic Skills Test Form I was regiven. This time the results showed that the total arithmetic range of difference was from 5.5 to 8.2, the concepts from 5.8 to 8.0, and the problem solving from 5.2 to 8.8. The mean was now 6.9. (See Appendix C, page 28)
CHAPTER IV

SUMMARY AND CONCLUSIONS

I. SUMMARY

An experiment in individualized arithmetic was carried out with the fifth grade at Campus School in the second semester of the 1963-1964 school year. The Iowa Basic Skills Test Form I was administered before and after the experiment and it was determined from the results of this particular test that the mean score had changed from 5.7 to 6.9 in a period of approximately seven months. The range of differences decreased during that period of time. (See Appendix C, page 28)

The children and teacher tried to identify problems of the individualized approach and arrive at the best possible solutions for the problems they encountered.

II. CONCLUSIONS

From the foregoing research and experiment, this author concludes the following:

(1) The individualized method of teaching arithmetic is another workable approach for teaching arithmetic.

(2) Much of the success in the individualized approach is contingent on the ability of the children to identify their problems and the willingness to ask for help.
(3) In an individualized approach to arithmetic the pressure changes so that there is very little teacher prodding and much more of the child's asking for help.

(4) According to most of the research done, it is suggested that the range of differences widens as a result of the individualized approach. This was not true as a result of the fifth grade experiment. Perhaps this is due to the nature of this particular group which is basically of above average ability. Maybe some who had not been working up to their ability were now more nearly working to their ability. As these low scorers more nearly reached their ability the range narrowed.

Perhaps this is another advantage of the individualized approach - for some children competition with self is more rewarding than competition with others. Another possibility for explanation of the narrowing range is that the Iowa Basic Skills Test for fifth grade level did not measure the top bracket of the class. A study of the test shows that there is nothing included on perimeter, areas, or addition and subtraction of decimals. Many of the children could have handled these areas quite proficiently.

(5) Because of the intense desire of the children to work in an individualized approach the experiment was likely the best possible approach for the fifth grade group at that time.
BIBLIOGRAPHY

A. BOOKS


B. PUBLICATIONS AND PERIODICALS


Williams, Roger J. "Individuality and Education," Educational Leadership, (December, 1957).
APPENDIX A

My Record Sheet

<table>
<thead>
<tr>
<th>Name</th>
<th>p. 203</th>
<th>pp. 204-5</th>
<th>p. 206</th>
<th>Test</th>
<th>p. 207</th>
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<tr>
<td>O. K.</td>
<td>O. K.</td>
<td>Need help Group I A, B, C</td>
<td>O. K.</td>
<td>Need help reducing fractions</td>
<td>O. K.</td>
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<td>pp. 208-9</td>
<td>Test</td>
<td>pp. 210-11</td>
<td>Need help reducing fractions</td>
<td>O. K.</td>
<td>Need help regrouping mixed numbers</td>
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<td>Need help C, F, H, P</td>
<td>0. K.</td>
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<td>p. 214</td>
<td>p. 215</td>
<td>Test</td>
<td>p. 219</td>
<td>Changing measures</td>
<td>0. K.</td>
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# APPENDIX B

**Teacher's Record of Child's Work**

Child 1. Tests following pages:

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APPENDIX C

RESULTS OF IOWA BASIC SKILLS TEST FORM I - BEFORE AND AFTER

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