EFFECTS OF TEAM-ASSISTED INDIVIDUALIZATION ON THE ATTITUDES AND ACHIEVEMENT OF THIRD, FOURTH AND FIFTH GRADE STUDENTS OF MATHEMATICS

by
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ABSTRACT

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Reva R. Bryant, Doctor of Education, 1981

Dissertation directed by:

Dr. Martin L. Johnson

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The philosophy of individualized instruction has been embraced by many school systems in the United States. However, research has not consistently supported claims that this approach will increase academic achievement. Teachers have lodged multiple complaints related to demands and problems imposed upon them and their students as a result of implementing individualized programs.

An attempt to alleviate the problems inherent in existing individualized programs has resulted in The Johns Hopkins University staff's development of Team-Assisted Individualization (TAI)--an approach based on the modification of a researched and widely used group-paced model of instruction with cooperative learning teams as one component.

This eight-week study evaluated the effects of three treatments on the achievement and attitudes toward mathematics class of 504 students in grades three, four and five. TAI combined student team learning and individualized instruction. Rapid Progress Mathematics (RPM) students used the exact materials as TAI students, but omitted the team component. This treatment was included to determine whether any effects of the program were due to the combination of teams and individualized instruction or only to the materials and procedures. Control students were instructed with traditional materials and procedures.

Results of the standardized mathematics test showed significant effects for

treatment and grade. After adjustment for pretests, the treatment effects were in the order TAI > RPM > Control. Effects approaching significance were also found on the diagnostic test, but on this test the order of the treatments was TAI > Control > RPM. Results of the attitude scale clearly showed that TAI and RPM conditions created more positive attitudes than did the control classes, but there were no differences between TAI and RPM.

Further research will be needed to assess and to adapt these methods for use over a longer time period and to clarify the relative contributions of the team component and the individualized instruction component of the TAI program. However, this study documents the effectiveness and practicality of combining team learning and individualized instruction.

DEDICATION -

To my mother, Eva;

my two sisters, Rose and Esther;

and to my son, Michael--with love.

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- Reva R. Bryant

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CHAPTER ONE

The Problem

Introduction

Never before have so many educational issues been in the forefront. Publics are questioning, accusing and suing. Budgets are being stripped. Students are staging walkouts. Drugs and crime are in the elementary schools. Vandalism is costing taxpayers millions of dollars each year. Family crises are increasing and have adversely affected students' emotional well-being. Child abuse is increasing. Each of these occurrences has an impact upon student learning. In addition to these major issues, pressure to meet the diverse needs of students from different cultures and to provide appropriate instruction for mainstreamed students as mandated in PL 94-142, as well as average, talented and gifted students, have added to the classroom teacher's responsibilities and taxed his or her energy level to the breaking point. In today's educational system it is not at all clear how these diverse issues can be addressed to the satisfaction of all parties.

In a summary of six reports on mathematics education between 1975 and 1980, Suydam (1981) points out that teachers frequently do not differentiate instruction to meet individual needs. Often, the same techniques and the same materials are used with the entire class. Whole-class instruction need not preclude attention to differing needs, but most teachers make few accommodations to provide for individual differences. This is a sad commentary when one analyzes the broad range of needs that exists in every classroom.

One method of providing for individual needs in the classroom is "ability grouping." Many different opinions exist about the value of this procedure. Research indicates that ability grouping can lead to the stereotyping of students which may lead to poor self-concepts (Begle, 1975; Levenson, 1979; Combs, 1952; Rosenthal

& Jacobson, 1968; Brassell, Petry & Brooks, 1980). Ability grouping may also lead to perpetuating segregation in the classroom along ethnic and socio-economic lines (Levenson, 1971; Findley & Bryan, 1975). A paper prepared by the U.S. Commission on Civil Rights (1976) states that the educational practice of ability grouping is the most common cause of classroom segregation.

Borg (1965) found that self-concepts, feelings of belonging and a reduction of anti-social tendencies were favorable in heterogeneous settings. Goldberg, Passow and Justman (1966) found that students grouped heterogeneously in forty-five New York City elementary schools had superior attainment to that of students in other grouping patterns and that the presence of gifted students had a positive effect on other students.

Not unlike many other leading school systems, the Howard County Maryland Public School System has included in its philosophy the belief that students should receive instruction at their own level and rate of learning. Emphasis is placed on achievement, opportunities to increase computational skills, positive attitudes and acceleration. Awareness of the diversity of abilities in a single classroom brings one to the logical conclusion that Howard County teachers need access to programs of individualization which will assist with the implementation of the accepted philosophy.

Although some teachers in Howard County have used available individualized mathematics programs, county test scores in elementary mathematics tend to support existing research which does not indicate increased academic achievement by students who have progressed through individualized programs. Teachers report that individualized instruction based on the IPI model is much more demanding on their time and is extremely difficult to manage. The checking component alone requires the assistance of aides or volunteers, both of which are often unavailable.

Teachers express concern that some students waste time on material they already know, and others move quickly through the units without clear understanding. They note that many students are bored by individualization and that working in isolation with infrequent direct-contact feedback may allow students to procede on work which is error laden, therefore, developing inappropriate habits. Working in isolation provides no opportunity for peer interaction which is crucial in the development of mathematics concepts and vocabulary as well as a clear understanding of word problems. Waiting for checking and additional assignments leads to wasted time, frustration, boredom and potential discipline problems. If students are unable to receive appropriate feedback at the time it is needed, they may not be motivated to participate and may develop negative attitudes toward mathematics (Aiken, 1961, 1970, 1976; Burbank, 1970; Callahan, 1971; Stanley & Campbell, 1963; Dutton, 1956; Moore, 1973).

Although many teachers support the concept of individualization, it is because of many of the above-cited reasons that individualization in mathematics seems to be diminishing in the schools as an instructional mode at a time when the need for individualization is accelerating.

During the fall of 1980, a pilot study was conducted by The Johns Hopkins University in a Howard County fourth grade mathematics class. The newly-developed individualized program was designed to maximize learning opportunities for students with diverse ability levels through the inclusion of a management system which involved a cooperative learning team component. Students were allowed to perform many of the functions which created management problems in other individualized programs, while at the same time they received the motivation which was needed to alleviate some of the problems related to checking, monitoring, assigning, feedback and motivation. Students were grouped for instruction within the program as well as expected to work independently.

Pilot study results revealed growth in mathematics achievement. Results showed that the management system was effective and that it contributed to positive attitude changes in some students, as well as increased on-task behavior. Students of varying abilities and learning levels were able to work effectively within the cooperative learning teams. The success of the pilot would indicate that there is a high degree of probability that these results could be replicated in a larger setting. Therefore, it was desirable that this assumption be tested in a larger study.

Statement of the Problem

Most past attempts to individualize instruction were of a certain type; well conceived in theory but insufficient in practice. It is clear that an effective delivery system is mandatory--a system which effectively customizes a program to provide for individual differences among learners (Jeter, 1980). To this end a new program was developed at The Johns Hopkins University in 1980 with the major purpose of providing a structured management system component different from others which are available. The effects of this program on achievement and attitudes of students have been fully explored in a controlled classroom situation for six weeks. The need to determine if this individualized progam could be applied to a larger setting such as an entire elementary school was immediately evident. Hence, the purpose of this study was to compare attitudes and achievement over an eight-week period, of third, fourth and fifth grade students who were instructed in three different treatments: Team-Assisted Individualization (TAI) as developed by The Johns Hopkins University, Rapid Progress Mathematics (RPM) which includes only the materials of The Johns Hopkins University-developed TAI program and the Regular Program (RP). Definitions of each treatment can be found at the end of this chapter.

Significance of the Problem

The Howard County Public School System is continuously looking for new and effective ways to improve instruction. This study has significance in that it directly relates to a specific need in this system. These arrangements and organizational patterns have never been used in such a complete package. The pilot study leads one to predict that implications of the study could be far reaching. If this study shows that Team-Assisted Individualization (TAI) is an effective way to increase acceleration and achievement and at the same time provide appropriate instruction for the diverse needs of students in the classroom, it will provide an alternative to the current elementary school mathematics program that, until now, has not existed.

Combining individualization and effective management components into TAI should provide solutions to problems which exist in current individualized programs. The specially designed materials will allow students of diverse abilities to receive instruction at their own level, and the treatment has been specifically structured to facilitate increased academic achievement through consistent support from teammates and the opportunity to progress at the student's individual rate. Assignment to a team should provide motivation toward a common goal and should eliminate problems and frustration which consistently arise in classrooms where downtime is extensive. Students can check, assist and encourage others, are continuously involved and are motivated by the team component to move quickly and accurately (DeVries & Slavin, 1976 & 1978). Therefore, it could be predicted that students who participate in a program with high motivation will out-perform and will have better attitudes than students with little motivation, and it is logical that teachers will prefer to teach with a system which offers the components of TAI that are so necessary for successful management and implementation.

In addition to assessing the impact of a form of cooperative learning in a regular classroom, this study will provide an extension to the growing literature on the use of cooperative learning strategies in education. The data collected in this study will provide an opportunity to replicate findings of increased achievement and rate of learning. Because this specific form of cooperative intervention is new, this study will provide a stronger test of the concept of cooperation and individualization in the classroom.

Definition of Treatments

For more than ten years, instructional techniques involving learning teams have been researched at The Johns Hopkins University and, as a result, are widely used throughout the United States (DeVries & Slavin, 1976 & 1978). Although these techniques have been found to be an effective instructional strategy, the foundation is a group-paced model in which all students learn the same material at the same rate. The new program (TAI) is a merging of individualization and a management system which includes a team component. Complete descriptions of the different treatments are found in Chapter Three as well as the Appendices where actual materials are included.

TAI: Team-Assisted Individualization is the individualized mathematics program designed by The John Hopkins University. High, average and low achieving students, as determined by a diagnostic test, are assigned to teams in which they proceed at their own rate to work at the appropriate place within individualized curriculum materials which are organized into skills, units and blocks. Students contribute to team scores which are the result of the sum of the average number correct of all tests taken by all team members. Posted performance of teams shows students how their accomplishments compare with other teams. TAI will be referred to as Treatment One (T_1).

RPM: Rapid Progress Mathematics is a variation of the TAI program which did not include the team component. Performance on the diagnostic test will determine the appropriate level at which students will begin instruction in the program. Procedures are identical to the TAI treatment except that all aspects of the TAI team component have been omitted. RPM will be referred to as Treatment Two (T_2).

RP: Regular Program teachers were instructed to proceed with their use of the current instructional strategies and mathematics materials with no changes in their regular program for the purpose of this study. RP will be referred to as Treatment Three (T_3).

Definition of Terms

Accuracy Score: The sum of the average number correct of all tests taken by all team members.

Answer Sheets: Sheets which contain the correct answers to the problems which are included on the Skillsheets, Checkouts and Final Tests.

Block: Collection of problems of equal difficulty which represents several skill areas. For example, a block might include several multiplication units, a numeration unit, a few fraction units and a word problem unit.

Checkout: A final worksheet which consists of two parallel sets of ten items which relate to a particular unit and which must be completed prior to the final test.

Cooperative Intervention: The specific treatment which has been designed to implement cooperative learning.

Cooperative Learning: Any of several instructional strategies in which students work in small groups toward an identified common goal.

CTBS: Comprehensive Tests of Basic Skills is the standardized test from which the Mathematics Computation scale was used to determine achievement by pre-and posttesting.

Down time: Any amount of time during which a student is not exhibiting on-task behavior due to waiting for such things as instruction, checking or receiving assignments.

Final Test: The evaluative test which is administered after instruction and assignments on a specific unit have been completed.

H_i: Hypothesis to be tested.

Individual Progress Record:	Sheet for students in RPM to record progress for a period of one week.
Instruction Sheet:	An instructional worksheet which explains the skill to be mastered and gives a step-by-step method for solving the problems.
Math Progress Form:	The student's individual record of units which have been and which are to be completed.
Monitor:	Rotating students whose responsibility is to locate and check the Final Test which is taken by a member from another team.
Pair:	Two students who work together within a team.
Progress Score:	The average number of units covered by each team member times ten.
Public Team Score Sheet:	Sheet on which the accomplishments of each team are posted.
Resource Help:	Any source of additional instructional help, such as reading, diagnostic-prescriptive or resource teachers.
Skillsheet:	A worksheet which consists of twenty problems which introduces a subskill that leads to final mastery of the entire skill.
Teacher Review Session:	A period of fifteen to twenty minutes during which the teacher instructs groups of students.
Teacher's Manual:	Specific directions needed in order for teachers to implement TAI and RPM.
Team:	Four or five members comprised of high, average and low achievers as determined by the diagnostic test.
Team Score:	The sum of points earned on accuracy, progress rate and facts drills.
Team Score Sheet:	The sheet on which each team member's scores are recorded for a period of one week.
Triad:	Three students who work together within a team.
Unit:	A specific topic of study, such as addition, fractions and decimals which is arranged for study in a definite sequential hierarchy.
Week:	Four to seven days (see Chapter Three).

CHAPTER TWO

Review of Relevant Literature

Research Related to Individualization

Individualized instruction has no precise definition. In a broad sense it simply requires the adaptation of instructional strategies and materials to fit a student's specific needs and characteristics. Rousseau (1906), sometimes referred to as the father of modern pedagogy, wrote that teachers must study each individual carefully in order to learn what the child is, what his/her strengths are and where the child's potential lies. It is then the teacher's responsibility to create the proper environment for the child so that he/she can develop to the fullest extent of his/her abilities. Davidson (1971) writes that only three of Rousseau's educational demands have truly influenced education. They are: (1) the demand that children should have complete freedom of movement from the moment of birth; (2) that children should be taught to use their hands in a productive way; (3) that children should be educated through direct experience.

In Educational Psychology Gates (1942) stresses the development of the total individual. Beginning with one's innate intelligence he elaborates on the rate of development in all areas--vocalizing, motor, emotional and social development, leadership adaptability, needs, ways of learning, degrees of creativity and mental health. Only by looking at each person as an individual and developing educational programs around that particular person can the schools be successful.

In the first fifty years after the union of the states, schools differed very little from what they had been during the colonial period in New England. They remained one-teacher schools within crude buildings and with poor supplies. The instructional method was still on a one-to-one basis, and each pupil continued to obtain only fleeting periods of private help from the teacher (Reisner, 1930). The methods were generally characterized by drill, memorization and severe discipline, with the major educational aim being the indoctrination in the church doctrines and chatechism. Until the middle 1880's the teacher's time was almost fully used in hearing an individual's assigned recitations, with very little actual instruction (Knight, 1940). Theoretically, the individual lessons should have helped the teacher meet the needs of individuals, but there were so many children waiting for a chance to recite that the amount of individual attention given to students was negligible. Individualized teacher-pupil recitation was not very popular because results were slow. Children may attend school for years and learn only a small amount of reading and writing. The communities did not wish to give more money for the support of schools, but when the monitorial school was introduced by Lancaster and Bell in England in 1797, people realized that education would be rather inexpensive by doing away with the individualized form of teaching. Citizens began to support public schools, and group instruction became popular. The monitorial method brought education to thousands of children who, had it not been for the Lancastrian schools, would never have had an opportunity to receive an education. Meeting the educational needs of a massive segment of the population led the public to the recognition that it was necessary to support public education. Great controversy over this led to the development of the graded school system as a means of improving the education of children (Thomas & Crescimbeni, 1967).

In 1888, Preston Search established a plan of individualized instruction in Pueblo, Colorado. Daily recitations were abolished, and students were permitted to advance at their individual rates of learning (Alberty & Alberty, 1962). Eight years later John Dewey challenged established practices of his time in an attempt to better society by liberating individuals and supporting the variations of children's abilities. His work at the University of Chicago Laboratory Schools eliminated arbitrary classification of grades and textbooks in an attempt to meet individual needs (Boyd, 1921). He stated that differences in capabilities, needs and preferences in individual children must be recognized, because one cannot assume that all minds work in the same way (Dewey, 1916).

Frederick Burk at the training school of San Francisco State College seems to have been the first educator to systematize a plan for individualized instruction. In 1913 his staff developed self-instructional materials, and students were guided to advance through the assignments at their own rate while the teacher assisted with any difficulties and checked the work. After the student successfully passed a test on the material, a new assignment was given (Alberty & Alberty, 1962).

Alfred Hall-Quest (1916), Professor of Education at the University of Virginia, pleaded for revision in the schools. He recognized that grouping students proved to be an immense time-saver over the method of individual instruction, but stated that grouping is inadequate and unjust to children. He requested quick revision of methods to help each individual reach his or her maximum potential.

Carleton Washburne was also concerned about the fact that children learn at different rates. His answer to how this could be dealt with realistically within a class was the beginning of programmed instruction. His Winnetka Plan abolished grade failure and promotion, attempted to provide for the learner's individual differences, and at the same time, teach for specifics. Curriculum was divided into two parts. The first phase involved the use of individual work centers which were developed around the basic skills and knowledge which everyone had to master. The second phase focused on the child's creativity, special abilities and interests (Bayles and Hood, 1966).

Still in use today are some of the original features of Helen Parkhurst's Dalton Plan which was put to use in the public schools of Dalton, Massachusetts, and in

1920, in the Dalton School of New York City. Students were conferenced, and each established a contract. Several teachers aided students as they progressed as opposed to a student's receiving the help of a single homeroom teacher. This plan was designed to help students of varying abilities to work unhampered by uniform grade expectations. This method of individualization caught the attention of professionals, because it was far superior to the old recitation method of individualization of the nineteenth century (Brubacher, 1947).

Henry Clinton Morrison's teaching method incorporated the steps of pretest, teach and test and focused upon the idea of mastery which, for him, meant only the achievement of a fundamental group of the material studied. His form of individualized instruction was similar to Washburne's in that both provided opportunities for each student to work alone so that he or she could progress at his or her own rate. After Morrison, workbooks and worksheets became widely used in American education (Bayles and Hood, 1966). All of these plans called attention to the inadequacies of daily recitation and pointed out the need for providing instruction according to individual needs.

Edward Thorndike found that in any classroom there are always children who are much poorer or much better than the average, even though the children may be close together in mental ability. He felt that the worst errors of teachers are for them to ignore the fact that these differences exist, and to create one set of fixed rules and habits for all children in the classroom, as well as to teach the class instead of the assortment of different individuals. He believed that variation in the amount, kind and quality of work and the amount of needed assistance vary for each child; that a competent teacher expects these differences and then teaches accordingly (Thorndike, 1913). Thorndike writes that the application of all of the principles of education are affected by individual differences.

They affect the implementation of the aims of education as well as the adaptation of the curriculum to the talents and limitations of each student (Thorndike and Gates, 1931).

By the mid-1930's there was some degree of individualization through the offering of a variety of courses, and through grouping, but there was still strict adherence to subject matter. Progressive educators felt that individual needs of students could be met more effectively by providing life experiences. From this attitude came the Eight Year Study, one of the greatest efforts up to that time to prove this philosophy.

Thirty-eight schools participated in the Eight Year Study from 1932 to 1940. Instruction included group work on common needs and individual activities on particular needs and interests. During this eight-year period certain colleges were persuaded to accept students without meeting the conventional requirements for entrance. At the end of the eight years the work of these students was compared to those with a traditional background. The 1942 published results indicated that success in a liberal arts college did not depend so exclusively as thought on the student's methods of study in the secondary school (Parker, 1963).

The term individualized instruction can be ambiguous. Some interpret this simply to mean that a teacher should treat each student as an individual instead of a number in an assigned seat. Arthur Bestor (1955) writes that individualized instruction means much more. A teacher must be capable of leading each child through the continuous steps in his or her development, regardless of the child's achievement level. The teacher resembles a tutor except that the conditions are less ideal than those under which an actual tutor works. Instead of giving undivided attention to one individual or small group, the classroom teacher must parcel out his or her time to all the pupils who are at different stages of advancement, and some people argue that he or she is neither teaching a class nor offering individual instruction.

Individualized differences became a primary topic in educational theory in the early years of this century. Until then there was a fixed curriculum. The elimination and the dropping out of less successful students provided the only method which was used to account for individual differences.

Later use of ability tests determined which students should drop out, be placed in an undemanding "slow" classroom or guided into "high" classes which prepared students for higher education. The social theory behind this selection system was that each student should have the opportunity to procede as far in school as his or her abilities warrant which, in turn, would support the dropping out of less responsive students.

Most schools tend to minimize the inconvenience of providing for individual differences so that the same curriculum can be taught. Rather than redesigning programs, most remedial instruction is an add-on to the regular program. Supplementary instruction is provided with the intent of repairing the skill gaps so that the student can be placed back in the regularly paced program. This could be interpreted as an attempt to erase individual differences as opposed to meeting needs of different individuals.

Research on child development by Piaget and others provides evidence that the quality and quantity of peer interactions in a child's school experience play a vital role. Through the interaction, children hear views of others, clarify their own and develop language and the ability to think logically. The lack of peer interaction in individualized programs creates many questions regarding the potential harm (Kamii, 1971; Graham, 1977). One of the conclusions of the extensive second- and fifth-grade observation studies of the Beginning Teacher Evaluation Study conducted by the Far West Laboratory for Educational Research and Development was that peer interactions can affect cognitive development as well as classroom performance and achievement. The studies showed that a student's achievement level is correlated with the amount of time engaged in meaningful learning tasks and is related to the amount of time spent with teachers and peers in interactions about the specific academic content (Schneider, 1979).

The burden that individualized instruction places upon the teacher is unrealistic, writes Bestor. The teacher must have strength in a large range of subjects and must be informed within the many levels of each subject. Bestor states that these demands are as great as those required of a professional clinical psychologist, are beyond the reach of most teachers, and that the success of any such program stands or falls on the ability of the individual teacher. In contrast, a classroom grouped homogeneously can be organized. Subject matter can be planned systematically, and even a mediocre teacher cannot entirely destroy the effectiveness (Bestor, 1955).

Management Through Individualization

The most encouraging attempts to individualize instruction today are the ungraded or multigrade classrooms where children are allowed to learn as much as fast as they can, or at least as much as the teacher can provide. Goodlad and Anderson (1959) advocated the development of the nongraded vertical pattern of school organization in order to accommodate differences among students. They recognized that the school structure must be designed to facilitate the continuous educational progress of each student. They also note that eliminating the stereotypes of grade expectancies should influence students' abilities to earn early approval of other children. Individual differences, instead of being a source of contention, would become a source of strength. Students of child development realize that the reality of growth defies the strict ordering of students' abilities and attainments into a conventional graded structure.

Individualized instruction has been categorized into several major types. Clearly specified behavioral objectives are a part of all individually diagnosed and prescribed programs. Materials and methods of implementation are coordinated with stated objectives. In self-directed programs, students and teachers cooperatively establish learning outcomes. Students have the freedom to select materials and the goal-reaching procedures. Personalized programs allow the student to choose his or her own objectives and then follow a prescribed program with specialized materials. The independent study approach allows the student to determine his or her own objectives, the topic of study and the means to attain the objectives (Pancella, 1973). Contracting as defined by Wilson and Gambrell (1973) is another variation of individualization. The student and teacher cooperatively agree upon specific learning objectives under the broad objective which is teacher-determined, and then negotiate a contract which takes into consideration the student's learning pace, study method and evaluation.

Driscoll (1980) writes that pace is the only individualized feature within individualized programs since students use the same materials in the same manner --through programmed texts or worksheets. Other objections to individualized instruction were published by the National Advisory Committee on Mathematical Education (NACOME, 1975). The report states that only computation is emphasized, that little, if any, peer interaction occurs and that little attention is given to problem solving and higher analytic skills.

Many schools are attempting to implement individualized programs with materials that are not designed to provide clear directions for the student, nor to provide immediate feedback--two of the most important components of an individualized program. Materials in use often require the teacher's teaching, providing feedback and giving directions. One of the benefits of individualized instruction is lost because students cannot easily move at their own pace. This occupies the teacher with the mundane management problems of the system instead of allowing the teacher to work with individual students. The built-in dependency on the teacher creates confused, frustrated students who must wait and, therefore, use instructional time in an off-task manner which decreases productivity (Kepler and Randall, 1977).

Data from studies conducted by Soar and Soar (1972), Brophy and Evertson (1976) and Good and Grouws (1977) seem to support the use of direct instruction when teaching basic skills. According to Rosenshine (1979), direct instruction is characterized by large group, teacher-directed instruction on specific goals with little choice of activity. These findings would create questions about the use of individualized instruction, but both concepts can be merged to form an effective instructional program.

A study of the individualization movement which peaked in 1920 was published by Grittner (1971). He concluded that present individualization programs will decrease in use just as they did decades ago, and for the same reasons--cost, no achievement increases, excessive demands on teachers, excessive test-taking and isolation. Nix (1970), Osmundson (1972), Palow (1973) and Sutton (1976) agreed that teachers who use individualized programs are overworked. Additionally, Colvin (1973) found that teachers felt isolated in spite of inservice training which was designed to instruct teachers how to manage the programs but which, in fact, did not. Schoen (1976) writes that the results favoring traditional approaches far outweigh those which support individualized approaches and that the numerous management problems which are a part of individualized programs are detrimental to learning.

Individualization Within Content Areas

One of the most popular attempts to individualize classroom reading and mathematics programs incorporates the use of kits such as those published by Scientific Research Associates. Students can be assigned to or select activities at an appropriate instructional level and are allowed to work at their own rate.

The learning center is another attempt to individualize learning. This is a place where directions and materials are provided for children's individual or group use in an attempt to solve problems or answer questions. The center is designed to help the learner gain knowledge, maintain skills, develop attitudes, or all of these.

Pancella (1973) clearly states in Harcourt Brace Javonovich's Concepts in Science that individualized instruction is not synonymous with independent study but is a program which provides for intrinsic motivation, increases the use of a variety of materials, increases opportunities for direct involvement, and allows each student to advance at his or her own pace. Concepts assumes that all students should master the same conceptual schemes, but that this should be allowed to take place in a variety of ways through different investigative processes.

Many reports of individualized mathematics programs were reviewed by Schoen (1976) who concluded that student achievement was no better in self-paced programs than traditional programs in mathematics, that program effectiveness was not balanced by the extra expense, teacher effort and time and that self-paced programs fared worse than traditional programs when used in the upper elementary grades.

Individually Guided Education (IGE) was developed at the Wisconsin Research

Development Center for Individualized Learning (1974) and is a comprehensive system which is designed to help students learn at their own pace and instructional level. The two key components of IGE are identified by Klausmeier and others (1977) as instructional programming for the individual student and the administrative-organizational arrangements that support the implementation. This innovative program involves the schools, community and teacher education programs, but leaves instructional decisions to the classroom teacher. Developing Mathematical Processes (DMP) is the mathematics component of IGE. The objective-based program allows for grouping and individualizing within an activity, within a topic and among topics. The philosophy of the program is based upon the beliefs that alternative approaches to the learning of a concept must be provided and that "no one understands enough about instructional procedures or how children learn to routinize instruction" (Wisconsin Research & Development Center for Cognitive Learning, 1974, p. 66).

A large scale evaluation of IGE has been designed to assess the program's impact. Results of the evaluation which is being conducted by the Wisconsin Research and Development Center for Individualized Learning are not complete, but preliminary results show that teacher satisfaction increases in relation to increases in the degree of implementation. It is common to find an increase in positive staff outcomes, but there has been no significant increase in student achievement (Romberg, 1976). Katzenmeyer and others (1976) found no differences in standard achievement measures in the pilot study involving IGE and non-IGE schools.

One multi-media approach to individualization is embodied in Programmed Logic for Automatic Teaching Operations (PLATO), a computer-assisted delivery system which combines a responsive typewriter, films, slides, tapes and other audio visual aids with computer programs. This is not intended to be the total curriculum, but an adjunct to the existing program. Traditional and PLATO classes were compared after data collection over a two-year period. Results showed that no differences occurred in achievement or attrition (Murphy and Appel, 1977). The teacher assigns an appropriate program to a student, after which the computer presents the material, monitors student progress and evaluates performance. The student determines the instructional pace and receives instant feedback for correct answers, as well as alternative information and instruction for incorrect responses (Jeter, 1980).

In 1970 a consortium of eight Utah local educational agencies and the state education agency developed the Utah System Approach to Individualized Learning (U-SAIL) as their approach to the individualization of mathematics and reading for the elementary grades. Curricula were designed to assist in diagnostic/prescriptive teaching, and interdependent components were designed to provide specific guidelines in planning, organizing, implementing and evaluating within a humane classroom environment. In mathematics, materials are coded to promote easy access, and use of manipulatives is stressed. After diagnosis, the student is assigned to groups according to identified need. The teacher presents to the group, monitors student progress, reteaches and conferences with each student as needed. Assignments vary among students, and immediate feedback is provided prior to reassignment or testing (Hales, 1978). Five evaluation studies on the U-SAIL system showed that students in the system showed significantly greater gains than students in non-U-SAIL programs. One of the studies showed that there was a relationship between achievement and the degree of implementation. High implementation classes significantly outperformed the low and middle implementation classes (Jeter, 1980).

Individualized Mathematics System (IMS) is a complete mathematics system for grades 1-6 which is developed on the hierarchial model. Each unit of instruction states behavioral objectives for teacher and student use. Instruction initially begins with seminars and leads to a student's working individually in each asssigned unit until mastery is demonstrated on the unit posttest. Monitoring within a unit is the responsibility of the student and is based upon recycling or branching as performance on worksheet tests indicates. The teacher determines placement, mastery and initiates assignment to seminars. Pacing is dependent upon the students' individual needs. The system requires considerable preparation as well as several aides, in addition to the classroom teacher (EPIE, 1974).

The University of Pittsburg's Learning Research and Development Center directed an experimental project in K-6 classrooms which eventually became what is known as Individually Prescribed Instruction (IPI)--a highly structured system for instruction in reading, science, spelling and mathematics. Individually prescribed learning activities allow students to work at their own pace and instructional levels after assignment according to placement tests. The system's foundation is a set of instructional objectives for each subject area sequenced into learning hierarchies and is grouped into instructional units. The teacher administers tests, diagnoses strengths and weaknesses, writes prescriptions, monitors student progress and instructs individual students. The scoring of tests is often performed by additional personnel (Bolvin, 1968). Duda (1970) analyzed the IPI program in an attempt to provide insight into its contribution to the field of individualization, and the Learning Research and Development Center for IPI conducted a comprehensive study of the program in 1973-74 in a large number of second grade classrooms across the United States. Analysis of data collected over a period of three years showed that the degree of implementation and individualization had increased since 1963. Increases were noted in reading and mathematics placement scores and teachers expressed greater confidence with the IPI system (Leinhardt, 1977). O'Daffer (1976), however, raises many concerns regarding the system. He questions whether or not the individual pacing is really what is meant by individualization. Students work basically in isolation and have few opportunities for interaction with peers. Concept development is minimal since there are few teaching aids, manipulatives or demonstrations. O'Daffer has observed the development of negative attitudes toward mathematics. Paraprofessionals were often instructing students while teachers were scheduling, prescribing, recording and testing. He concludes that careful consideration should be given to the true meaning of an individualized program and that programs should be built around true student needs. Oles (1973) found that the self-scoring component was enjoyed by students, but that 88% of the students cheated.

The Comprehensive School Mathematics Program (CSMP), in its eighth year of the pilot study, is designed to overcome what the program developers identified as a typical problem in elementary school mathematics programs--the lack of appropriate verbal-language skills and abilities. Program components incorporate extensive use of the non-verbal languages of strings, arrows and minicomputer without the symbology and notation that are customarily used. Classroom management techniques allow for large and small group instruction and independent study. The individualization component is implemented through the use of worksheets and workbooks which increase in difficulty as the students progress through the series. Data collected in 1974, 1975 and 1976 favored the CSMP classes, but areas of concern include the cost factor and recruitment and training of teachers (Woodward, 1980).

Management Through Social Organization

Over thirty years ago a small group of social scientists began to write about the effectiveness of team competition within the classroom (Deutsch, 1949b; Sherif & Sherif, 1953; Coleman, 1959; Bronfenbrenner, 1970). Intrateam cooperation and interteam competition seemed to promote peer support for academic success as well as more eagerness to assist peers. It provided teachers with an instructional strategy which allowed for a successful mode of dealing with the diversity in student achievement within the same class.

Again, an upsurge in research on the attitudinal, social-interactive and academic effects of cooperative team learning in the classroom has occurred during the past decade. Teams are designed to promote peer interaction and to cooperatively pursue the study of an academic subject. Research on cooperative interventions shows that use of this strategy leads to an increase in students' mutual concern for peers as well as in the number of friends which were named (DeVries & Edwards, 1973; Edwards & DeVries, 1974; Slavin, 1978c, 1979; Johnson, Johnson, Johnson & Anderson, 1976; Wheeler, 1977). This has resulted in areas of study such as social studies, mathematics and language arts. Edwards and DeVries (1974), Slavin (1980), Johnson et al (1976) and Wheeler and Ryan (1973) reported students' increased liking of school as a positive effect of cooperative structures. Additionally, Blaney et al (1977), and Slavin and Karweit (1979) reported that students learning cooperatively showed increased self-esteem.

Johnson, Johnson, Johnson and Anderson (1976) hypothesized that structuring learning in different ways would lead to different patterns of interaction among students and would promote different learning outcomes. Their study used an individualized instruction approach where a student's goal achievement is unrelated to the goal achievement of the other students and a cooperative learning structure where all students are affected by the success of a student. The cooperative learning group studied together, completed one assignment per group, assisted each other and received praise from the teacher on an individual basis. Results at the end of the 17-day study indicated that "cooperative interaction with peers, compared with studying individualistically, promotes altruistic behavior by children" (p. 450). There was also some evidence to indicate that cooperative learning facilitates an intrinsic motivation to learn while the opposite may occur with individualized learning experiences. There was a positive correlation with cooperative learning and attitude, and higher daily achievement occurred with the cooperative learning group, but no differences existed between groups on an individual review test. However, when students in that setting and students in the individualized condition completed the review test individually, the cooperative group performed better.

Artzt (1979) found that whole class instruction does not allow for enough time to work with individuals, too much time is used to answer questions which are relevant to only a few students, little student interaction occurs, certain students tend to dominate discussions and others hesitate to ask questions. In an attempt to diminish these problems in her secondary mathematics classes, the homogeneous groups were divided into above average, average and below average tracks. Students subdivided themselves into teams of four to six members. Students worked cooperatively and submitted assignments from the team rather than individually. New teams were formed after each unit test. Parents expressed satisfaction with the teaming component, discipline problems decreased, more work was completed, attitudes toward mathematics became more positive and grades improved.

An extensive review of research by Johnson and Johnson (1979) found that student achievement was higher on problem solving tasks when in a cooperative learning situation as opposed to a competition learning situation. Michaels (1977) reviewed ten selected studies and found that in seven, competition promoted higher achievement than both the individualistic or cooperative efforts. However, Davis, Laughlin and Komorita (1976) found that cooperation promoted higher achievement in concept attainment tasks than competition or individualistic efforts. Studies by Clifford (1971) as well as Scott and Cherrington (1974) found that competition resulted in higher achievement than individual efforts, although one study found no difference between the two efforts (Clifford, 1972).

Educational critics (Holt, 1967; Johnson & Johnson, 1975; Postman & Weingartner, 1969) have warned that consistent use of competition in education can have deleterious effects upon students. A field study reported by Sherif, Harvey, Hood, White and Sherif (1961) found that intergroup tensions can be alleviated by an organization which incorporates a mutual interdependence component as opposed to an intergroup competitive organizational structure. Blaney, Stephan, Rosenfield, Aronson and Sikes (1977) assessed the effect of interdependent learning groups, as opposed to traditional teacher-directed competitive groups, upon the attitudes and interpersonal liking of elementary school students. The study concurred with Gottheil (1955), Phillips (1956), and Phillips and D'Amico (1956) that positive interpersonal benefits result from cooperative interaction; that there was an increased liking for classes (Wheeler & Ryan, 1973) and that students manifested higher self-esteem (Lippitt & Lohman, 1965; Lippitt, Eiseman & Lippitt, 1969) in interdependent groups as opposed to students in traditional classes. This study did not measure academic performance, but a subsequent study suggests that academic performance of students in interdependent learning groups is as good as or is better than that of students in a traditional classroom setting (Lucher, Rosenfield, Aronson & Sikes, in press). Additionally, improvement in ethnic relations in the form of increases in cross-ethnic helping behavior has been the result of the use of cooperative techniques in the classroom (DeVries & Edwards, 1974; Weigel, Wiser & Cook, 1975).

A study of 45 first grade students by Johnson, Skon and Johnson (1980) showed that students solve problems best by working cooperatively. Groups comprised of high, middle and low achievers were assigned to one of three treatments--the cooperative group where students worked together on tasks, the competitive group where students competed against one another and those in the individual group where students worked independently. Students' tasks included solving verbal and spatial reasoning problems as well as categorizing and retrieving information. Cooperative group students scored significantly better on performance tests than did students in the other two treatments.

The Johns Hopkins University Programs

Aronson and associates (1975, 1978) developed a teaching method, Jigsaw, which is designed to increase a student's sense of responsibility for his or her own learning and to foster peer cooperation and tutoring. Each student becomes an "expert" on one component of the instructional unit and then assumes the responsibility for teaching this to all members of the team to which he or she is assigned. Because team members have knowledge of only the assigned component, their unique information makes their contribution valuable to the success of the team. Task closure is contingent upon mutual cooperation among team members. As existing materials required rewriting by the teacher prior to implementation, Jigsaw II was developed to help alleviate this problem by assigning students to read all of the descriptive or narrative material which is to be studied (Slavin, 1978b).

Teams-Games-Tournaments (TGT) is an imaginative classroom intervention which incorporates a cooperative group structure, active competition among individuals from different teams and games which are integrated into the curriculum (DeVries & Edwards, 1973). Results from ten field experiments over a four-year period show that TGT, when compared to traditional instruction, "has generally consistent effects on students' academic achievement, mutual concern, positive race relations, peer norms supporting academic achievement and positive attitudes toward school" (DeVries & Slavin, 1976, 1978, p. 31).

A simplification of TGT, Student Teams-Achievement Divisions (STAD) replaces the TGT games with a quiz (Slavin 1977, 1978a, 1980a). Team cooperation is an integral part of the program, but it does not include individual competition. Games and tournaments are replaced by quizzes and rewards to students for special improvement and effort on any given quiz rather than ability. Teachers are encouraged to alternate the use of TGT and STAD in the classroom in order to maintain high student interest over a long period of time.

One could conclude that involving students in an interdependent task will not ensure an improvement in achievement. Greater achievement gains were found where members in the cooperative group received rewards which were contingent upon total group performance. Deutsch (1949) describes this as reward interdependence--a situation in which peer norms develop which encourage efforts that lead to group success and discourage behavior which could hinder the group success.

Based on the findings on Aronson and associates (1975, 1978), DeVries and Edwards (1973), DeVries and Slavin (1976, 1978) and Slavin (1977, 1978a, 1980a) it appears that an intervention designed to facilitate a cooperative learning environment where students with diverse ability levels in mathematics can succeed and student attitudes and academic achievement will improve, would enhance the existing classroom curriculum. It is felt that such an intervention has not existed and that the issue of management of an individualized program has not been addressed adequately in the literature.

SUMMARY

Research has focused on ways to individualize, but yet no suitable program has been found whereby students and teachers agree that it is motivating, manageable, flexible and tailored to meet the diverse ability needs of students. Individualized mathematics programs that were found suffered from various weaknesses which included limited feedback to students, no peer interaction, unrealistic planning demands on teachers, management difficulties, weak monitoring of student progress, built-in dependency on the teacher and the development of negative attitudes.

The literature search has revealed that research on cooperative-learning techniques has shown that both internal and external validity are high and that the "positive effects of cooperative learning methods are well enough established to begin to evaluate extensions or adaptations of the methods to new uses, such as (...) individualization and mastery learning" (Slavin, 1980b, p. 110).

The program proposed in this study was designed by The Johns Hopkins University staff in an attempt to overcome the weaknesses of existing individualized mathematics programs. Based upon the research it would be logical to expect that the use of Team-Assisted Individualization would improve the attitudes and achievement of students of mathematics, and this program, as described in detail in the next chapter, is the foundation of this dissertation.

CHAPTER THREE

Methodology

Subjects

The subjects for the study were 504 third, fourth and fifth grade students from six elementary schools in the Howard County Public School System in the State of Maryland. Male and female Black, Asian and Caucasian students from middle and upper middle socioeconomic communities comprised the sample, which also included students who received resource help in addition to the regular classroom instruction.

Selection of Subjects

Howard County is a small geographic area in which there are 27 elementary schools. In accordance to the philosophy of this county's school system, schools participate in studies on a voluntary basis. For purposes of this study, within the set of eighteen volunteers, six schools were chosen to participate by utilizing a table of random numbers. It was determined by the researcher and the Director of Program Evaluation, Research and Development that these schools were representative of the total population as it relates to IQ, race, sex, socioeconomic status and achievement.

Selection of Teachers

The random selection of the six participating schools also provided for the selection of eighteen teachers who were representative of the third, fourth and fifth grade teachers of the Howard County Public Schools. The average teaching experience of the eighteen teachers was 8.6 years. Five teachers had earned a

Bachelor's degree and thirteen had completed a Master's degree or equivalency.

Teacher Inservice

One week prior to implementation, two separate inservices of three hours each were conducted for the six Team-Assisted Individualization and the six Rapid Progress Mathematics teachers. Training included an introduction to the materials and teachers' manuals, established guidelines and timelines for the project and attempted to develop support system networks within each of the participating schools. Teachers were instructed to keep careful records of student and teacher attendance. Students for whom test data were missing were excluded from the final analyses.

Overview of Treatments

Three treatments were utilized in this study. One, Team-Assisted Individualization (Slavin, Leavey & Madden, 1980), involved the use of cooperative task and reward structures in the classroom. The second, Rapid Progress Mathematics (Slavin, Leavey & Madden, 1981) was a variation of the Team-Assisted Individualization program in which only the materials were utilized. The third, Regular Program, was the curriculum which would have been used for instruction whether or not this study was in progress.

Description of Treatments

Team-Assisted Individualization (T_1)

Team. Students were assigned to four- to five-member teams which consisted of high, average and low achievers as determined by the diagnostic test. Boys, girls and students of any ethnic groups in the classes were represented in the proportion in which the entire class was comprised.

Diagnostic test. The students were pretested at the beginning of the project on mathematics operations and were placed at the appropriate point in the individualized program based on their performance on the diagnostic test (see Appendix, p. 95). Students were assigned to skill categories on which their performance was less than 80 per cent.

Curriculum materials. For all operations skills, the students worked on individualized curriculum materials that had the following subparts:

1. An Instruction Sheet explaining the skill to be mastered and giving a step-by-step method of solving problems.
2. Several Skillsheets, each consisting of twenty problems. Each Skillsheet introduced a subskill that led to final mastery of the entire skill.
3. A Checkout which consisted of two parallel sets of ten items.
4. A Final Test.
5. Answer Sheets for Skillsheets, Checkouts, and Final Tests.

Monitors. At the beginning of each class period, three students from different teams were appointed to serve as monitors for that period. Each received 15 points for their team (as though they had taken one test and received a perfect score) because he or she could not contribute to his or her team during the period in which he or she served as monitor. Monitors distributed, scored and filed appropriate tests.

Team study method. Following the diagnostic test, students were given a starting place in the individualized mathematics units. They progressed through their units in their teams, following these steps:

1. Students formed pairs or triads within their teams which were initially formed at random. Students located the unit on which they were working and brought it to the work area. The units consisted of the Instruction

Sheet, Skillsheets and Checkouts stapled together, and the Skillsheet Answers and Checkout Answers stapled together.

2. In pairs, students exchanged Answer Sheets with their partners. In triads, they gave their Answer Sheets to the student on their left.

3. Each student read his or her Instruction Sheet and asked teammates or the teacher for help, if necessary.

4. When students had read the Instruction Sheet they began with the first Skillsheet in the unit. Students copied the problems from the stapled sheets onto their own paper prior to completing the tasks.

5. Each student worked the first four problems on his or her own Skillsheet and then had his or her partner check the answers against the Answer Sheet. If all four were correct, the student progressed to the next Skillsheet. If any were wrong, the student completed the next four problems, and so on until he or she got one block of four problems correct.

6. When a student successfully completed four in a row on the last Skillsheet, he or she took Checkout A, a ten-item quiz that resembled the last Skillsheet. On the Checkout, students worked alone until they finished. When the problems were completed, a teammate scored the Checkout. If the student got eight or more correct, the teammate signed the Checkout to indicate that the student was certified by the team to take the Final Test. If the student did not get eight correct, the teacher was called to explain any problems the student was having. The teacher had the prerogative of asking the student to work again on certain Skillsheet items or the student may have then taken Checkout B, a second ten-item test comparable in content and difficulty to Checkout A. Otherwise, students skipped Checkout B and went directly to the

Final Test. No student could take the Final Test until he or she had been passed by a teammate on a Checkout.

7. When a student "checked out," he or she took the Checkout to a student monitor from a different team. Three students served as monitor at any given time. The monitors' responsibilities included finding the proper test and giving it to the student. The student moved his or her desk away from all other students to take the test. A student taking a test was not to be disturbed for any reason. After completion, the student located the monitor who scored the test. The student could check the scoring in the presence of the monitor and bring any discrepancies to the attention of the teacher for resolution. The teacher had the option to check all Final Tests to keep track of student progress and to be sure that all scoring was accurate. When the tests were scored, they were given to the teacher to be entered on the student's Team Score Sheet, and the student checked the unit off on his or her own Math Progress Form. The student then wrote the unit and his or her score on the Team Score Sheet posted in the classroom.

8. There is no "down time" in this model. Whenever a student's partner left to take a Checkout or Test, to serve as a monitor or for any other purpose, the student joined another pair in his or her team to form a triad, or if the rest of the team was already a triad, the student formed a new pair with one of the students.

Facts Sequence

The system described above does not include addition, subtraction, multiplication or division facts. These facts were taught using a separate method.

Preparation for the facts units occurred entirely out of class, as homework.

Students were able to take home facts practice sheets to study with parents, siblings or other students. Students worked first for accuracy, then for speed on each facts unit.

Every Tuesday and Friday, all students took five-minute tests on the facts unit they were studying. The facts tests were comprised of ninety problems organized in three sections: A, B and C. The A section consisted of facts from 0-3; B contained 4-6; and C contained 7-9 facts. When a student began a fact sequence, he or she had to first get 100% on Section A, then 100% on Section B, then 100% on Sections A and B taken together, then 100% on C, then 100% on B and C taken together, and finally 100% on A, B and C in five minutes, as indicated in the chart below:

Facts Sequence

1. A
2. B
3. A + B
4. C
5. B + C
6. A + B + C

Five minutes should be more than sufficient for any one section, but as sections were added together, the task became more of a speed drill. A student stayed on each step of the sequence until he or she passed it and then proceeded to the next step. If a student passed step 6, he or she went to the next fact sequence (e.g., from multiplication to division).

The fact tests were scored in class. Students exchanged tests with members of other teams after which the teacher read the answers, displayed them on an overhead projector or chart paper or distributed answer sheets. When a student passed a step in the sequence, he or she put a "15" by his or her name on the Team Score Sheet to indicate a perfect paper, gave the teacher the correct test and entered the date in the appropriate place on the Math Progress Form.

If any students were having difficulty with their facts so that this interfered with their progress through their skill units, they had the opportunity to use a grid until they passed the relevent facts sequence. If any students passed all of their facts sequences, they worked on their individualized units during the facts tests. The teacher provided homework for these students, as they were not studying facts at home.

Teacher review session. As soon as students were working well in their teams on the individualized materials, the teacher began forming groups of one to ten students who were at about the same point in the curriculum and provided instruction in 10-20 minute sessions. The purpose of these sessions was to discuss any points with which students were having trouble and to prepare students for upcoming units. During the time that the teacher was working with the small groups, other students were continuing on their own units.

Curriculum organization. The curriculum was organized into nine skills: addition, subtraction, multiplication, division, fractions, decimals, numeration, ratio/per cent and word problems. The units in each skill area were arranged in a specific sequence in which each unit depended on the last unit's having been mastered.

The units were also organized into blocks that included units from several skill areas but at about the same level of difficulty. Most blocks included at least one word problem unit. A block might have included, for example, several multiplication units, a few fraction units, a numeration unit and a word problem unit.

Students could complete the units in a block in any order as long as they did the units in the same skill area in order. They were required to complete all the units in a block before they could proceed to the next block.

Students maintained personal folders with all of their work and with a Math Progress Form on which they checked off units as they completed them. The teacher checked each student's Math Progress Form before making up groups for review sessions, to see how students were doing and to prepare for anticipated difficult upcoming units.

Record keeping. The Individual Progress Record was used to monitor student progress through the curriculum. An example of an Individual Progress Record appears as an Appendix. Each Individual Progress Record encompassed one week. The letter-number combination (such as M13, D3) in the space for "unit," and the number correct on the fifteen-item test in the space for "score" were recorded. When a student passed a step in the facts sequence, this was indicated by putting, for example, MF2 to show that the student passed the second step in multiplication facts (the B section, 4's, 5's, and 6's facts). The facts units were designated AF (addition), SF (subtraction), MF (multiplication) or DF (division). Under the unit designation, a "15" was recorded to indicate a perfect score (the 100% correct required to pass the unit).

In addition to the Individual Progress Record, student progress was recorded on the Math Progress Forms.

Team scores. At the end of each week, the teacher calculated team scores. Those scores were the sum of the average number correct of all tests taken by all team members (the Accuracy Score) and the average number of units covered by each team member times ten (the Progress Score). To calculate the Accuracy Score, the sum of the number correct on all Final Tests taken by all students in the team was divided by the number of tests taken and multiplied by ten. If a student attended class two days or less, his or her scores were not included in the Accuracy Score. To compute the Progress Score, the total number of tests taken by all students who were in the class three or more days were counted and divided by the number of students on the team who were present three or more days and multiplied by ten. For the purposes of scoring, a "week" was considered four or more days. If a week had three or fewer days due to snow days, holidays, school assemblies etc., the week's scores were combined with those of the next week.

The team score was equal to the sum of the Accuracy Score and the Progress Score. A sample Team Score Sheet appears in the Appendix.

Team recognition. It was critical in Team-Assisted Individualization for students to feel that team success was important, and that any team could be successful. For this purpose, goals were set for team success that teams could achieve if they worked well together. Students could see how their accomplishments moved the team toward its goal as they posted their scores on the Public Team Score Sheet. The goals for different levels of team achievement and the awards for achieving them were as follows:

Award	Goal	Reward
GOODTEAM	35	Congratulations in class
GREATTEAM	40	Certificate to each team member
SUPERTEAM	50	Fancy certificate to each team member

The GREATTEAM certificates were standard certificates for all students who made 40 or more team points. SUPERTEAM certificates were fancier and had spaces on which to put the team and team member's name. In addition to these rewards, the teacher was encouraged to give other special privileges to successful teams. It was also recommended that the team names be put on pieces of cardboard and then displayed on a bulletin board on which the team names were displayed under "GOODTEAM," "GREATTEAM" or "SUPERTEAM." It was very important that the teacher emphasize the importance of team success and the fact that any team could achieve it if they worked together. A sample SUPERTEAM certificate appears in the Appendix.

If a short week existed because of vacations, assemblies, fire drills, etc., the teacher could lower the goals temporarily. If two weeks were combined, the teacher could raise the goals temporarily.

Rapid Progress Mathematics (T_2)

Diagnostic test. The students were pretested at the beginning of the project on mathematics operations and were placed at the appropriate point in the individualized program based on their performance.

Curriculum materials. For all operations skills, the students worked on individualized curriculum materials that had the following subparts:

1. Instruction Sheet explaining the skill to be mastered and giving a step-by-step method of solving problems.
2. Several Skillsheets, each consisting of twenty problems. Each Skillsheet introduced a subskill that led to final mastery of the entire skill.
3. A Checkout, which consisted of two parallel sets of ten items.
4. A Final Test.
5. Answer Sheets for Skillsheets, Checkouts and Final Tests.

Monitors. At the beginning of each class period, three students were appointed to serve as monitors for that period. Their responsibilities were to distribute, score and file appropriate tests.

Study method. Following the diagnostic test, students were given a starting place in the individualized mathematics units. They progressed through their units, following these steps.

1. Students located the unit on which they were working and brought

it to their desks. The units consisted of the Instruction Sheet, Skillsheets and Checkouts stapled together, and the Skillsheet Answers and Checkout Answers stapled together.

2. Each student read his or her Instruction Sheet and asked the teacher for help, if necessary.

3. When they had read the Instruction Sheet, the students began with the first Skillsheet in the unit. Students copied the problems from the stapled sheets onto their own paper prior to completing the tasks.

4. Each student worked the first four problems after any examples on his or her own Skillsheet and then checked the answers against the Answer Sheet. If all four were correct, the student proceeded to the next Skillsheet. If any were incorrect, the student tried the next four problems, and so on until he or she got one block of four problems correct.

5. When a student successfully completed four in a row on the last Skillsheet, he or she took Checkout A, a ten-item quiz that resembled the last Skillsheet. On the Checkout, students worked until they were finished. They scored their own Checkouts, using their Answer Sheets. If the student got eight or more correct, he or she signed the Checkout to indicate that he or she was ready to take the Final Test. If the student did <u>not</u> get eight correct, he or she called on the teacher to explain any problems. The teacher had the prerogative of asking the student to work again on certain Skillsheet items or the student may have then taken Checkout B, a second ten-item test comparable in content and difficulty to Checkout A. Otherwise, students skipped Checkout B and went directly to the Final Test. No student could take the Final Test until he or she had passed a Checkout.

6. When a student "checked out," he or she took the Checkout to a student monitor. Three students served as monitor at any given time. The monitors' responsibilities included finding the proper test and giving it to the student. The student moved his or her desk away from all other students to take the test. A student taking a test was not to be disturbed for any reason. After completion, the student located the monitor who scored the test. The student could check the scoring in the presence of the monitor and bring any discrepancies to the attention of the teacher for resolution. The teacher had the option to check all Final Tests to keep track of student progress and to be sure that all scoring was accurate. When the tests were scored, they were given to the teacher to be entered on the student's Math Progress Form and recorded by the teacher.

Facts sequence. The facts were taught according to the procedures outlined on the proceding pages in the TAI guidelines.

Teacher review sessions. As soon as students were working well on the individualized materials, the teacher began forming groups for instruction as described on the preceding pages in the TAI guidelines.

Curriculum organization. The curriculum is organized identically to the TAI curriculum as previously described.

Record keeping. Record keeping procedures were identical to those in the TAI treatment.

Regular Program (T_3)

The curriculum is that which would have been used for instruction whether or not this study had occurred, but was restricted to the same nine units of study which were included in T_1 and T_2 (numeration, addition, subtraction, multiplication, division, fractions, decimals, word problems, ratio/per cent).

Test Instruments

The standardized Comprehensive Tests of Basic Skills Mathematics Computation (1973) subscale was administered as pre- and posttests to assess achievement. The forty-eight item test was forty-five minutes in length.

A sixteen-item questionnaire was given as a pre- and post measure to assess students' attitudes toward mathematics and feelings of competence in mathematics. The scales were "Liking of Mathematics" and "Feelings of Competence in Mathematics" and were presented in a Likert-type format where students' agreement or disagreement with each statement was indicated by circling one of the following responses: YES! yes no NO! This was adapted from scales used previously by Slavin (1978c).

A diagnostic test was administered to determine appropriate placement in the program. The test was designed as a part of the Team-Assisted Individualization package and consisted of sixty-four items of varying levels of difficulty which were representative of the nine skills included in the materials (Slavin, Leavey & Madden, 1980 & 1981).

Treatment Schedule

The timeline for implementation of the study was as follows:

March 16	a.m. inservice for T_1 teachers
	p.m. inservice for T_2 teachers
March 17	administered diagnostic pretest
March 18	administered achievement pretest

March 19	administered attitude survey pretest
March 20	administered make-up tests
March 23	project began
May 22	project ended
May 26	administered diagnostic posttest
May 27	administered achievement posttest
May 28	administered attitude survey posttest
May 29	administered make-up tests

Outline of Research Design

A Pretest-Posttest Control Group Design outlined in Stanley and Campbell (1963) was used to assess the effects of the use of specifically designed individualized mathematics materials and the accompanying management system. Utilization of table of random numbers determined assignment of schools to treatment groups T_1, T_2 or T_3. Within each school, one teacher in grades three, four and five, or a total of three teachers was assigned by the Principal to participate in the study.

This study made it possible to assess the effects of using Team-Assisted Individualization in a classroom setting which was comprised of students with varying levels of ability. Use of analysis of covariance with pretests and grade level as covariates reduced the possibility that any differences found were due to pre-existing differences.

Threats to the generalizability of the findings to the regular classroom were minimized by specific features of the experimental design. First, regular classroom teachers who were encumbered by all of the usual problems of teaching full time, implemented the treatments. This would be true in most situations in which any findings would be applied. Second, the use of the treatment with materials only (T_2) also demanded a restructuring of the classroom and a new curriculum. Treatment T_3 groups proceeded according to what they would have done if they had not participated in the study. The design can be described as follows:

$$R\ 0\ T_1\ 0$$

$$R\ 0\ T_2\ 0$$

$$R\ 0\ T_3\ 0$$

Table 1 provides a complete outline of the research design for this study. Only

TABLE 1
Outline of Research Design

Teacher	Grade Level	School	Treatment
I	3	A	T_1
II	4	A	T_1
III	5	A	T_1
IV	3	B	T_2
V	4	B	T_2
VI	5	B	T_2
VII	3	C	T_3
VIII	4	C	T_3
IX	5	C	T_3
X	3	D	T_1
XI	4	D	T_1
XII	5	D	T_1
XIII	3	E	T_2
XIV	4	E	T_2
XV	5	E	T_2
XVI	3	F	T_3
XVII	4	F	T_3
XVIII	5	F	T_3

one of the three treatments was assigned to a given school. Different treatments in progress concurrently within the open-spaced structures would have confounded the treatments. It was also the intent of the researcher to build a support system among teachers in a given building who were participating in identical programs.

Hypotheses to be Tested

Providing appropriate instruction for students of high, average and low abilities within the same classsroom has geen a goal for many individualized mathematics programs. However, available programs have not provided solutions to many of the problems which are previously discussed. Thus, this study was designed to answer the following question: Will the use of Team-Assisted Individualization result in a difference in third, fourth and fifth graders' achievement and attitudes? With the aforestated question in mind, the researcher formulated the following hypotheses:

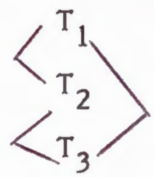
H_1: There will be a significant difference among treatments on the mean scores of the achievement pre- and posttests in favor of the T_1 classes.

H_2: There will be a significant difference among treatments on the mean scores of the attitude pre- and posttests in favor of the T_1 classes.

H_3: There will be a significant difference among treatments on the mean scores of the achievement pre- and posttests in favor of the T_2 classes over the T_3 classes.

H_4: There will be a significant difference among treatments on the mean scores of the attitude pre- and posttests in favor of the T_2 classes over the T_3 classes.

Analysis of covariance was used to determine statistical significance which was predicted to be at the $p = <.05$ level on all comparisons. It was determined that grade level and pre-test scores on both the CTBS-math and diagnostic tests would be used as covariates. It was agreed that if significance were found, pairwise comparisons would be made using the procedures as diagrammed below:



Data Analysis

The data analysis was comprised of four basic parts. The first set of analyses examined the effect of TAI on students' attitudes toward mathematics. The second set of analyses dealt with the effects of RPM on students' attitudes towards mathemetics. The third set analyzed data to determine the effect of TAI on students' achievement. A fourth set of analyses dealt with the effect of RPM on students' achievement. Data analyses are outlined as follows:

Analysis I: Attitudes of T_1 and T_2 students at all grade levels.

Analysis II: Attitudes of T_1 and T_3 students at all grade levels.

Analysis III: Attitudes of T_2 and T_3 students at all grade levels.

Analysis IV: Achievement of T_1 and T_2 students at all grade levels using pretest achievement on the CTBS-math and grade level as covariates.

Analysis V: Achievement of T_1 and T_3 students at all grade levels using pretest achievement on the CTBS-math and grade level as covariates.

Analysis VI: Achievement of T_2 and T_3 students at all grade levels using pretest achievement on the CTBS-math and grade level as covariates.

Analysis VII: Achievement of T_1 and T_2 students at all grade levels using pretest achievement on the diagnostic test and grade level as covariates.

Analysis VIII: Achievement of T_1 and T_3 students at all grade levels using pretest achievement on the diagnostic test and grade level as covariates.

Analysis IX: Achievement of T_2 and T_3 students at all grade levels using pretest achievement on the diagnostic test and grade level as covariates.

CHAPTER FOUR

Results of the Study

The data were analyzed by means of analysis of covariance, with the CTBS-

TABLE 2
Means and Standard Deviations, Grade Three
Achievement and Attitude Measures

Instrument		TAI $\bar{X}$	TAI SD	RPM $\bar{X}$	RPM SD	Control $\bar{X}$	Control SD
CTBS - Math	Pre	19.84	6.23	19.73	7.94	17.06	6.88
	Post	24.33	7.87	22.65	8.65	19.43	9.19
	Adjusted	23.58		22.01		21.26	
Diagnostic Math Test	Pre	23.02	6.44	25.35	9.04	21.19	8.86
	Post	29.65	6.92	26.65	9.13	24.57	9.72
	Adjusted	29.95		24.99		26.40	
Liking of Math Class	Pre	21.55	6.44	25.07	5.98	23.05	5.33
	Post	25.24	6.73	26.72	5.34	20.89	6.74
	Adjusted	26.20		25.72		21.02	
Self-Concept in Math	Pre	23.32	3.69	24.31	5.62	24.50	4.27
	Post	25.62	4.11	25.00	4.78	25.34	4.76
	Adjusted	26.02		24.83		25.06	

TABLE 3
Means and Standard Deviations, Grade Four
Achievement and Attitude Measures

Instrument		TAI $\bar{X}$	TAI SD	RPM $\bar{X}$	RPM SD	Control $\bar{X}$	Control SD
CTBS - Math	Pre	33.02	7.82	30.29	11.74	26.39	8.95
	Post	34.46	7.19	36.00	10.39	28.73	10.49
	Adjusted	31.91		35.62		31.45	
Diagnostic Math Test	Pre	38.17	6.82	39.39	13.73	32.69	9.02
	Post	39.77	7.98	45.04	14.50	37.33	11.27
	Adjusted	38.25		42.32		41.23	
Liking of Math Class	Pre	26.45	5.59	24.83	5.24	23.00	5.72
	Post	25.77	5.70	25.86	4.86	23.27	5.54
	Adjusted	24.94		25.79		24.07	
Self-Concept in Math	Pre	25.70	4.36	24.52	4.39	24.06	4.24
	Post	25.52	5.06	25.05	4.04	24.02	4.92
	Adjusted	24.80		25.21		24.53	

math and diagnostic pretests and grade level as the covariates. The experimental factor was treatment: T_1 vs. T_3 and T_2 vs. T_3. Three comparisons were computed: T_1 vs.

TABLE 4
Means and Standard Deviations, Grade Five
Achievement and Attitude Measures

Instrument		TAI $\bar{X}$	TAI SD	RPM $\bar{X}$	RPM SD	Control $\bar{X}$	Control SD
CTBS - Math	Pre	36.59	7.29	35.29	8.97	38.11	6.43
	Post	39.57	6.15	36.15	9.23	39.11	7.34
	Adjusted	39.69		37.27		38.05	
Diagnostic Math Test	Pre	45.94	6.12	43.47	9.83	45.54	7.86
	Post	51.33	6.35	46.62	12.36	50.93	8.41
	Adjusted	50.41		48.02		50.38	
Liking of Math Class	Pre	25.37	5.59	25.11	3.99	23.51	4.43
	Post	24.37	6.08	24.02	5.45	21.54	5.15
	Adjusted	23.84		23.66		22.23	
Self-Concept in Math	Pre	25.67	3.96	23.91	4.54	24.97	4.06
	Post	26.22	3.53	24.89	4.42	24.14	4.55
	Adjusted	25.68		25.48		24.05	

TABLE 5
Means and Standard Deviations, Full Sample
Achievement and Attitude Measures

Instrument		TAI $\bar{X}$	TAI SD	RPM $\bar{X}$	RPM SD	Control $\bar{X}$	Control SD
CTBS - Math	Pre	30.18	10.08	28.51	11.59	29.25	11.27
	Post	33.12	9.43	31.45	11.31	31.02	11.86
	Adjusted	32.40		32.18		30.95	
Diagnostic Math Test	Pre	35.83	11.54	36.11	13.40	35.05	13.05
	Post	40.40	11.39	39.35	15.10	39.68	15.10
	Adjusted	40.31		38.96		40.14	
Liking of Math Class	Pre	24.37	6.23	25.02	5.09	23.23	5.07
	Post	25.09	6.19	25.51	5.35	21.93	5.75
	Adjusted	24.94		25.01		22.56	
Self-Concept in Math	Pre	24.87	4.13	24.23	4.89	24.56	4.16
	Post	25.80	4.23	24.97	4.42	24.40	4.72
	Adjusted	25.57		25.14		24.44	

T_2, T_1 vs. T_3 and T_2 vs. T_3. Means, adjusted means and standard deviations by grade level are shown on Tables 2, 3 and 4 and by treatment in Table 5.

It was hypothesized that there would be significant differences on the mean scores of the achievement and attitude posttests (controlling for pretests and grade level) in favor of TAI over all groups and that there would be significant differences on the mean scores of the achievement and attitude posttests in favor of RPM over Control.

Grade three comparisons show in Tables 6 and 7 that a statistically significant effect ($p < .001$) was found in favor of RPM and TAI students over Control students in Liking of Math. TAI students showed a statistically significant higher performance on the diagnostic test than Control students ($p < .003$), as shown in Table 7, and were significantly higher than RPM students on the diagnostic test ($p < .001$), as shown in Table 8.

TABLE 6
Individual Comparisons
Grade Three, RPM vs. Control

Instrument	F	df	p <	Direction
CTBS - Math	.342	1,83	N.S.	
Diagnostic	2.44	1,94	N.S.	
Liking of Math	19.113	1,89	.001	RPM > C
Self-Concept	.088	1,89	N.S.	

TABLE 7
Individual Comparisons
Grade Three, TAI vs. Control

Instrument	F	df	p <	Direction
CTBS - Math	2.789	1,75	N.S.	
Diagnostic	9.23	1,88	.003	TAI > C
Liking of Math	20.598	1,86	.001	TAI > C
Self-Concept	2.039	1,85	N.S.	

TABLE 8
Individual Comparisons
Grade Three, TAI vs. RPM

Instrument	F	df	p <	Direction
CTBS - Math	1.856	1,91	N.S.	
Diagnostic	22.756	1,101	.001	TAI > RPM
Liking of Math	.008	1,102	N.S.	
Self-Concept	2.133	1,101	N.S.	

Comparisons of grade four students show (Table 9) that RPM students scored at a statistically significant level over Control students on the CTBS - math test ($p < .003$) and Liking of Math scale ($p < .001$). Table 10 shows a statistically significant difference in the performance of Control students over TAI students ($p < .004$) on the diagnostic test and, in Table 11, RPM students over TAI students on the CTBS - math test ($p < .005$) and diagnostic test ($p. < .001$).

TABLE 9
Individual Comparisons
Grade Four, RPM vs. Control

Instrument	F	df	p <	Direction
CTBS - Math	9.083	1,88	.003	RPM > C
Diagnostic	.641	1,94	N.S.	
Liking of Math	14.142	1,88	.001	RPM > C
Self-Concept	.952	1,88	N.S.	

TABLE 10
Individual Comparisons
Grade Four, TAI vs. Control

Instrument	F	df	p <	Direction
CTBS - Math	.060	1,92	N.S.	
Diagnostic	8.763	1,96	.004	C > TAI
Liking of Math	.525	1,90	N.S.	
Self-Concept	.038	1,90	N.S.	

TABLE 11
Individual Comparisons
Grade Four, TAI vs. RPM

Instrument	F	df	p <	Direction
CTBS - Math	8.273	1,85	.005	RPM > TAI
Diagnostic	12.039	1,91	.001	RPM > TAI
Liking of Math	.816	1,83	N.S.	
Self-Concept	.302	1,83	N.S.	

Table 12 shows that there was a statistically significant difference in the performance of the grade five Control students over RPM students ($p < .031$) on the diagnostic test and of RPM students over Control students on the self-concept scale ($p < .032$). TAI students also showed a statistically significant difference on the self-concept scale over Control students ($p < .008$) as shown in Table 13. Table 14 shows that there was a statistically significant performance on both the standardized ($p < .014$) and diagnostic tests ($p < .050$) by TAI students over RPM students.

TABLE 12
Individual Comparisons
Grade Five, RPM vs. Control

Instrument	F	df	p <	Direction
CTBS - Math	.301	1,116	N.S.	
Diagnostic	4.759	1,124	.031	C > RPM
Liking of Math	3.182	1,118	N.S.	
Self-Concept	4.724	1,117	.032	RPM > C

TABLE 13
Individual Comparisons
Grade Five, TAI vs. Control

Instrument	F	df	p <	Direction
CTBS - Math	2.244	1,110	N.S.	
Diagnostic	.006	1,115	N.S.	
Liking of Math	3.445	1,116	N.S.	
Self-Concept	7.294	1,114	.008	TAI > C

TABLE 14
Individual Comparisons
Grade Five, TAI vs. RPM

Instrument	F	df	p <	Direction
CTBS - Math	6.266	1,101	.014	TAI > RPM
Diagnostic	3.914	1,108	.050	TAI > RPM
Liking of Math	.036	1,103	N.S.	
Self-Concept	.143	1,102	N.S.	

As shown in Table 15, pretest comparisons of academic performance between classes in the different treatments show no significant differences ($p > .10$). However, the RPM groups entered the study with a better liking of math than did other groups.

TABLE 15
Analysis of Variance, TAI vs. RPM vs. Control, Full Sample
Comparison of Performance on Pretests

Instrument	F	df	p <	Direction
CTBS - Math	.826	2,431	N.S.	
Diagnostic	.299	2,466	N.S.	
Liking of Math	4.14	2,448	.02	RPM >TAI> C
Self-Concept	.783	2,445	N.S.	

The results of the overall comparison of TAI vs. RPM vs. Control on the standardized mathematics test (CTBS) showed that effects for treatment were not statistically significant. After adjustment for pretests and grade level by using the analysis of covariance the adjusted posttest scores were in the order TAI >RPM >Control. Statistically significant effects ($p < .001$) were found for the Liking of Math measure (RPM > TAI > Control) and for Self-Concept ($p < .017$; TAI > RPM > Control).

The comparison of TAI vs. RPM (Table 17) showed that TAI students scored significantly higher than RPM students on the diagnostic test ($p < .052$), but there

TABLE 16
Analysis of Covariance, TAI vs. RPM vs. Control, Full Sample
Posttest Comparisons on Achievement and Attitudes

Instrument	F	df	p<	Direction
CTBS - Math	2.74	2,429	N.S.	
Diagnostic	2.60	2,464	N.S.	
Liking of Math	11.60	2,446	.001	RPM>TAI>C
Self-Concept	4.11	2,443	.017	TAI >RPM>C

were no other differences. However, as is shown in Table 18, TAI students scored significantly higher than Control students on the CTBS-math test ($p < .021$), the Liking of Math scale ($p < .001$) and the Self-Concept scale ($p < .008$).

TABLE 17
Analysis of Covariance, TAI vs. RPM, Full Sample
Achievement and Attitudes

Instrument	F	df	p <	Direction
CTBS - Math	.305	1,282	N.S.	
Diagnostic	3.79	1,305	.052	TAI > RPM
Liking of Math	.015	1,293	N.S.	
Self-Concept	1.27	1,291	N.S.	

TABLE 18
Analysis of Covariance, TAI vs. Control, Full Sample
Achievement and Attitudes

Instrument	F	df	p <	Direction
CTBS - Math	5.36	1,282	.021	TAI> C
Diagnostic	.194	1,304	N.S.	
Liking of Math	16.26	1,297	.001	TAI >C
Self-Concept	7.22	1,294	.008	TAI >C

Although RPM students scored higher than Control students on the CTBS-math test and lower than Control students on the diagnostic test ($p < .052$), only the latter of these findings was statistically significant. RPM students scored significantly higher than Control on the Liking of Math scale ($p < .001$), and marginally higher on the Self-concept scale ($p < .075$).

TABLE 19
Analysis of Covariance, RPM vs. Control, Full Sample
Achievement and Attitudes

Instrument	F	df	p <	Direction
CTBS - Math	2.87	1,292	N.S.	
Diagnostic	3.82	1,317	.052	C > RPM
Liking of Math	19.37	1,300	.001	RPM > C
Self-Concept	3.19	1,299	N.S.	

Test-retest correlations of pre- and posttest instruments are shown in Table 20, and the correlations of the standardized (CTBS) mathematics test and the diagnostic test are reflected in Table 21.

TABLE 20
Reliability Estimates
Test-Retest Correlations

Instrument	r
CTBS - Math	.86
Diagnostic	.91
Liking of Math	.52
Self-Concept	.63

TABLE 21
Test Correlations
CTBS and Diagnostic

Test	r
CTBS and Diagnostic Pretests	.81
CTBS and Diagnostic Posttests	.86

CHAPTER FIVE

Conclusions and Discussion

Four hypotheses were formulated in the proposal which served as the foundation for this study. It was hypothesized that:

1. There will be a significant difference among treatments on the mean scores of the achievement pre-and posttests in favor of the TAI classes.
2. There will be a significant difference among treatments on the mean scores of the attitude pre- and posttests in favor of the TAI classes.
3. There will be a significant difference between treatments on the mean scores of the achievement pre- and posttests in favor of the RPM classes over the control classes.
4. There will be a significant difference between treatments on the mean scores of the attitude pre- and posttests in favor of the RPM classes over the control classes.

Conclusions

Full sample analyses (Table 5) show that TAI students gained more than RPM and Control students on both the CTBS-math and diagnostic tests, but that the gain was not statistically significant (Table 16). Tables 17 and 18 show that TAI students gained at a statistically significant level over RPM on the diagnostic test and over Control on the CTBS-math test, but hypothesis one was not confirmed by the results of the study.

Confirmation was not received on hypothesis two. RPM students showed a statistically significant gain ($p < .001$) over TAI and Control students on the Liking of Math scale, but TAI students gained a statistically significant amount ($p < .017$) over RPM and Control students on the Self-Concept scale (Tables 5 and 16). No statistical significance was found between TAI and RPM on both attitude scales (Table 17), but a statistically significant gain was found in favor of TAI over Control students on both the Liking of Math scale ($p < .001$) and the Self-Concept scale ($p < .008$, Table 18).

Hypothesis three cannot be confirmed. Results in Table 19 indicate that there was no significant difference between the RPM and Control groups on the CTBS-math test and that the Control group outperformed the RPM group on the diagnostic test ($p < .052$).

Hypothesis four was not fully confirmed. Although RPM students gained at a statistically significant level over Control students on the Liking of Math scale ($p < .001$), no significant difference could be determined on the Self-Concept scale (Table 19).

On the CTBS -mathematics test, both Team-Assisted Individualization and Rapid Progress Mathematics groups gained more than the Control group, while on the diagnostic test the Team-Assisted Individualization groups gained more than Rapid Progress Mathematics groups. This can be interpreted to mean that the results of the CTBS comparisons support the effectiveness of the individualized instructional program itself, while the results of the diagnostic test support the importance of the team component as an addition to the individualized program. Because the results from the CTBS -mathematics and diagnostic tests are different, firm conclusions are difficult to draw; but the fact that the Team-Assisted Individualization classes gained the most overall on both measures supports the conclusion that the TAI treatment is effective in increasing student achievement. The unclear factor is whether this is due to the use of the team/individualized instruction combination or just to the program of individualization.

Attitude effects were more distinct than achievement effects. They clearly showed that Team-Assisted Individualization and Rapid Progress Mathematics treatments increased student attitudes toward mathematics and toward their own mathematical abilities more than the Control condition. Because no differences were found between TAI and RPM on attitude measures, it must be assumed that the attitude effects are due to the use of the individualized mathematics program, not specifically to the combination of this program with the team component. This is contrary to Hypothesis 2 in that it was expected that the team component would add to student attitudes. This finding, however, does correspond to impressions which resulted from classroom visits where it was observed that students very much enjoyed both the Team-Assisted Individualization and Rapid Progress Mathematics treatments.

Discussion

Overall, the results of the study support the usefulness of Team-Assisted Individualization for increasing student mathematics achievement and student attitudes toward mathematics. While there were major differences in the total sample, some differences could be determined in favor of TAI at specific grade levels (Tables 7, 8, 13 and 14).

It was hypothesized that TAI would outperform both RPM and Control groups in terms of achievement. Perhaps the treatment was too short to effect such a change, or there may have been other factors since there is no way to control the actual procedures of implementation that teachers actually use.

There is a possibility that other mathematics learning was occurring that was not measured by the tests which were used in the study. Perhaps different findings would have occurred if another standardized test had been used, since some of the items on the CTBS-math test were unrelated to the units in the TAI program. This is a possible explanation as to why little significant difference was found on the TAI groups' CTBS-math test performance over other groups. Further studies should be concerned about the appropriateness of the achievement measure.

In an attempt to develop some insight into the feelings of the teachers who participated in the program, a short questionnnaire was developed and administered to the TAI and RPM teachers. Team-Assisted Individualization and Rapid Progress Mathematics teachers reported very positive attitudes toward the program on the part of both TAI and RPM, but neither received a stronger preference over the other. Of the six teachers involved in each treatment, five in each indicated that they would definitely use their method next year, and one teacher in each treatment predicted that she might use the same method. Four teachers in each treatment thought that their classes learned more than in their usual program, one teacher in each treatment felt that their classes learned about the same as in their usual program and one teacher in each treatment felt that their classes learned less. Two TAI teachers and one RPM teacher felt that their method was the best they had used to teach mathematics, three in each treatment liked it better than their usual methods, one in each treatment liked it the same as their usual methods, and one RPM teacher liked RPM less than her usual method.

A side note involves remarks from some teachers in the study. Comments included statements that certain students who seemed to have no desire to learn the basic facts did indeed learn them; that some students who were major discipline problems were no longer problems; that students who did not like mathematics and who were not performing assigned tasks won awards; that parents seemed enthused and supportive of the programs; and that both high and low achievers could work successfully in the same classroom.

In summary, there are some ambiguities in the results, but overall the study showed that Team-Assisted Individualization, the first attempt to combine cooperative learning methods with individualization, had significantly positive effects on both achievement and attitudes. Rapid Progress Mathematics had positive effects on student attitudes, but its effects on achievement were unclear. Classroom observations and a teacher survey gave the impression that both TAI and RPM are enjoyable methods of learning and teaching mathematics.

Contribution

Use of Team-Assisted Individualization provides teachers with a mathematics program which supports the Howard County Maryland Public School System's philosophy that students should receive instruction at their own level and rate of learning with emphasis on achievement, opportunities to increase computational skills, positive attitudes and acceleration. It also provides for the diverse abilities of students who are assigned to a single classroom.

The problems related to other individualized programs such as requiring the assistance of aides or volunteers, demands on the teacher, massive "checking" responsibilities, student wasting of time on known material or moving quickly through units without clear understanding, bored students, working in isolation, no peer interaction, infrequent feedback, proceeding on work which is error laden, waiting for checking and additional assignments, frustration and discipline problems are minimized through the use of Team-Assisted Individualization. It has now been shown that TAI provides an alternative to the current elementary school mathematics program which has never before existed which addresses most of the concerns related to individualized instruction expressed in the literature, and that these issues have been resolved.

Bestor (1955) wrote that the burden that individualized instruction places on the teacher is unrealistic and that the demands are beyond the reach of most teachers. Kepler and Randall (1977) wrote that materials in many individualized programs are not designed to provide clear directions to students, don't provide immediate feedback, create management problems for teachers and allow students to wait. Nix (1970), Osmundson (1972), Palow (1973) and Sutton (1976) agreed that the use of individualized programs overworked teachers. Schoen (1976) felt that the management problems which are part of individualized programs are detrimental to learning. The success of Team-Assisted Individualization shows that these need no longer be concerns.

This study supports the research related to cooperative team learning which shows that positive attitudinal and academic effects result from their use and that it provides teachers with an instructional strategy which allows for a successful way of meeting the diverse needs of students within the same class (Coleman, 1959; DeVries & Edwards, 1973; Slavin, 1978c, 1979; Johnson, Johnson, Johnson & Anderson, 1976; Wheeler, 1977). Additional research is supported by Team-Assisted Individualization which showed that there was an increase in the liking of mathematics and self-concept (Gottheil, 1955; Phillips, 1956; Phillips & D'Amico, 1956; DeVries & Slavin, 1976, 1978).

Limitations

Length of the study could be a contributing factor to many of the unclear results. It would be desirable to extend a similar study over a period of a school year as further described in this chapter.

For students who had been receiving instruction in a structured setting, it is possible that a period of adjustment to the independent learning component with the accompanying responsibilities delayed an immediate and total participation in the assigned treatment and that, over a longer period of time, this would have been eliminated.

It is probable that the confusing performance patterns between grade levels were partially due to differences between teachers rather than the differences in treatments. When dealing with such a small number of teachers, it is very likely that this did affect results. This is further supported by analyzing results of the teacher-attitude survey. Negative and positive teacher attitudes are known to impact upon learning. An interesting study would result if teachers were randomly selected from the total population as opposed to the random selection of schools and the utilization of the teachers who happen to be assigned therein.

The ultimate study would include the random selection of students throughout the county and the placement of these students in a particular treatment, but this is an impossibility in a public school system.

There was a general impression on the part of the researcher that the attitude of the building principal had a strong influence on the success of the program. One principal was so enthusiastic that new groups were formed and teachers were reassigned to accommodate the study. In a few others, the principal was involved on a daily basis, offered continuous support and learned details of the program. In two schools the principal had minimal participation. It might be interesting to study the effects of principal involvement on the success of an innovation such as TAI.

Many times the key to successful instruction is controlled by a teacher's management and organizational techniques rather than the knowledge of content. Limitations of individualized programs have been discussed previously in detail. Team-Assisted Individualization offers a solution to the multiple problems named, as well as provides a unique and workable management system which should make a positive impact in any classroom. Teaching ability is as diverse as the academic needs and abilities of students. TAI provides a successful alternative to the teaching of mathematics which, hopefully, will be used as widely throughout the country as are STAD, TGT and Jigsaw.

Implications for Howard County

It would be desirable to expand this study in the project schools. There is a strong feeling on the part of the researcher that, if the program were expanded over the period of a school year, results would show more consistent improvement in all four areas tested (CTBS - math, diagnostic, Liking of Math and self-concept). The intensive use of the Team-Assisted Individualization and Rapid Progress Mathematics programs over a period of eight weeks as was done in this study should be modified so that the program is in use for 2 to 3 weeks at a time. At the end of each of these periods, instruction should be directed to such units as measurement, geometry and other units not included in the material, and toward units with more emphasis on application of skills which lend themselves to activity-oriented and/or teacher-directed lessons.

Funds should be budgeted for the purpose of purchasing one set of materials for each of the nonproject schools and accompanying teacher inservice. Volunteer teachers within each school should have the opportunity to use the program.

The elementary supervisors should receive inservice on the program as well so each can serve as a resource person who is easily accessible to teachers in their assigned areas; however, the primary responsibility should be assumed by the elementary supervisor who is responsible for the mathematics curriculum for the county.

Inservice should include both the Team-Assisted Individualization and Rapid Progress Mathematics procedures so that teachers can opt to implement the program in the manner that is most appropriate for them. If results of the one-year study provide statistically significant results in favor of either TAI or RPM, the elementary supervisors should be responsible for conveying the results to the Director of Curriculum, principals and teachers who are using the programs.

It would be desirable to monitor the progress of the project students to determine if they score higher in mathematics on the required standardized tests which are administered to students each year, as well as to whether a greater percentage of these students enter classes in higher mathematics than do control students.

A similar new study should be made at the middle school to determine if Team-Assisted Individualization will provide a successful alternative at that level.

"Research on cooperative learning techniques represents an unusual event in the history of educational research. The techniques arose out of social-psychological theory; they have been evaluated in numerous field experiments that were generally high in both internal and external validity; and they are in use in hundreds of classrooms across the country and in Israel" (Slavin, 1980b, p. 110). The addition of Team-Assisted Individualization to cooperative learning techniques in the classroom should provide another successful alternative to those which presently exist.

Additional Research

As in any program of research there is a need for further investigation of limitations, interactions and extensions of findings, some of which might include the following as related to Team-Assisted Individualization:

1. What are optimum uses of TAI materials?
2. What effects on attitude and achievement would result if the TAI program were integrated with other units and extended over the period of one school year?
3. What effects does selection of the teacher have on the successful implementation of the TAI program?
4. Can additional units be developed and successfully incorporated into the TAI program?

5. With what types of students is TAI most effective?

6. To what degree does student training for working in TAI affect the success of student achievement and attitude?

7. How can TAI be adapted for use with students who have special needs?

Appendices

Name ______________________________

Teacher ______________________________

Mathematics Attitude Questionnaire

How do you feel about your math class? Please tell us how you honestly feel. This is not a test, and no one in your school will know what you write down.

DIRECTIONS:

1. Read each sentence carefully.
2. Think about how well the sentence describes the class you are in now.
3. Circle one (and only one) of the four words across from the sentence.

   Circle YES! if you think the statement is definitely true for you.

   Circle yes if you think the statement is mostly true for you.

   Circle no if you think the statement is mostly not true for you.

   Circle NO! if you think the statement is definitely not true for you.

EXAMPLES:

1. I like spinach. YES! yes no NO!

   Circle the letter that tells how you feel about spinach.

   --If you really love spinach, circle YES!
   --If you kind of like it, circle yes.
   --If you do not like it, circle no.
   --If you hate it, circle NO!

2. I do not like to roller skate. YES! yes no NO!

   --If you do like to roller skate very much, you would circle NO!, because the sentence is definitely not true for you.

1.	I like this math class very much.	YES!	yes	no	NO!
2.	I am good at math in this class.	YES!	yes	no	NO!
3.	This math class is always a lot of fun.	YES!	yes	no	NO!
4.	I can do almost all the math problems in this class.	YES!	yes	no	NO!
5.	This math class is sometimes boring.	YES!	yes	no	NO!
6.	I'm proud of my math work in this class.	YES!	yes	no	NO!
7.	This math class is the best part of my school day.	YES!	yes	no	NO!
8.	I have trouble learning new things in math.	YES!	yes	no	NO!
9.	I look forward to math class every day.	YES!	yes	no	NO!
10.	I'm doing the best work I can do in math.	YES!	yes	no	NO!
11.	I wish I didn't have to go to this math class.	YES!	yes	no	NO!
12.	I can do math as well as anyone else in this class.	YES!	yes	no	NO!
13.	I like learning math in this class.	YES!	yes	no	NO!
14.	I'm a success in math.	YES!	yes	no	NO!
15.	I like my math class this year better than last year.	YES!	yes	no	NO!
16.	I worry a lot when I have to take a math test.	YES!	yes	no	NO!

LIST OF UNITS BY SKILL AREA

Numeration

N1 Numeration - Tens
N2 Numeration - Hundreds
N3 Numeration - Working with Ones, Tens and Hundreds
N4 Numeration - Thousands
N5 Numeration - Greater than, Less than
N6 Numeration - Ten Thousands
N7 Numeration - Hundred Thousands
N8 Numeration - Place Value
N9 Numeration - Millions and Billions
N10 Numeration - Approximation

Addition

AF1 Understanding Addition
A1 Adding Three Numbers
A2 Adding One Digit and Two Digits
A3 Adding Two Digits and Two Digits
A4 Adding Three or Four Single Digit Addends
A5 Adding Three Digits and Three Digits
A6 Adding One or Two Digits to Three Digits
A7 Introduction to Addition with Renaming
A8 Addition: Renaming with Tens and Hundreds
A9 Renaming Twice in Addition
A10 Renaming When Necessary
A11 Column Addition
A12 Adding Four or Five Digits: No Renaming
A13 Renaming More than Twice
A14 Adding Money

Subtraction

S1 Subtracting Two or Three Digits Minus One Digit: No Renaming
S2 Subtracting Two or Three Digits Minus Two Digits: No Renaming
S3 Renaming Tens as Ones
S4 Renaming Tens as Ones for Subtraction
S5 Renaming Hundreds as Tens
S6 Renaming Hundreds as Tens for Subtraction
S7 Renaming Twice in Subtraction
S8 Zero in Subtraction I
S9 Zero in Subtraction II
S10 Renaming Thousands in Subtraction
S11 Subtracting Money

Multiplication

M1 Introduction to Multiplication
M2 Multiplying Multiples of Ten by One Digit
M3 Multiplying Two Digits by One Digit: No Renaming
M4 Multiplying Two Digits by One Digit with Renaming
M5 Multiplying Multiples of 100 by One Digit
M6 Multiplying Three Digits by One Digit with Carrying
M7 Multiplying Three Digits by One Digit: Zero in the Tens' or Ones' Place
M8 Multiplying by Multiples of Ten: No Carrying
M9 Multiplying by Multiples of Ten with Carrying
M10 Multiplying Two Digits by Two Digits: The Long Way
M11 Multiplying Two Digits by Two Digits: The Short Way: No Carrying
M12 Multiplying Two Digits by Two Digits: Carrying Once
M13 Multiplying Two Digits by Two Digits: Carrying Twice
M14 Multiplying Three Digits by Three Digits
M15 Multiplying with Money

Division

D1 Introduction to Division
D2 Labeling in Division
D3 Two Digits ÷ One Digit = Two Digits
D4 Two Digits ÷ One Digit = One or Two Digits
D5 Division with a Remainder
D6 Checking an Estimate: Too Much
D7 Checking an Estimate: Too Little and Too Much
D8 Two Digits ÷ One Digit = One Digit
D9 Two Digits ÷ One Digit = Two Digits: With Renaming, No Remainder
D10 Two Digits ÷ One Digit = Two Digits: With Renaming and Remainder
D11 Two Digits ÷ One Digit = Two Digits: Zero in the Ones' Place
D12 Mixed Practice: Two Digits ÷ One Digit
D13 Three Digits ÷ One Digit = Three Digits
D14 Three Digits ÷ One Digit = Two or Three Digits
D15 Three Digits ÷ One Digit = Three Digits: Zero in the Tens' Place
D16 Mixed Practice: Three Digits ÷ One Digit
D17 Four Digits ÷ One Digit = Three or Four Digits
D18 Two or Three Digits ÷ Multiples of Ten = One Digit: No Renaming
D19 Three Digits ÷ Multiples of Ten = Two Digits: Estimating with Renaming
D20 Three Digits ÷ Multiples of Ten = Two Digits: With Renaming and Remainder
D21 Three Digits ÷ Multiples of Ten = One or Two Digits
D22 Three Digits ÷ Two Digits = One Digit: Learning to Estimate
D23 Three Digits ÷ Two Digits = One Digit: Estimate Too High or Too Low
D24 Three Digits ÷ Two Digits = Two Digits: Learning to Estimate
D25 Three Digits ÷ Two Digits = Two Digits: Estimate Too High
D26 Three Digits ÷ Two Digits = Two Digits: Estimate Too Low
D27 Three Digits ÷ Two Digits = Two Digits: Mixed Practice
D28 Four Digits ÷ Two Digits = Two or Three Digits

Common Fractions

F1 Identifying 1/2, 1/3, 1/4, 1/5, and 1/8
F2 Numerators Greater Than One
F3 Fractions and Whole Numbers
F4 Comparing Fractions I
F5 Comparing Fractions II
F6 Addition of Fractions I
F7 Subtraction of Fractions I
F8 Equivalent Fractions
F9 Factors
F10 Greatest Common Factor
F11 Simplest Name
F12 Addition of Fractions II: Simplest Name for the Sum
F13 Subtraction of Fractions II: Simplest Name for the Difference
F14 Mixed Numerals
F15 Addition with Mixed Numerals: Like Denominators
F16 Least Common Multiple
F17 Least Common Denominator
F18 Addition with Unlike Denominators
F19 Subtraction with Unlike Denominators
F20 Dividing to Find Mixed Numerals
F21 Addition of Fractions III: Improper Fractions in the Sum
F22 Subtraction of Fractions III: Mixed Numerals in the Difference
F23 Multiplying Fractions I
F24 Multiplying Fractions II: Fractions with Whole Numbers
F25 Multiplying Fractions III: Fractions and Mixed Numerals
F26 Multiplying Fractions IV: Mixed Numerals/Mixed Numerals and Whole Numbers
F27 Multiplying Fractions V: Reciprocals
F28 Dividing Fractions I: Dividing a Fraction by a Fraction
F29 Dividing Fractions II: Fractions and Whole Numbers
F30 Dividing Fractions III: Fractions and Mixed Numerals
F31 Addition of Fractions IV: Mixed Numerals with Unlike Denominators
F32 Subtraction of Fractions IV: Mixed Numerals with Unlike Denominators

Decimal Fractions

Dec1 Decimal Tenths
Dec2 Decimal Hundredths
Dec3 Decimal Thousandths
Dec4 Decimal: Place Value
Dec5 Comparing Decimals
Dec6 Adding Decimals
Dec7 Subtracting Decimals
Dec8 Multiplying by 10, 100, 1000
Dec 9 Multiplying by .1, .01, .001
Dec10 Multiplying with Decimals
Dec11 Dividing by Tenths
Dec12 Dividing by Hundredths
Dec13 Dividing Whole Numbers with a Decimal Divisor
Dec14 Writing Decimal Fractions for Common Fractions

Word Problems

W1 Word Problems: Addition or Subtraction
W2 Word Problems: Multiplication
W3 Word Problems: Addition or Multiplication
W4 Word Problems: Addition, Subtraction or Multiplication
W5 Word Problems: Division
W6 Word Problems: Multiplication or Division
W7 Word Problems: Addition, Subtraction, Multiplication or Division

Ratio and Per Cent

R1 Ratios: An Introduction
R2 Equivalent Ratios
R3 Ratios: Time, Rate and Distance
R4 Ratios and Money
P1 Introduction to Per Cent
P2 Decimals and Fractions for Per Cent
P3 Per Cents for Decimals and Fractions
P4 Using Per Cent in Multiplication: Fraction Method
P5 Using Per Cent in Multiplication: Decimal Method

Team Assisted Individualization

Math Progress Form

You may decide to start with any skill (addition, multiplication, and so on) you wish within a block. You must complete all of the units on that skill before moving to another skill. You must complete all of the skills within a block before starting a new block.

Date Comp.	Test Score	BLOCK 1	Date Comp.	Test Score	BLOCK 2
		N1 Numeration - Tens			N2 Numeration: Hundreds
		A Intro-Understanding Addition			A5 Adding Three Digits and Three Digits
		A1 Adding Three Numbers			A6 Adding One or Two Digits to Three Digits
		A2 Adding One Digit and Two Digits			S Intro-Understanding Subtraction
		A3 Adding Two Digits and Two Digits			S1 Subtracting Two or Three Digits Minus One Digit-No Renaming
		A4 Adding Three or Four Single Digit Addends			S2 Subtracting Two or Three Digits Minus Two Digits - No Renaming
		BLOCK 3			BLOCK 4
		N3 Numeration-Working with Ones & Hundreds			S3 Renaming Tens as Ones as Ones
		A7 Introduction to Addition with Renaming			S4 Renaming Tens as Ones for Subtraction
		A8 Addition-Renaming in Tens and Hundreds			S5 Renaming Hundreds as Tens
		A9 Renaming Twice in Addition			S6 Renaming Hundreds as Tens For Subtraction
		W1 Word Problems: Addition or Subtraction			A10 Renaming When Necessary
					A11 Column Addition

You may decide to start with any skill (addition, multiplication, and so on) you wish within a block. You must complete all of the units on that skill before moving to another skill. You must complete all of the skills within a block before starting a new block.

Date Comp.	Test Score	BLOCK 5	Date Comp.	Test Score	BLOCK 6
		S7 Renaming Twice in Subtraction S8 Zero in Subtraction I S9 Zero in Subtraction II N4 Numeration - Thousands N5 Numeration - Greater Than Less Than N6 Numeration - Ten Thousands			A12 Adding Four or Five Digits- No Renaming A13 Renaming More Than Twice A14 Adding Money S10 Renaming Thousands in Subtraction S11 Subtracting Money M1 Introduction to Multiplication
		BLOCK 7 M2 Multiplying Multiples of ten by one digit M3 Multiplying Two Digits by One Digit (No Renaming) M4 Multiplying Two Digits by One Digit with Renaming M5 Multiplying Mulitiples of 100 by One Digit M6 Multiplying Three Digits by One Digit with Carrying W2 Word Problems: Multiplication			BLOCK 8 M7 Multiplying Three Digits by One Digit: Zero in the Tens' or Ones' Place M8 Multiplying by Multiples of Ten: No Carrying M9 Multiplying by Multiples of Ten With Carrying W3 Addition or Multiplication D1 Introduction to Division D2 Labeling in Division

You may decide to start with any skill (addition, multiplication, and so on) you wish within a block. You must complete all of the units on that skill before moving to another skill. You must complete all of the skills within a block before starting a new block.

Date Comp.	Test Score	BLOCK 9
		M10 Multiplying Two Digits by Two Digits: The Short Way
		M11 Multiplying Two Digits by Two Digits: The Long Way - No Carrying
		D3 Two Digits ÷One Digit = Two Digits
		D4 Two Digits ÷One Digit = One or Two Digits
		D5 Division with a Remainder
		W4 Addition, Subtraction or Multiplication

Date Comp.	Test Score	BLOCK 10
		F1 Identifying 1/2, 1/3, 1/4, 1/5 and 1/8
		F2 Numerations Greater Than One
		W5 Word Problems: Division
		D6 Checking an Estimate: Too Much
		D7 Checking an Estimate: Too Little & Too Much
		D8 Two Digits ÷ One Digit = One Digit
		N7 Hundred Thousands

Date Comp.	Test Score	BLOCK 11
		F3 Fractions and Whole Numbers
		F4 Comparing Fractions I
		F5 Comparing Fractions II
		M12 Multiplying Two Digits by Two Digits Carrying Once
		M13 Multiplying Two Digits by Two Digits Carrying Twice
		N8 Numeration: Place Value

Date Comp.	Test Score	BLOCK 12
		N9 Millions and Billions
		D9 Two Digits ÷ One Digit = Two Digits with Renaming, no Remainder
		D10 Two Digits÷One Digit = Two Digits with Renaming and Remainder
		F6 Addition of Fractions I
		F7 Subtraction of Fractions I
		F8 Equivalent Fractions

You may decide to start with any skill (addition, multiplication, and so on) you wish within a block. You must complete all of the units on that skill before moving to another skill. You must complete all of the skills within a block before starting a new block.

Date Comp.	Test Score	BLOCK 13
		M14 Multiplying Three Digits by Three Digits
		M15 Multiplying with Money
		F9 Factors
		F10 Greatest Common Factor
		F11 Simplest Name
		W6 Word Problems: Multiplication or Division

Date Comp.	Test Score	BLOCK 14
		D11 Two Digits ÷ One Digit = Two Digits: Zero In the Ones' Place
		D12 Mixed Practice - Two Digits ÷ One Digit
		F12 Addition of Fractions II: Simplest Name for the Sum
		F13 Subtraction of Fractions II: Simplest Name for the Difference
		F14 Mixed Numerals
		F15 Addition with Mixed Numerals: Like Denominators

Date Comp.	Test Score	BLOCK 15
		W7 Word Problems: Addition, Subtraction, Multiplication or Division
		N10 Numeration: Approximation
		D13 Three Digits ÷ One Digit = Three Digits
		D14 Three Digits ÷ One Digit = Two or Three Digits
		D15 Three Digits ÷ One Digit = Three Digits Zero in the Tens' Place
		D16 Mixed Practice: Three Digits ÷ One Digit

Date Comp.	Test Score	BLOCK 16
		Dec 1 Decimal Tenths
		Dec 2 Decimal Hundredths
		Dec 3 Decimal Thousandths
		Dec 4 Decimals: Place Value
		D17 Four Digits ÷ One Digit = Three or Four Digits

You may decide to start with any skill (addition, multiplication, and so on) you wish within a block. You must complete all of the units on that skill before moving to another skill. You must complete all of the skills within a block before starting a new block.

Date Comp.	Test Score	BLOCK 17
		Dec 5 Comparing Decimals
		Dec 6 Adding Decimals
		Dec 7 Subtracting Decimals
		D18 Two or Three Digits ÷ Multiples of Ten = One Digit: No Renaming
		D19 Three Digits ÷ Multiples of Ten = Two Digits Estimating with Renaming
		D20 Three Digits ÷ Multiples of Ten = Two Digits: With Renaming and Remainder
		D21 Three Digits ÷ Multiples of Ten = One or Two Digits
		BLOCK 19
		F16 Least Common Multiple
		F17 Least Common Denominator
		F18 Addition with Unlike Denominators
		F19 Subtraction with Unlike Denominators
		F20 Dividing to Find Mixed Numerals
		D28 Four Digits ÷ Two Digits = Two or Three Digits

Date Comp.	Test Score	BLOCK 18
		D22 Three Digits ÷ Two Digits = One Digit: Learning to Estimate
		D23 Three Digits ÷ Two Digits = One Digit: Estimate Too High or Too Low
		D24 Three Digits ÷ Two Digits = Two Digits: Learning to Estimate
		D25 Three Digits ÷ Two Digits: Estimate Too High
		D26 Three Digits ÷ Two Digits = Two Digits: Estimate Too Low
		D27 Three Digits ÷ Two Digits = Two Digits: Mixed Practice

You may decide to start with any skill (addition, multiplication, and so on) you wish within a block. You must complete all of the units on that skill before moving to another skill. You must complete all of the skills within a block before starting a new block.

Date Comp.	Test Score	BLOCK 20	Date Comp.	Test Score	BLOCK 21
		F21 Addition of Fractions III: Improper Fractions in the Sum			F28 Dividing Fractions I: Dividing a Fraction by a Fraction
		F22 Subtraction of Fractions III: Mixed Numerals in The Difference			F29 Dividing Fractions II: Fractions and Whole Numbers
		F23 Multiplying Fractions I			Dec8 Multiplying by 10, 100, 1000
		F24 Multiplying Fractions II: Fractions with Whole Numbers			Dec9 Multiplying by .1, .01, .001
		F25 Multiplying Fractions III: Fractions and Mixed Numerals			Dec10 Multiplying with Decimals
		F26 Multiplying Fractions IV: Mixed Numerals With Mixed Numerals and Whole Numbers			Dec11 Dividing by Tenths
		F27 Multiplying Fractions V: Reciprocals			Dec12 Dividing by Hundredths

		BLOCK 22
		F30 Dividing Fractions III: Fractions and Mixed Numerals
		F31 Addition of Fractions III: Fractions and Mixed Numerals
		F32 Subtraction of Fractions IV: Mixed Numerals with Unlike Denominators
		Dec13 Dividing Whole Numbers with a Decimal Divider
		Dec14 Writing Decimal Fractions for Common Fractions

You may decide to start with any skill (addition, multiplication, and so on) you wish within a block. You must complete all of the units on that skill before moving to another skill. You must complete all of the skills within a block before starting a new block.

Date Comp.	Test Score	BLOCK 23
		P1 Introduction to Per Cent
		P2 Decimals and Fractions for Per Cent
		P3 Per Cents for Decimals and Fractions
		P4 Using Per Cent in Multiplication: Fraction Method
		P5 Using Per Cent in Multiplication: Decimal Method
		R1 Ratios: An Introduction
		R2 Equivalent Ratios
		R3 Ratios: Time, Rate and Distance
		R4 Ratios and Money

TEAM SCORE SHEET

Team FANTASTIC FOUR Week Beginning MARCH 23 Ending MARCH 27

Student		1	2	3	4	5	6	7	8	9	10
ANDY BAKER	Unit	D6	D7	D8							
	Score	14	15	15							
CINDY DOREN	Unit	S7	S8	S9	M1						
	Score	15	13	15	14						
ELAINE FORD	Unit	F6	F7								
	Score	15	15								
GEORGE HALL	Unit	Dec 1	Dec 2	Dec 3							
	Score	13	12	15							
	Unit										
	Score										

Total Number Correct		Total Number of Tests Taken		Accuracy Score	No. Units Completed X 10		No. Students on Team		Progress Score		Accuracy Score		Team Score
171	÷	12	=	14	120 (12 x 10)	÷	4	=	30	+	14	=	44

GREAT TEAM!

Week Beginning MARCH 23 Ending MARCH 27

Individual Progress Record

Student		1	2	3	4	5	6	7	8	9	10
ANDY BAKER	Unit	D6	D7	D8							
	Score	14	15	15							
CINDY DOREN	Unit	S7	S8	S9	MF3						
	Score	15	13	15	15						
ELAINE FORD	Unit	F6	F7								
	Score	15	15								
GEORGE HALL	Unit	Dec 1	Dec 2	Dec 3							
	Score	13	12	15							
IRIS JONES	Unit	M12	M13	DF1	M14						
	Score	15	14	15	13						
KIM LEWIS	Unit	A11	A12	S6	S7	S8	MF1	W3			
	Score	15	14	15	15	14	15	13			
MIKE NELSON	Unit	D3	DF3	D4	D5						
	Score	13	15	15	15						
OCTAVIA POPE	Unit	Dec 5	Dec 6								
	Score	14	15								
QUINN ROSE	Unit	F13	F14	F15	D13	D14	W7				
	Score	13	14	15	14	15	14				
SARA TORRES	Unit	N8	S9	S10	MF2	S11					
	Score	15	14	14	15	14					
URSULA VANN	Unit	Dec 9									
	Score	15									
WILL XAVIER	Unit	D24	D25	DF6	D26						
	Score	13	15	15	14						
YOLANDA ZACK	Unit	F9	F10	DF1	W4						
	Score	15	15	15	13						
	Unit										
	Score										
	Unit										
	Score										
	Unit										
	Score										

Team Assisted Individualization

Facts Progress Form

Addition

__________A

__________B

__________A + B

__________C

__________B + C

__________A + B + C

Subtraction

__________A

__________B

__________A + B

__________C

__________B + C

__________A + B + C

Multiplication

__________A

__________B

__________A + B

__________C

__________B + C

__________A + B + C

Division

__________A

__________B

__________A + B

__________C

__________B + C

__________A + B + C

Name____________________

Date____________________

Number Correct____________

Addition Facts

Work only these problems

_____ A
_____ B
_____ A &
_____ C
_____ B &
_____ A, B &

A

7	2	7	1	6	6	3	4	2	9
+3	+2	+1	+3	+0	+2	+3	+2	+1	+2

6	8	0	9	6	8	7	8	4	8
+0	+3	+2	+1	+3	+1	+2	+3	+1	+0

3 + 2 =   5 + 2 =   4 + 3 =   5 + 0 =   2 + 3 =

9 + 3 =   0 + 0 =   1 + 2 =   5 + 3 =   8 + 2 =

B

1	4	7	6	2	6	8	2	3	5
+5	+4	+6	+5	+6	+4	+6	+4	+5	+6

8	1	6	4	0	9	5	5	3	0
+4	+6	+6	+5	+4	+5	+4	+5	+6	+5

7 + 5 =   7 + 4 =   8 + 5 =   0 + 6 =   1 + 4 =

3 + 4 =   9 + 6 =   4 + 6 =   9 + 4 =   2 + 5 =

C

5	7	3	1	2	2	4	9	7	6
+7	+8	+9	+7	+8	+9	+7	+9	+7	+9

2	1	9	6	4	4	5	8	5	0
+7	+9	+8	+7	+8	+9	+8	+7	+9	+8

1 + 8 =   0 + 7 =   8 + 9 =   8 + 8 =   0 + 9 =

7 + 9 =   6 + 8 =   3 + 8 =   3 + 7 =   9 + 7 =

Subtraction Facts

Name________________________

Date________________________

Number Correct____________

Work only these problems
_____ A
_____ B
_____ A and B
_____ C
_____ B and C
_____ A, B and C

A

8	8	5	1	4	3	7	2	7	8
- 2	- 0	- 2	- 1	- 3	- 2	- 3	- 1	- 2	- 1

6	6	10	9	7	12	9	10	11	0
- 2	- 3	- 3	- 2	- 1	- 3	- 1	- 2	- 3	- 0

2 - 2 =　　4 - 1 =　　6 - 0 =　　8 - 3 =　　5 - 1 =

3 - 3 =　　11 - 2 =　　5 - 3 =　　4 - 2 =　　9 - 3 =

B

6	8	12	12	13	7	7	11	9	11
- 4	- 6	- 4	- 6	- 4	- 6	- 5	- 6	- 4	- 5

9	7	13	5	4	15	10	10	10	12
- 5	- 4	- 6	- 5	- 4	- 6	- 5	- 6	- 4	- 5

9 - 6 =　　11 - 4 =　　13 - 5 =　　6 - 6 =　　8 - 4 =

5 - 4 =　　8 - 5 =　　14 - 6 =　　14 - 5 =　　6 - 5 =

C

9	11	8	12	13	9	11	11	17	15
- 8	- 9	- 7	- 9	- 7	- 9	- 8	- 7	- 9	- 8

14	12	10	16	8	13	9	15	16	15
- 7	- 8	- 7	- 9	- 8	- 9	- 7	- 9	- 8	- 7

18 - 9 =　　16 - 7 =　　10 - 8 =　　12 - 7 =　　14 - 8 =

7 - 7 =　　13 - 8 =　　17 - 8 =　　10 - 9 =　　14 - 9 =

Multiplication Facts

me____________________

te____________________

mber Correct________________

Work only these problems

- ____ A
- ____ B
- ____ A and B
- ____ C
- ____ B and C
- ____ A, B and C

9	4	0	1	8	2	3	3	5	6
x 0	x 3	x 2	x 1	x 3	x 2	x 3	x 1	x 3	x 2

3	0	4	7	7	9	2	9	0	5
x 2	x 3	x 0	x 3	x 2	x 1	x 3	x 2	x 1	x 2

1 x 3 =	0 x 0 =	8 x 2 =	6 x 1 =	6 x 0 =
1 x 2 =	9 x 3 =	4 x 2 =	6 x 3 =	5 x 1 =

1	2	4	4	6	2	0	0	6	7
x 5	x 6	x 4	x 6	x 5	x 4	x 5	x 6	x 4	x 5

1	3	7	3	5	5	9	5	9	2
x 4	x 5	x 6	x 4	x 6	x 4	x 6	x 5	x 4	x 5

7 x 4 =	9 x 5 =	6 x 6 =	8 x 6 =	8 x 4 =
8 x 5 =	3 x 6 =	0 x 4 =	4 x 5 =	1 x 6 =

5	1	4	9	8	0	6	2	3	3
x 7	x 8	x 9	x 7	x 9	x 8	x 9	x 7	x 9	x 8

8	1	9	4	8	7	7	2	6	3
x 8	x 7	x 9	x 8	x 7	x 9	x 7	x 9	x 8	x 7

6 x 7 =	5 x 8 =	7 x 8 =	5 x 9 =	1 x 9 =
0 x 9 =	4 x 7 =	2 x 8 =	0 x 7 =	9 x 8 =

Division Facts

ame ______________________

ate ______________________

umber Correct ______________________

Work only these problems
- ____ A
- ____ B
- ____ A and B
- ____ C
- ____ B and C
- ____ A, B and C

3) 12	1) 0	2) 2	1) 6	3) 21	2) 10	3) 3	1) 3
2) 6	3) 6	2) 16	1) 5	2) 8	3) 27	2) 4	1) 8
2) 0	1) 2	3) 0	1) 1	3) 9	1) 7	3) 15	2) 12

14 ÷ 2 = 9 ÷ 1 = 24 ÷ 3 = 4 ÷ 1 = 18 ÷ 2 = 18 ÷ 3 =

3

5) 15	6) 36	5) 0	4) 16	6) 54	5) 10	6) 18	4) 12
4) 4	5) 40	4) 24	6) 12	5) 30	4) 0	6) 42	4) 28
5) 5	6) 24	4) 32	6) 0	5) 20	6) 30	4) 36	5) 35

20 ÷ 4 = 25 ÷ 5 = 6 ÷ 6 = 48 ÷ 6 = 8 ÷ 4 = 45 ÷ 5 =

C

9) 9	7) 0	9) 63	8) 32	7) 28	8) 8	9) 18	7) 42
8) 56	9) 45	7) 63	9) 36	8) 48	7) 21	9) 54	8) 72
7) 35	8) 16	9) 72	7) 7	8) 0	9) 0	7) 49	8) 64

24 ÷ 8 = 14 ÷ 7 = 27 ÷ 9 = 40 ÷ 8 = 56 ÷ 7 = 81 ÷ 9 =

INSTRUCTION SHEET: Adding One Digit and Two Digits

You will be able to do problems like this:

$$\begin{array}{r} 64 \\ +\ 3 \\ \hline 67 \end{array}$$

1ST Step

WHEN you add a one digit numeral to a two digit numeral FIRST add the ones' place

$$\begin{array}{r} 64 \\ +\ 3 \\ \hline \end{array}$$

THINK

3 plus 4=7

WRITE "7" in the sum here in the ones' place.

$$\begin{array}{r} 64 \\ +\ 3 \\ \hline 7 \end{array}$$

2nd Step

THEN add the tens' place.

$$\begin{array}{r} 64 \\ +\ 3 \\ \hline 7 \end{array}$$

THINK

$$\begin{array}{r} 64 \\ +\ 03 \\ \hline \end{array}$$

I am adding no tens and 6 tens.

0 plus 6=6

WRITE "6" in the sum here in the tens' place.

$$\begin{array}{r} 64 \\ +\ 3 \\ \hline 67 \end{array}$$

THAT'S IT!

A2

Skillsheet: Adding One Digit and Two Digits

Step 1: Add the ones.

1) 28 + 1 = 9	2) 74 + 3	3) 65 + 2	4) 80 + 8	5) 93 + 3
6) 34 + 2	7) 55 + 4	8) 41 + 1	9) 12 + 6	10) 54 + 4
11) 72 + 5	12) 23 + 6	13) 50 + 5	14) 46 + 2	15) 81 + 5
16) 63 + 6	17) 22 + 3	18) 31 + 4	19) 92 + 7	20) 60 + 8

Skillsheet: Adding One Digit and Two Digits

Step 2: Now, add the tens.

1) 41 + 8 = 9	2) 33 + 3 = 6	3) 92 + 5 = 7	4) 52 + 7 = 9
5) 66 + 2 = 8	6) 73 + 6 = 9	7) 84 + 4 = 8	8) 10 + 9 = 9
9) 24 + 5 = 9	10) 47 + 2 = 9	11) 56 + 3 = 9	12) 92 + 6 = 8
13) 77 + 1 = 8	14) 85 + 3 = 8	15) 60 + 8 = 8	16) 25 + 4 = 9
17) 31 + 6 = 7	18) 52 + 4 = 6	19) 46 + 2 = 8	20) 95 + 4 = 9

A2

Skillsheet: Adding One Digit and Two Digits

Step 3: Add and write the answer.

1) 26 + 2	2) 35 + 1	3) 86 + 3	4) 71 + 7
5) 62 + 4	6) 51 + 5	7) 42 + 2	8) 93 + 6
9) 15 + 3	10) 82 + 1	11) 33 + 4	12) 25 + 4
13) 75 + 1	14) 41 + 8	15) 53 + 5	16) 61 + 1
17) 92 + 3	18) 14 + 4	19) 81 + 6	20) 32 + 7

Skillsheet Answers: Adding One Digit and Two Digits

Step 1: Add the ones.

1)	2)	3)	4)	5)
28	74	65	80	93
+ 1	+ 3	+ 2	+ 8	+ 3
9	7	7	8	6
6)	7)	8)	9)	10)
34	55	41	12	54
+ 2	+ 4	+ 1	+ 6	+ 4
6	9	2	8	8
11)	12)	13)	14)	15)
72	23	50	46	81
+ 5	+ 6	+ 5	+ 2	+ 5
7	9	5	8	6
16)	17)	18)	19)	20)
63	22	31	92	60
+ 6	+ 3	+ 4	+ 7	+ 8
9	5	5	9	8

A2

Skillsheet Answers: Adding One Digit and Two Digits

Step 2: Now, add the tens.

1) 41 + 8 = 49

2) 33 + 3 = 36

3) 92 + 5 = 97

4) 52 + 7 = 59

5) 66 + 2 = 68

6) 73 + 6 = 79

7) 84 + 4 = 88

8) 10 + 9 = 19

9) 24 + 5 = 29

10) 47 + 2 = 49

11) 56 + 3 = 59

12) 92 + 6 = 98

13) 77 + 1 = 78

14) 85 + 3 = 88

15) 60 + 8 = 68

16) 25 + 4 = 29

17) 31 + 6 = 37

18) 52 + 4 = 56

19) 46 + 2 = 48

20) 95 + 4 = 99

A2

Skillsheet Answers: Adding One Digit and Two Digits

Step 3: Add and write the answer.

1) 26 + 2 = 28	2) 35 + 1 = 36	3) 86 + 3 = 89	4) 71 + 7 = 78
5) 62 + 4 = 66	6) 51 + 5 = 56	7) 42 + 2 = 44	8) 93 + 6 = 99
9) 15 + 3 = 18	10) 82 + 1 = 83	11) 33 + 4 = 37	12) 25 + 4 = 29
13) 75 + 1 = 76	14) 41 + 8 = 49	15) 53 + 5 = 58	16) 61 + 1 = 62
17) 92 + 3 = 95	18) 14 + 4 = 18	19) 81 + 6 = 87	20) 32 + 7 = 39

A2

Checkout: Adding One Digit and Two Digits

A: Add

1) 32 + 5

2) 61 + 4

3) 88 + 1

4) 43 + 2

5) 94 + 3

6) 72 + 7

7) 11 + 6

8) 55 + 3

9) 24 + 4

10) 67 + 2

B: Add

1) 85 + 1

2) 56 + 2

3) 30 + 9

78 + 1

5) 23 + 3

6) 64 + 5

7) 91 + 7

8) 45 + 3

9) 12 + 6

10) 46 + 3

A2

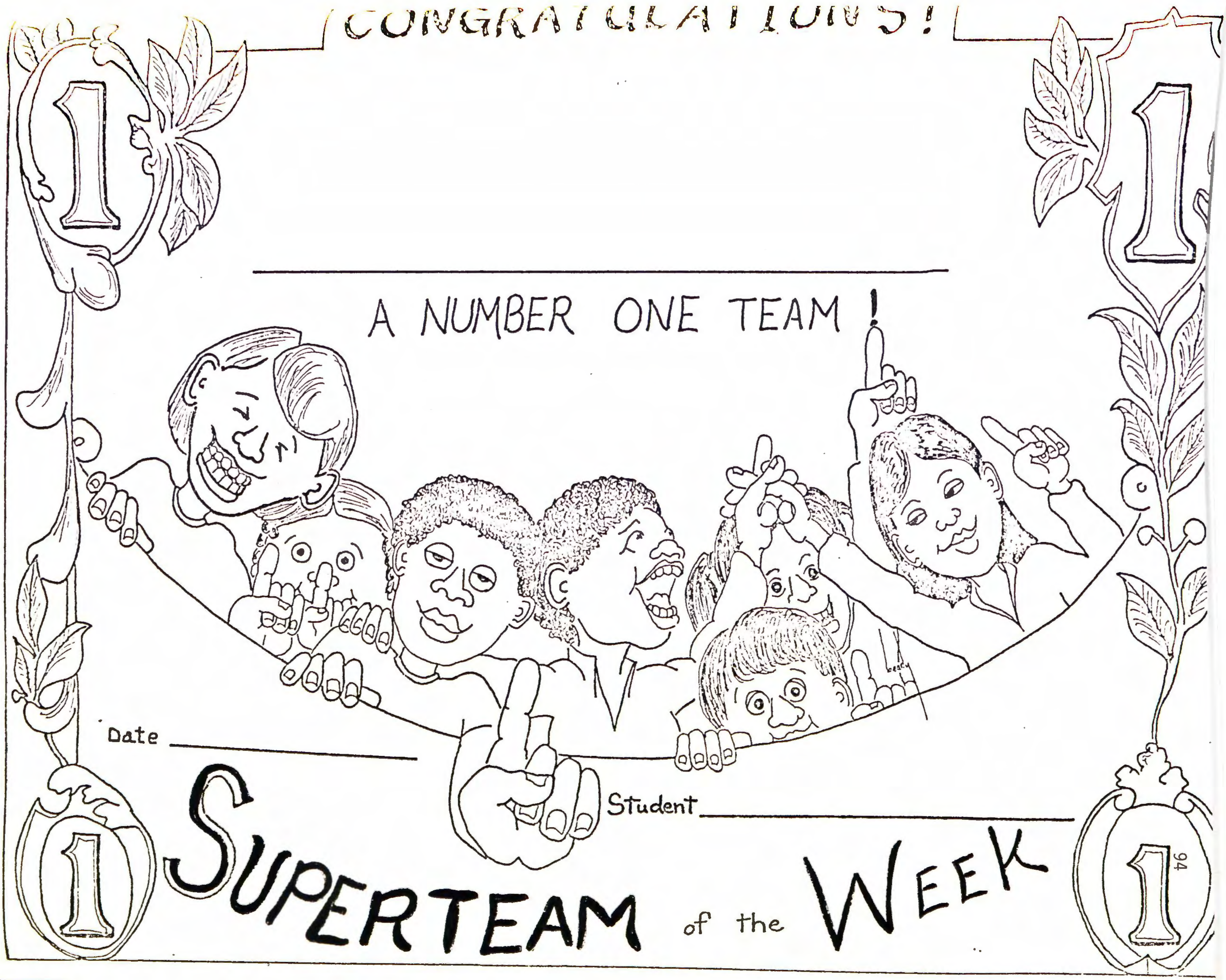
Checkout Answers: Adding One Digit and Two Digits

Checkout Answers A:

1. 37
2. 65
3. 89
4. 45
5. 97
6. 79
7. 17
8. 58
9. 28
10. 69

Checkout Answers B:

1. 86
2. 58
3. 39
4. 79
5. 26
6. 69
7. 98
8. 48
9. 18
10. 49


CONGRATULATIONS!
A NUMBER ONE TEAM!
Date
Student
SUPERTEAM of the WEEK

Name________________________ Period________________

Teacher______________________ Date________________

Diagnostic Test

1. (A1) $\begin{array}{r} 6 \\ +\ 7 \\ \hline \end{array}$

2. (A2) $\begin{array}{r} 12 \\ +\ 4 \\ \hline \end{array}$

3. (A3) $\begin{array}{r} 38 \\ +\ 16 \\ \hline \end{array}$

4. (A8) $\begin{array}{r} 608 \\ +\ 427 \\ \hline \end{array}$

5. (S1) $\begin{array}{r} 14 \\ -\ 8 \\ \hline \end{array}$

6. (S1) $\begin{array}{r} 29 \\ -\ 3 \\ \hline \end{array}$

7. (S3) $\begin{array}{r} 35 \\ -\ 7 \\ \hline \end{array}$

8. (S2) $\begin{array}{r} 89 \\ -\ 37 \\ \hline \end{array}$

9. (S4) $\begin{array}{r} 461 \\ -\ 138 \\ \hline \end{array}$

10. (S5) $\begin{array}{r} 517 \\ -\ 388 \\ \hline \end{array}$

11. (S8) $\begin{array}{r} 706 \\ -\ 188 \\ \hline \end{array}$

12. (S9) $\begin{array}{r} 730 \\ -\ 578 \\ \hline \end{array}$

13. (M1) $\begin{array}{r} 5 \\ \times\ 2 \\ \hline \end{array}$

14. (M2) $\begin{array}{r} 20 \\ \times\ 4 \\ \hline \end{array}$

15. (M3) $\begin{array}{r} 52 \\ \times\ 3 \\ \hline \end{array}$

16. (M4) $\begin{array}{r} 39 \\ \times\ 7 \\ \hline \end{array}$

17. (M5) $\begin{array}{r} 300 \\ \times\ 4 \\ \hline \end{array}$

18. (M6) $\begin{array}{r} 437 \\ \times\ 5 \\ \hline \end{array}$

19. (M7) $\begin{array}{r} 307 \\ \times\ 8 \\ \hline \end{array}$

20. (M8) $\begin{array}{r} 12 \\ \times\ 30 \\ \hline \end{array}$

21. (M10) 27 x 43

22. (M14) 607 x 127

23. (D1) 2) 14

24. (D3) 3) 96

25. (D6) 6) 27

26. (D9) 6) 72

27. (D10) 5) 71

28. (D13) 8) 473

29. (D18) 30) 690

30. (D19) 70) 374

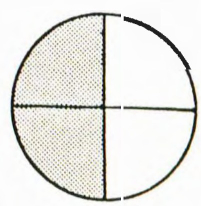
31. (D22) 33) 177

32. (D24) 27) 892

33. (D24) 14) 813

34. (F1) Write a fraction for this picture.

____



35. Circle the larger fraction.
(F4)

$\frac{2}{3}$ $\frac{2}{7}$

36. $\frac{1}{6} + \frac{4}{6} =$
(F6)

37. $\frac{7}{8} - \frac{4}{8} =$
(F7)

38. $\frac{1}{3} = \frac{\square}{9}$
(F8)

39. What is the greatest common factor of 12 and 16? ______
(F9)

40. $3\frac{2}{3} - 1\frac{1}{3} =$
(F15)

41. Add and simplify if necessary.
(F16)

$$\begin{array}{r} \frac{1}{5} \\ + \frac{2}{8} \\ \hline \end{array}$$

42. (F19) Subtract and simplify if necessary.

$$\frac{8}{9} - \frac{3}{4}$$

43. (F20) Write $\frac{9}{7}$ as a mixed numeral.____

44. (F23) $\frac{3}{5} \times \frac{7}{8} =$

45. (F26) Multiply and simplify if necessary.

$$7\frac{2}{3} \times 6\frac{3}{5} =$$

46. (F28) $\frac{1}{3} \div \frac{3}{8} =$

47. (F29) Divide and simplify if necessary.

$$3\frac{1}{2} \div 2 =$$

48. (F31) Add and simplify if necessary.

$$7\frac{3}{4} + 2\frac{1}{14}$$

49. (Dec1) Write as a decimal:

$$3\frac{7}{100}$$

50. (Dec2) Write as a decimal:

$$1\frac{3}{1000}$$

51. (Dec4) Circle the smaller decimal.

.2 .18

52. (Dec5) 13.7 + 6.95 =

53. (Dec6) 41.3 - 6.11 =

54. (Dec7)

$$\begin{array}{r} 7.25 \\ \times\ \ .7 \\ \hline \end{array}$$

55. (Dec10)

$2.5 \overline{)\,35\quad}$

56. (Dec12) Write $\frac{3}{8}$ as a decimal fraction. _____

57. (D1) Write .05 as a percent. _____

58. (P3) Write 60% as a fraction. Simplify if necessary. ____________

59. (P5) What is 3% of 126? _______

60. (P6) 4 is 10% of what number? ________

61. (R1) $\frac{4}{7}$ of fruits in a grocery bag are apples. What percent of fruits are apples? ________

62. (R2) Fill in the missing numerator of the second ratio:

$$\frac{3}{8} = \frac{\square}{120}$$

63. (R3) How long will it take if you travel 14 miles per hour for 98 miles? _______

64. (R4) If you buy 6 pieces of candy for a total of 3 cents, how much will 24 pieces of candy cost? _________

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