INSTRUCTIONAL MANAGEMENT SYSTEM: HOW IT AFFECTS ACHIEVEMENT, SELF-CONCEPT, AND ATTITUDES TOWARD MATH OF FIFTH-GRADE STUDENTS

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CHAPTER I

THE PROBLEM

Introduction

Since the beginning of the development of human beings, man was involved in transferring knowledge from one generation to the next generation. Anthropologists suggest that "human history falls naturally into four phases" (Coon, 1962, p. 9) and this knowledge transferral has been an important endeavor during each phase. In phase one, Homo erectus learned to speak, which added to his communication skills. In phase two, Homo sapiens replaced Homo erectus. Homo sapiens taught his offspring how to hunt and kill animals for food and clothing. He invented the written symbol which he used to transmit culture, as well as survival skills, to the next generation. During phase three, Homo sapiens tamed the animals, cultivated the plants, and wasted the natural resources. The need arose to transfer a larger body of knowledge from one generation to the next, if mankind was to survive (Coon, 1962).

As Homo sapiens entered the fourth phase, it became even more important for educators to seek ways to "increase the learning success rates" of their students (Rollins, 1983, p. 120). Block (1965) had suggested that the utilization of a learning strategy based upon mastery learning (ML) theory was one means whereby more students could learn more material at a faster rate.

According to Horton (1981) and Perko (1984), elements of the ML theory date back to the Sophists. Some of those elements were: specific objectives were developed which each learner was expected to master, learning materials were arranged systematically, a lesser skill was mastered before the student was permitted to advance to another skill, diagnostic tests were included as part of the process, and feedback and feedback-correctives were provided (Horton, 1981).

The ML theory had formed the basis for various teaching/learning strategies and patterns, such as programmed learning and computer-assisted instruction during the 1950s, 1960s, and 1970s (Horton, 1981). The Instructional Management System (IMS), another learning strategy based upon ML theory, was introduced in Missouri during the 1980s. IMS was "a way of organizing instruction and managing learning" (Mallory, 1982, p. 4) using the following ML elements: specific objectives were developed which each learner was expected to master, one objective or skill was mastered before the student was permitted to advance to another skill, diagnostic tests were part of the process, and feedback and feedback-correctives were provided to the student. Another element in the IMS organizational pattern was that "all students have the time they need to master the objectives" (Mallory, 1982, p. 4).

DeArman (1983) suggested that the IMS, as proposed by the State Board of Education and the State Commissioner, was based upon the following ideas: first, different students need different amounts of time to master a skill; and second, anyone can learn anything if given the appropriate amount of time to succeed. These two ideas were congruent with the ML elements as proposed by Carroll (1963) and Bloom (1976). Carroll's main thesis was that aptitude was the amount of time necessary to learn something under ideal instructional conditions. Bloom agreed that virtually everyone could learn any fact, skill, or theory if allowed the appropriate amount of time.

Proponents of IMS (the State Board of Education and the State Commissioner of Education) suggested that the students' academic achievement would be benefited. They were interested in formative and summative testing for academic achievement, but it is possible that they ignored the affective domain.

Koehn (1983) proposed that both skill development (academic achievement) and satisfaction with learning (affective domain) should be assessed and monitored. He stated:

> Improved achievement and satisfaction is the essence of Bloom's theory of Mastery Learning. The theory rests on the premise that 'success breeds success,' with a positive self-concept being the basis for effective learning (p. 2).

Theoretical Rationale

In the past, school served as "a <u>differentiator</u> of student accomplishment and a <u>selection agent</u> for the society" (Spady, 1981, p. 3). "Modern societies no longer can content themselves with the selection of talent; they must find the means for developing talent" (Bloom, 1976, p. 17). Modern societies need a large number of educated persons; whereas in the past, the society could function with only a select few being educated.

Bloom (1976) carried the idea of educating the masses a step further. He felt all learners should be given the opportunity to learn virtually all things. He realized there were differences in learning outcomes. Those differences were a product of the student's learning history (his cognitive entry behavior plus his affective entry behavior) and the quality of instruction he received. Bloom advocated modifying the amount of time and opportunity available to learners; his purpose was to decrease the differences in individual's learning outcomes. The cognitive entry behavior, prerequisites for a learning task, provided the link between the learner and the achievement of the task. A learner mastered a learning task only if he acquired the prerequisites for that task; therefore, an element of Bloom's ML concept was that one skill had to be mastered before going to a more complex skill. Bloom proposed that virtually all students could learn any task if given the appropriate amount of time.

Bloom's (1976) ML concept was based upon Carroll's (1963) learning model. Carroll separated the <u>capacity to learn</u> from the <u>speed of learning</u>, and defined aptitude as the amount of time necessary to learn a skill under ideal instructional conditions. He suggested that if a student did not achieve as well as expected, it might be the result of an inadequate amount of time or opportunity rather than the learner possessing a low aptitude. In a typical classroom, a fixed amount of time was allowed each student to learn; therefore, a difference existed in the amount of learning which was acquired. Carroll advocated varying the time and opportunity to enable most students to learn all things. His model implied that the learner's degree of learning was a function of the ratio of time actually spent to the amount of time necessary for learning (Figure 1).

As shown in Figure 2, opportunity and perseverance were variables Carroll (1963) included in <u>time actually spent</u>. The three variables in the <u>time necessary for learning</u> construct were aptitude, ability to understand, and quality of instruction (Carroll, 1963). Time actually spent was controlled by the student's self-perceptions of his adequacy or inadequacy as he received feedback from significant others (teacher, parents, peers) and as he compared his accomplishments with the accomplishments of his peers. His feelings of adequacy and/or inadequacy effected his academic self-concept and his attitude toward the subject (Bloom, 1977). Those two variables had a direct effect upon his opportunity and perseverance; thus, academic self-concept and attitude toward the subject affected the degree of learning.

$$\text{degree of learning} = \text{function of } \frac{\text{time actually spent}}{\text{time necessary for learning}}$$

Figure 1. Carroll's (1963) Model Suggesting that the Learner's Degree of Learning is a Function of the Ratio of Time Actually Spent on a Task to the Amount of Time Necessary to Master that Task

$$\text{DL} = \text{f } \frac{\text{opportunity + perseverance}}{\text{aptitude + ability to understand + quality of instruction}}$$

Note: The learner's degree of learning is a function of the ratio of opportunity plus perseverance to aptitude plus ability to understand plus quality of instruction.

Figure 2. Carroll's (1963) Degree of Learning Constructs and Variables

ML, the integration of Carroll's (1963) learning model and Bloom's (1977) learning theory, provided the basis for the IMS utilized in Missouri public school districts:

> Instructional Management is simply an organizational pattern that combines two mutually supportive techniques: teaching to objectives and mastery learning. Teaching to objectives means each subject is broken down into bitesized skills which can be easily communicated by teachers to student and parents. These skills or objectives specify what is expected of students and provide teachers a logical way of planning and organizing their instructional activities. Mastery teaching[1] is a process in which students are allowed all the time and instruction they need to master each skill or objective. Students do not advance to more complex skills until they have demonstrated mastery of simpler skills (DeArman, 1983, p. 40).

Missouri's Commissioner of Education advised that the state encourage school districts to institute an IMS. The Missouri State Board of Education adopted the Commissioner's IMS concept as a priority in 1981, and suggested that all school districts integrate IMS strategies into their curriculum planning, development, and implementation (Jones, 1982).

Why should schools utilize the IMS based upon ML theory? Block (1971) had advocated the utilization of a ML concept for the following reasons: first, this approach enabled 75 to 90% of the students to achieve to the same degree at which only the top 25% had accomplished under conventional approaches. Apparently, Block did not accept the premise that virtually all students could learn a specific objective if given the appropriate amount of time to learn. He excluded 10 to 25% of the students when he discussed the percentage who could learn using a ML technique. A second reason to use ML was that students learned more material in less time. A third reason was that the students had a better

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[1]The reader will note that DeArman used "mastery learning" in the first sentence and "mastery teaching" later in the paragraph to describe mastery learning.

attitude toward the subject learned. Finally, the successes derived from learning enhanced the learners' academic self-concepts.

In "Affective Outcomes of Mastery Learning," Bloom (1977) reported the results of two empirical studies. One study examined academic self-concept and one study dealt with the subject-related affect. Subject-related affect was the same as attitude toward the subject. It included the student's liking, preference, or desire to be involved with a particular subject.

Results of the study involving three middle-class Chicago suburban schools showed that the self-perception of "frequency and consistency of adequacy or inadequacy over a period of years has major effects on the academic self-concept" of a student (Bloom, 1977, p. 198). At the end of second grade there was only a small difference in the academic self-concept mean scores of the successful (top one-fifth of the class) and the unsuccessful (bottom one-fifth of the class) learners; however, by the end of sixth grade a large difference existed. Bloom suggested that when ML was utilized, the learner would be successful. This success enhanced his feelings of adequacy, which proved to be a positive force on his academic self-concept. Academic self-concept of students in the three middle groups was not affected as much by achievement or feelings of adequacy and inadequacy as were the top one-fifth and the bottom one-fifth of the class.

Results of the second study showed that a student's attitude toward a subject was "influenced by his perception of his adequacy or inadequacy" with tasks pertaining to that subject (Bloom, 1977, p. 195). If the student received evidence from his teacher that he had done well on a task, then he felt adequate and was motivated to pursue more tasks in that subject. Bloom found that by the end of third grade, the students in the top one-fifth of the class had a different attitude toward the subject than did the students in the bottom one-fifth. On a five-point scale measuring from positive to negative, the students in the top one-fifth averaged two points higher than the students in the bottom one-fifth of the class. They were still at that level by the eleventh grade. No results were reported concerning the attitude toward the subject of the three middle one-fifth groups.

A student's perception of his adequacy or inadequacy was based upon three things: achievement, the teacher's marking scheme, and the student's performance based on the performance of the others in the class. Thus, the following question was posed: does the learner feel more adequate when he stays on a skill for several days until he reaches mastery, or does he feel inadequate because the teacher has not given a mark of approval and the other students are advancing to new skills?

Garvey (1980) posited that giving slow learners adequate time to learn one specific task before they advanced to the next skill enabled them to achieve at a higher level. "And like a domino effect, a student who is able to see improvement becomes more confident, more willing to learn, and, finally, a better student" (Garvey, 1980, p. 111). ML was the means to "higher student affect, confidence, achievement. . . ." (Bonczar, 1983, p. 8).

There was a need for empirical research to ascertain if ML increases learning, promotes a positive academic self-concept, and enhances attitude toward the subject (Strasler, 1982). Missouri's IMS was based upon ML theory utilizing ML elements advocated by Block, Bloom, and Carroll; consequently, the need for empirical research to determine if utilization of IMS increases academic achievement, enhances academic self-concept, and/or promotes a positive attitude toward the subject was evident.

Statement of the Problem

The problem was whether the IMS, as advocated by the Missouri Commissioner of Education and the State Board of Education, was an effective instructional system. How does one measure the effectiveness of an instructional system? Three criteria were chosen for the purpose of this study.

The first criterion was academic achievement (Mallory, 1982). The following questions were asked to satisfy the first criterion:

1. Was there a significant difference in the achievement of the IMS and the non-IMS groups?

2. Did the IMS group outperform the non-IMS group?

Since a positive self-concept is the basis for effective teaching (Koehn, 1983), academic self-concept was a second criterion used to determine the effectiveness of IMS. Two questions were posed:

1. Was there a difference in the academic self-concept of the IMS and non-IMS groups?

2. Did the IMS groups have a more positive academic self-concept than the non-IMS group?

Attitude toward the subject was the third criterion used in this study. Bloom (1981) stated that effective schools promote interest in lifelong learning. One way to promote that interest is by improving students' attitudes toward the various academic subjects. This question was considered: Did the IMS students have a more positive attitude toward math than the non-IMS students?

This investigation analyzed the effect, if any, that the IMS had upon students' achievement, their academic self-concept, and their attitudes toward the subject. These criteria were investigated in studying the utilization and effectiveness of the IMS, a learning strategy based upon a ML process.

Purpose of the Study

The purpose of this study was to provide information which would enable educators to make decisions concerning the utilization of IMS, based upon theory and empirical research. The Missouri Commissioner of Education and the State Board of Education were convinced that, through the implementation of IMS, students would master the basic facts which would enable them to become better scholars. As educators utilized IMS, three questions arose which needed to be addressed:

1. What effect would IMS, an ML model, have upon student achievement?

2. What effect would IMS have upon academic self-concept?

3. What effect, if any, would IMS have upon student attitude toward the subject being mastered?

Research Hypotheses

The hypotheses for this study were stated in the null form:

> The null hypothesis does not necessarily reflect the scientist's expectations but is preferred by many researchers because this form can be used in nearly any study that explores a difference or relationship. Also, the null hypothesis is better suited to the statistical tools that are used to analyze research evidence (Borg, 1981, p. 70).

To achieve the purpose of this study, the difference between the achievement of the IMS experimental group and the non-IMS control group was considered. In addition, the difference between the students' self-concepts of the IMS and the non-IMS groups was analyzed. Finally, the difference between the attitude toward math of the IMS and the non-IMS groups was examined.

The following hypotheses were tested:

Hypothesis I_0. There was no statistically significant difference between the achievement of the IMS experimental group of fifth-grade math students and the achievement of the non-IMS control group of fifth grade math students as determined by the results of the Iowa Test of Basic Skills.

Hypothesis II_0. There was no statistically significant difference between the academic self-concept scores of the IMS group and the academic self-concept scores of the non-IMS group as determined by the results of the Piers-Harris Children's Self-Concept Scale.

Hypothesis III_0. There was no statistically significant difference in the attitudes toward math between the IMS group and the non-IMS group determined by the results of the Cox Math Attitude Index.

Assumptions of the Study

The researcher considered four assumptions in this study:

1. Each member of the experimental and control group answered the questions on the Iowa Test of Basic Skills to the best of his or her ability.

2. Each student answered the questions on the Children's Self-Concept Scale and the Cox Math Attitude Index truthfully.

3. Sufficient time (one school term) was given to determine whether there were differences in the achievement, academic self-concept, or attitude toward math between the experimental treatment group and the control group of fifth-grade math students.

4. Traits included in the cognitive and affective domains can be measured by administering a paper and pencil written instrument.

Scope and Limitations

The study was limited to 173 fifth-grade students from the Intermediate School at Neosho, a small rural town in southwest Missouri. Learners were included from the upper, middle, and low socioeconomic levels.

The time element of the 1984-85 school term was another limiting factor of this study. The treatment period was from September, 1984, until the middle of March, 1985, when the instruments were administered.

Definition of Terms

The following definitions are included for this study:

Academic Self-Concept. A description of the perceived self in a learner role. This appraisal includes such areas as ability to learn, work habits, and relations with teachers (Beane and Lipka, 1984).

Achievement. "Accomplishment; attainment" (Funk, 1956, p. 12).

Affective Domain. Interests, attitudes, values, and the development of appreciation (Bloom, 1956).

Aptitude. The amount of time the learner needs to learn under ideal instructional conditions (Carroll, 1963).

Attitude. "State of mind, behavior or conduct regarding some matter as indicating opinion or purpose" (Funk, 1956, p. 93).

Cognitive Domain. Recall or recognition of knowledge and the development of intellectual abilities and skills (Bloom, 1956).

Feedback. Information given to the learner pertaining to his accomplishments and the items he has not mastered (Thompson, 1980).

Feedback Correctives. Time, instruction, and/or information given to the learner to assist him as he attempts to master the skills which were not mastered previously (Thompson, 1980).

Instructional Management System (IMS). An instructional strategy using the elements of adequate time for mastery and feedback correctives to master one skill before advancing to the next skill. It is based upon mastery learning strategies.

Mastery Learning (ML).

> An educational strategy developed by Benjamin Bloom based on the premise that virtually all students can learn virtually any subject, if they are given clear objectives, adequate learning tools, and sufficient time to assimilate the material (Garvey, 1980, p. 111).

Self-Concept. "The description an individual attaches to himself or herself . . . based on the roles one plays and the attributes one believe he or she possesses" (Beane and Lipka, 1984, p. 5).

Summary

During the late 1970s and early 1980s, educators were seeking ways to increase learners' knowledge bases. Various strategies were implemented, including the IMS, based upon the Bloom-Carroll model of ML.

ML elements included in IMS were: specific objectives were developed which each learner was expected to master, one objective or skill was mastered before the student was permitted to advance to another objective or skill, diagnostic tests were part of the process, feedback and feedback-correctives were provided to the student, and students had the time needed to master an objective.

Carroll (1963) offered a learning model which held that the learner's degree of learning is a function of the ratio of opportunity plus perseverance to aptitude plus ability plus quality of instruction.

Perseverance was affected by a learner's academic self-concept and his attitude toward the subject (Bloom, 1981); therefore, academic self-concept and attitude toward the subject were factors in the learner's degree of learning. To determine if IMS was an effective learning strategy, three null hypotheses were listed pertaining to academic achievement, academic self-concept, and attitude toward the subject.

To complete Chapter I, three final items were given. The assumptions for the study were listed. The scope and limitations to the study were discussed. Finally, definitions of pertinent terms were included.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Since "Instructional Management System" (IMS) was coined in Missouri in 1981, it has become a familiar term to Missouri educators. Because IMS was unique to Missouri, it had not become well-known in educational circles on the national level. Obviously, IMS had not been addressed in the general educational literature. IMS was based upon Carroll's (1963) model of learning and Bloom's (1976) mastery learning (ML) concept (DeArman, 1983); therefore ML literature was reviewed.

Anecdotal and empirical literature were reviewed pertaining to student academic achievement, academic self-concept, and attitude toward the subject to determine if students involved in strategies utilizing the ML theory performed better than students utilizing other learning strategies. Correlational studies of the three variables were also reviewed to ascertain the correlation between achievement and academic self-concept and between achievement and attitude toward the subject. The purpose of this part of the review was to furnish evidence which would support or reject the idea that academic self-concept and/or the attitude toward the subject affected the degree of learning.

Instructional Management System

History

During the 1981 annual fall meeting at the Missouri State Board of

Education, priorities were established for the 1982-83 school term. The number one priority was the adoption of IMS as advocated by the State Commissioner of Education. Mallory (1982) stated that IMS was not a new concept. It had emerged from theories found in Carroll's (1963) "A Model of School Learning" and Bloom's (1976) Human Characteristics and School Learning. By March, 1985, over one-half of Missouri's 546 school districts had implemented some form of IMS.

Definition and Purpose

IMS was not a subject, a curriculum, or a method of teaching (Mallory, 1982). Mallory defined IMS as "an approach to organizing instruction and managing learning" (p. 4). The purpose of managing learning was threefold. First, it was to provide a guarantee that learning objectives were clearly defined and coordinated for each grade level and subject area. Secondly, it was to make certain that each student was given the appropriate amount of time to master essential objectives. Third, it was to guarantee that parents, teachers, and students be cognizant of which objectives had been mastered and which objectives had not.

The IMS concept was based on the following ideas: first, all studenta can learn at a mastery level if teachers believe students can achieve and if the curriculum is devised to allow the appropriate amount of time for each student to learn; secondly, students must experience success to remain motivated and/or interested in learning: "This implies that each student should have school work presented at a rate no faster than he can master. Learning deficits should not be allowed to accumulate" (Mallory, 1982, p. 7).

Recent research produced evidence to support utilization of methods with the IMS strategy, according to Mallory (1982). He stated: "The techniques used with the IMS approach can yield impressive gains in student achievement and in students' attitudes toward learning" (p. 5). "It's a practical approach to improving student achievement and it works" (p. 7).

No statistical evidence was cited in Mallory's (1982) articles to validate his claims, nor were there any statistical data available from the limited amount of IMS literature. Thus, it was found necessary to investigate ML data to determine if there was any support for the IMS approach to learning.

Mastery Learning

History

ML is not a new concept. According to Horton (1981), ML principles were included in the writings of the Sophists, early Jesuit educators, Comenius, Pestalozzi, and Herbart. Those principles or elements were:

1. Learners should start with a simple task.
2. Learners should not be allowed to move forward until the first task was mastered (Comenius, 1887).

The subject should be broken into small steps and/or objectives (Pestalozzi, 1885). Pestalozzi also believed that all things could be taught to all men (Piaget, 1967).

One man responsible for keeping ML alive during the early twentieth century was W. W. Charters (cited in Horton, 1981). Charters (1924) emphasized identifying objectives. He concluded that the teacher should decide what was expected of the student and what the student should receive from the study of a subject. Charters also stated that activities should be arranged into hierarchical sequences and that the student should master the first task before advancing to another task.

"Mastery was defined in terms of particular educational objectives each student was expected to achieve" (Block, 1971, p. 3). During the 1920s, two major attempts were made to produce mastery in students' learning (cited in Horton, 1981). One attempt was the Winnetka Plan, developed by Washburne et al. The other attempt was developed by Professor Henry Morrison at the University of Chicago Laboratory School. Washburne's objectives were cognitive in nature, whereas Morrison included affective, psychomotor, and cognitive objectives. The objectives were sequenced in such a way that each learning task built upon the previously learned task.

The student was required to master each task before being permitted to advance. A mastery test was administered to provide feedback to determine if more instruction and/or time was necessary. Time was the variable considered in individualizing instruction for ML. In the Winnetka Plan, the student was allowed as much time as was necessary to master the unit, whereas in the Morrison method the teacher determined the amount of time needed for the majority of the class to master the objective.

Block (1971) explained that the utilization of the ML concept declined during the 1930s and 1940s; however, the pendulum had swung back by the late 1950s and early 1960s. ML resurfaced in the form of programmed instruction based upon Skinner's (1972) theory of dividing a complex behavior into component behaviors. Skinner theorized that a student could master any complex skill if he mastered each component of the skill first. Fennell (1981) reported that individualized programmed mathematics instruction continued its rise in popularity through the early 1970s. The programmed instruction usually consisted of a pretest, some instructional activities, and a posttest. It worked well for students requiring drill and constant reinforcement, but it was not effective for most students (Block, 1971).

John Carroll: Model of School Learning

Carroll (1963) provided a school learning model which was useful as an ML model. Carroll's model, based upon his earlier research in foreign language learning, posited the following ideas:

1. A student's aptitude for a particular discipline predicted the amount of time necessary for him to learn to a specified level and also predicted the level to which he could learn in a given amount of time.

2. Aptitude was defined as the time necessary for an individual to learn a skill to a predetermined level in an ideal instructional environment.

3. If a student were given the appropriate amount of time to learn to a predetermined mastery level, the teacher could expect him to be successful.

4. If a student were not given the necessary time to learn to a specified level, he could not be expected to learn to that level.

Carroll's (1963) model suggested that the degree of learning (DL) was a function (F) of the ratio of time spent (ts) on a given task to the time necessary (tn) to master the task (Figure 3).

Figure 4 shows the time allowed (opportunity) and the amount of perseverance the student possessed were the variables in the time actually spent construct. The student's aptitude, his ability to understand, and the quality of instruction were the variables included in the time necessary for learning construct.

$$DL = F \left(\frac{ts}{tn}\right)$$

Note: The degree of learning is a function of the ratio of time spent to time needed.

Figure 3. Carroll's (1963) Degree of Learning Formula

$$DL = F \frac{\text{opportunity + perseverance}}{\text{aptitude + ability to understand + quality of instruction}}$$

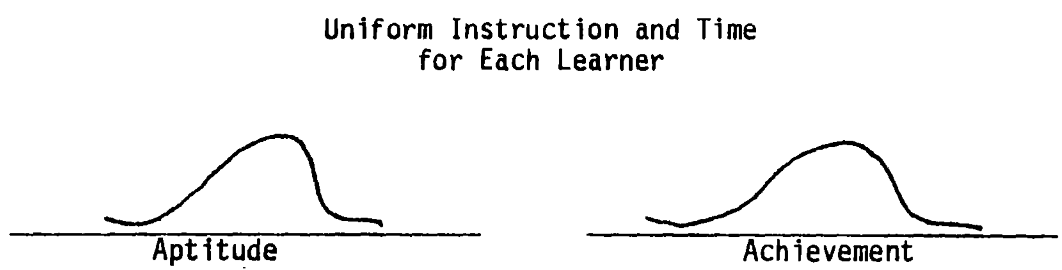
Note: Opportunity and perseverance are variables in the time spent construct. Aptitude, ability to understand, and quality of instruction are time needed variables.

Figure 4. Carroll's (1963) Degree of Learning Constructs and Variables

The time actually spent was determined by the amount of time allowed and the amount of time the student was willing to spend on the given task. This was the point at which the affective domain variables of self-concept and attitude toward the subject became involved. If the student felt successful, he enjoyed the subject, was willing to spend more time on the task, and had a more positive self-concept (Bloom, 1981). The time necessary to master the task was determined by the student's aptitude for that discipline, the quality of the instructor's presentation, and the student's ability to understand the instruction.

Benjamin Bloom's ML Strategy

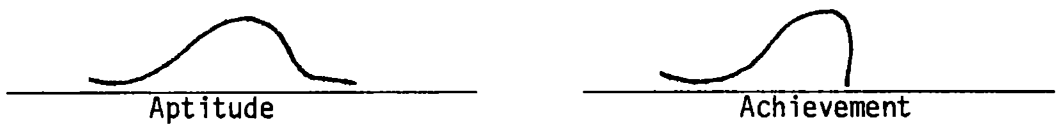
Benjamin Bloom (1981) built a working ML model from Carroll's (1963) conceptual model. Carroll had posited that aptitude was a prediction of the rate at which a student could learn. The degree of learning expected, the master level, was determined. By changing instructional variables, each student could reach that mastery level. Bloom agreed that if students were normally distributed in relation to aptitude, were given similar instruction and the same amount of time, the achievement would be normally distributed (Figure 5). A high relationship existed between aptitude and achievement in that set of circumstances. If students were normally distributed in relation to aptitude, were given optional instruction and adequate time, achievement would not be normally distributed (Figure 6). Instead, most of the students could be expected to reach the mastery level. A low relationship or no relationship existed between aptitude and achievement (Bloom, 1981).



Note: If aptitude is normally distributed and uniform instruction and time is allotted each learner, achievement will be normally distributed (Block, 1971).

Figure 5. Uniform Instruction and Time for Each Learner

Optional Instruction and Adequate Time
for Each Learner



Note: If aptitude is normally distributed and optional instruction is administered allowing adequate time for each learner, achievement will not be normally distributed (Block, 1971).

Figure 6. Optional Instruction and Adequate Time for Each Learner

Over 90% of the student population can master the materials educators attempt to teach them; therefore, the normal curve distribution of achievement should be disregarded. Bloom (1981, p. 155) stated: "In fact, we may even insist that our educational efforts have been unsuccessful to the extent to which our distribution of achievement approximates the normal distribution." When test scores were distributed on a normal curve, established student expectations tended "to fix the academic goals of teachers and students at inappropriate low levels and thus reduce(d) both teacher and student motivation" (Gagne and Briggs, 1974, p. 165).

Many educators assumed that students with high aptitude scores could learn complex tasks; whereas, only simple tasks could be learned by those at the low end of the aptitude scale. Both Bloom (1981) and Carroll (1963) suggested that, given enough time, mastery of a skill was theoretically available to all students if educators found the appropriate instructional techniques for each student. This view was also supported by Glaser (1968) in his standardized achievement test studies which showed that students learned specific objectives if allowed more time. The top students' scores on a selected criterion at the end of one acadmeic year were replicated by the majority of the other students the next year.

As Bloom (1981) investigated appropriate instructional techniques and developed his ML model, he operated under the following assumptions:

1. Carroll's (1963) preconditions to learning were correct.

2. Students attempted to learn skills they thought they would be tested and judged upon.

3. The success of the ML strategy depended upon students being motivated to utilize additional corrective materials; therefore, an evaluation and feedback process was deemed necessary (Glaser, 1968).

Cognitive Domain Effects

A substantial amount of literature was uncovered concerning the effects of ML strategies upon achievement of students ranging from elementary age to college age. Block and Burns (1976) reviewed 96 research studies. They discovered that there was a statistically significant difference in favor of pupil achievement in the ML group in 59 studies. Only three studies reported a statistically significant difference in favor of pupil achievement in the non-ML group. No significant difference was found between the experimental (ML) group and the control (non-ML) group in 34 cases.

Burrows and Okey (1975) examimed the achievement of students with varying aptitudes for learning who were from different age groups and different grade levels. Burrows and Okey's sample consisted of 84 fourth- and fifth-grade students:

> The students were stratified by grade level and blocked on two levels of mathematics aptitude (above and below the 50th percentile) measured with Arithmetic Skills Test of the Iowa Test of Basic Skills. Students were then assigned at random to one of four treatment groups (p. 3).

These four groups were described as follows: Group 1 was a control group in which students received individual instruction from a skill booklet. The teacher clarified instruction and recorded the students' progress as each skill was studied. Group 2 was like Group 1, with one added feature--the teacher read a specific performance objective and referred to it as the students worked. Group 3 was also like Group 1, with one added feature--the teacher gave a sample test to the students, with the instructions to study it as they worked. Group 4 was like Group 1, which had the added features of Groups 2 and 3. Group 4 had diagnostic tests as another added feature. The tests were graded with immediate feedback and feedback-correctives. The students had to demonstrate mastery before attempting the next skill.

Students in Group 4 scored significantly higher than the other three groups on the posttest. There was also a statistically significant difference in achievement between the students in the high and low mathematical aptitude subgroups within each of the four groups. ML students of low mathematical aptitude scored better than high aptitude students in the control group. Low aptitude fourth graders exposed to the ML methods scored as well as the high aptitude fifth graders who were in the control group. No statistically significant difference in performance existed between fourth- and fifth-grade students within each group. Trembath and White (1979) found that young students exposed to ML strategies whereby one subunit was mastered before attempting the next subunit performed better than students three years older who had not utilized the ML philosophy.

Higher education students also appeared to have benefited from ML exposure. Thompson (1980) examined the effects of ML on achievement of graduate students enrolled in elementary educational statistics classes. Her research supported the following hypotheses: learners instructed with the ML strategy achieved significantly higher than learners instructed without the ML strategy.

Thompson's (1980) findings were supported by a study conducted at Chicago City Colleges. After utilizing ML for 10 years, it was determined that significantly more students earned passing grades in classes taught using the ML strategy (Bonczar, 1983).

Affective Domain Effects

In the development of a human, the stage of industry or accomplishment is very important (Hass, 1980). It begins around the age of six and lasts for five or six years. "The chief danger of this period is the presence of conditions that may lead to the development of a sense of inadequacy or inferiority" (Hass, 1980, p. 113). Hass continued by stating that a child needs to have a feeling of successful accomplishment. He should never be made to feel that he is not as good as the rest of the group. Hass agreed with the following quote:

> One student learning outcome inherent in the mastery learning approach to school learning involves emotional outcomes (including) such aspects as attitude toward subject matter and affective traits as self-concept and mental health (Strasler, 1982, p. 3).

Strasler (1982) examined three facets of self-concept: academic self-concept, norm-referenced self-concept, and general school self-concept. Academic self-concept was a description of the perceived self in a learner role. The norm-referenced self-concept was a self-perception based on comparisons the student made of himself and his peers. General school self-concept was a description which the student attached to himself as he considered his roles and attributes in the school setting.

Strasler's (1982) research involved 93 seventh-grade students from three metropolitan areas. His subjects were enrolled in two mini-courses (ecology and geometry) for 23 days. Forty-seven students were instructed utilizing the ML strategies of immediate feedback and corrective measures and additional time in the classroom. The hypothesis that students in ML classes will acquire a higher academic self-concept than students in non-ML classes was tested. The means for academic self-concept and norm-referenced self-concept increased slightly for ML students from the pretesting to the posttesting. The mean remained constant for general school self-concept from the pretesting to the posttesting. The means on academic self-concept, norm-referenced self-concept, and general school self-concept decreased slightly from pretesting and posttesting for non-ML students. No statistically significant difference at the .05 level was shown on the three affective variables as measured on the <u>Scott's Academic Self-Concept</u>, <u>General School Self-Concept</u>, and <u>Norm-Referenced Self-Concept Scale</u> for either the ML or the non-ML students (Strasler, 1982).

> Although the results revealed no significant differences between the mastery and the non-mastery groups on three affective measures after experimental treatment, certain trends seem to favor the learning for mastery approach with respect to affective outcomes of school learning. As previously noted, the means of the mastery learning students either increased slightly or remained constant from pre- to posttesting, while the means of all three affective measures decreased slightly for the nonmastery learning students. If one takes Kifer's (1975) view that it is the student's <u>history</u> of consistent success or failure (in terms of patterns of academic achievement) which attributes to the learner's affective traits, then the mastery learning instructional model should lead to increases in academic self-concept over an <u>extended</u> period of time (Strasler, 1982, p. 21).

No longitudinal research studies pertaining to academic self-concept or attitude toward the subject were available for review.

Block (1971) presented the following to be facts: students involved in ML concepts will develop a high level of positive interest in the subject and a positive attitude toward the subject learned. The interest in the subject and the attitude toward the subject may depend upon the level of proficiency the student is expected to maintain. If perfection is expected of the student, he may lose interest in the task.

When students received positive feedback declaring they had mastered a skill, they developed a positive attitude toward learning. There was a positive relationship between mastery or achievement and self-concept; therefore, ML influenced the affective domain of the learner (Bloom, Hastings, and Madans, 1971).

An empirical study also supported the idea that self-concept and achievement were significantly and positively correlated (Brookover, Thomas, and Patterson, 1964). Brookover, Thomas, and Patterson conducted an experiment with a sample of 1050 seventh-grade students from an urban school district to determine if the above hypothesis were supported. Two parallel forms of an eight-item multiple choice questionnaire were administered. One form measured general self-concept. The other form measured academic self-concept in math, English, social studies, and science. The student's grade point average was used as the index of academic achievement. The intelligence quotient was controlled using the average of each student's third- and fifth-grade scores on the California Test of Mental Maturity. Product-Moment Correlations between variables showed that even with IQ controlled, there was a significant relationship between self-concept and achievement.

Attitude toward the subject was affected by school achievement (Bloom, 1977). Bloom believed that a student's liking or disliking of a subject was "influenced by his perceptions of his adequacy or inadequacy" in that subject (p. 195). He found that by the end of the third grade, the attitude toward math was definitely different in successful students (top one-fifth of the class) and the unsuccessful students (bottom one-fifth of the class). Using a five-point scale, with five being the most positive toward the subject and one being the most negative, the successful students were two points higher than the unsuccessful students. The difference was maintained through the eleventh grade.

Attitude toward the subject was affected by academic self-concept. Ludwig and Maehr (1967) conducted a study using 65 seventh- and eighth-grade boys in a physical education exercise. Each boy went to a room to perform a physical exercise test before a physical education expert. The expert then read a letter of approval or disapproval to the student. Next, three instruments, the Maehr-Hass Physical Self-Concept Test, Behavioral Choice Questionnaire, and an adaptation of Helper's Self-Esteem Activities Test, were administered. Results of these measures indicated that after the approval treatment, the students' academic self-concept rating increased and they preferred physical activities. After the disapproval treatment, the opposite effects were present. The following hypotheses of self-concept theory were supported. Self-concept change is a function of the reaction of significant others. Changes in self-concept cause changes in preference for a subject or activity.

Summary

Proponents of IMS declared that all learners would benefit from using the ML-based learning pattern. Since "Instructional Management

System" was a term coined in Missouri only, literature was unavailable in general education data banks. IMS was based upon ML theory; therefore, ML anecdotal and empirical evidence were reviewed.

There was evidence of the utilization of the ML theory from the writings of the Sophists to the present day educators. During the twentieth century, interest in ML declined during the twenties and resurfaced during the fifties in the form of programmed learning. Another decline ensued. The period of accountability, the 1980s, brought about a renewed interest in the mastery of skills, facts, and decision-making strategies.

This review considered the effects of ML upon achievement, self-concept, and attitude toward the subject. Numerous research studies supported ML strategies when achievement was considered. Limited statistical evidence surfaced supporting the ML approach when investigating the effects of ML upon self-concept or attitudes toward the subject. A need for further research in this affective area was uncovered.

CHAPTER III

DESIGN AND RESEARCH PROCEDURES

Introduction

The design and research procedures chapter begins with a statement of the purpose of this study. Next, the design and research procedures are described. A description of the three instruments (Iowa Test of Basic Skills, Piers-Harris Children's Self-Concept Scale, and Cox Math Attitude Index) follows in the instrumentation section. A discussion pertaining to the data collection and the design and analysis of the data precedes the summary of the chapter.

Purpose

The purpose of this study was to provide information which would enable educators to formulate decisions concerning the utilization of IMS, based upon theory and empirical studies. The effects of IMS upon the academic achievement, the academic self-concept, and the attitude toward the subject were examined to achieve this purpose.

Design

All the elementary-school learners in grade five at the Intermediate School in Neosho, a rural town in southwestern Missouri, served as the population for this study. This same group of 173 fifth-grade learners was also the sample.

To provide information which would enable educators to formulate informed decisions, three hypotheses were tested. The research hypotheses were:

Hypothesis I_0. There was no significant difference between the achievement of the IMS experimental group of fifth-grade math students and the achievement of the non-IMS control group of fifth-grade math students as determined by the results of the Iowa Test of Basic Skills.

Hypothesis II_0. There was no significant difference between the academic self-concept scores of the IMS group and the academic self-concept scores of the non-IMS group as determined by the results of the Piers-Harris Children's Self-Concept Scale.

Hypothesis III_0. There was no statistically significant difference in the attitudes toward math between the IMS group and the non-IMS group as determined by the results of the Cox Math Attitude Index.

It was impossible to assign the subjects for this study randomly; therefore, Campbell and Stanley's (1963) quasi-experimental nonequivalent control group design was chosen. The pretest, posttest control group design, "an excellent design which is subject to none of the eight internal validity threats described by Campbell and Stanley," was chosen for Hypothesis I_0 (Borg, 1981, p. 182). The posttest only control group design was selected for Hypotheses II_0 and III_0. According to Borg, experimental mortality was a threat to internal validity when the posttest only design was utilized.

Commencing with the 1981-82 school term, fifth-grade students at Intermediate had been assigned to one of two pods for instructional purposes. Each pod consisted of approximately 86 students and two teachers. The group of 86 students was subdivided into four groups, with each teacher instructing two groups--one class in the morning and one class in the afternoon (Figure 7).

Pod A		Pod B	
Teacher Q Morning 22 Students	Teacher R Morning 22 Students	Teacher S Morning 22 Students	Teacher T Morning 22 Students
Afternoon 21 Students	Afternoon 21 Students	Afternoon 21 Students	Afternoon 21 Students

Note: There were four groups in Pod A and four groups in Pod B.

Figure 7. Fifth-Grade Students Assigned to Eight Groups

There were 173 fifth graders during the 1984-85 school term which were divided into two pods. Those pods were subdivided into the eight groups in the following manner: first, the students were rank-ordered according to the results of their Iowa Test of Basic Skills total math scores from the spring of 1984, as shown in the partial listing in Table I. Next, students were assigned to Pod A or Pod B. The student with the highest score became a member of Pod A, the second highest was assigned to Pod B, the third highest was assigned to Pod B, the fourth to Pod A, the fifth to Pod A, and the sixth to Pod B. This process continued until all 173 students were assigned, as shown in the partial listing in Table

II. This procedure was utilized to ensure that heterogeneous ability grouping was in place. One pod was to not have a majority of high achievers while the other pod consisted of a majority of low achievers.

TABLE I

STUDENT SCORES ON 1984 IOWA TEST OF BASIC SKILLS

Student	Score
1	99
2	99
3	99
4	99
5	99
6	98
7	97
8	97
9	97
10	95
12	95
.	.
.	.
.	.

TABLE II

STUDENTS ASSIGNED TO 1984-85 PODS

Student	Score	Pod
1	99	A
2	99	B
3	99	B
4	99	A
5	99	A
6	98	B
7	97	B
8	97	A
9	97	A
10	95	B
11	95	B
12	95	A
.	.	.
.	.	.
.	.	.

Finally, the students in each pod were assigned to two teachers utilizing the same method described to assign students to Pod A and Pod B (Tables III and IV). Eighty-seven students in Pod A were assigned to teachers Q and R for the 1984-85 school term. Each teacher instructed two classes--one in the morning and one in the afternoon. Pod

B consisted of 86 students who were assigned to teachers S and T. Each teacher in Pod B also taught two classes. For the purposes of this study, Pod A was the experimental group and Pod B was the control group.

TABLE III

TEACHER ASSIGNMENTS, POD A

Student	Score	Teacher
1	99	Q
4	99	R
5	99	R
8	97	Q
9	97	Q
12	95	R
.	.	.
.	.	.
.	.	.

Procedures

After the 1984-85 school year, Intermediate fifth-grade students were assigned to the control and experimental groups, and, as described in the foregoing section, treatment was administered to Pod A. Pod A, the experimental group, received instruction from teachers Q and R, both of whom utilized an IMS based upon the Bloom-Carroll ML model.

TABLE IV

TEACHER ASSIGNMENTS, POD B

Student	Score	Teacher
2	99	S
3	99	T
6	98	T
7	97	S
10	95	S
11	95	T
.	.	.
.	.	.
.	.	.

Teacher R served on the district-wide IMS team. He wrote the fifth-grade math objectives (Appendix A), compiled feedback-correctives and enrichment materials (Appendix B), and constructed the testing instruments (Appendix C). Teacher R was cognizant of the IMS approach to teaching math and shared this information with teacher Q. Both teachers received initial training, as well as periodic follow-up sessions with the Director of Elementary Education to ensure that they were adhering to the following steps in the IMS procedures:

1. Instruction was delivered to teach a specific objective.

2. A formative test A was administered.

3. Students not reaching mastery (80% correct responses) were given feedback-correctives, which included instruction from the teacher and/or peers.

4. Students reaching the mastery level on test A were assigned enrichment activities.

5. Formative test B was administered to those students who were working correctives. Those students who reached mastery proceeded to enrichment activities; the others received more corrective instruction.

6. After formative test C, everyone went to the next objective, except those not reaching mastery. They continued to receive instruction and practice on objective one. Those steps were in harmony with the ML cycle, as prescribed by Gusky (1985) (Figure 8).

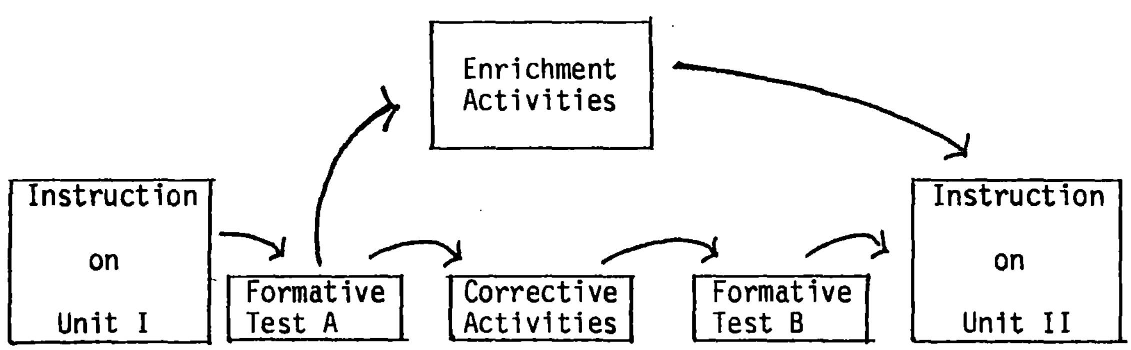


Figure 8. Guskey's (1985) ML Cycle

After an objective unit was taught, a formative test was administered. Those students demonstrating mastery of the objective or unit were provided with enrichment opportunities, whereas the other students received specific feedback-correctives to enable them to master the objective. The testing feedback phase continued until each student demonstrated mastery on a formative test. After mastery, a new objective or unit was presented.

Teachers S and T did not receive the instruction from the Director concerning IMS. They continued to teach their math students in the following manner: students were led through the math book, chapter by chapter. A test was administered at the end of each chapter to determine how well students understood the math concepts presented; however, the chapter test was not used as a prescriptive tool. After the test was administered, the next chapter was presented for investigation.

The 1984-85 school term was the beginning of the IMS exposure to the Intermediate fifth-grade students. During that term, students in the treatment group were led through the math book as the sequential objectives, written by a teacher, directed them. The formative test was administered after an objective had been taught. Students then received enrichment activities or correctives as prescribed by the results of the test. Each student was allowed the time to master the first objective before preceeding to the second objective. Students in the non-IMS control group used the same text; however, they proceeded through the book, chapter by chapter, without regard to passing mastery tests.

The principal monitored the control and treatment groups to ensure that teachers Q and R followed the IMS steps and that teachers S and T did not. She discussed teaching strategies with the four teachers, observed in the classrooms, and examined lesson plans throughout the treatment period.

In March of 1985, the end of the treatment period, three instruments were administered to the students in both groups. The Iowa Test of Basic Skills was used to determine if there was a significant difference in the achievement of the IMS and the non-IMS groups. The Piers-Harris Children's Self-Concept Scale was used to determine if a significant difference existed between the academic self-concepts of the IMS and the non-IMS groups. Finally, the results of the Cox Math Attitude Index were used to determine if there was a significant difference in the attitude toward math of the two groups.

Instrumentation

Iowa Test of Basic Skills

Nitko's (cited in Mitchell, 1985a) review in The Ninth Mental Measurements Yearbook, Volume I, described the Iowa Test of Basic Skills as an instrument which measured the learner's growth in these skill areas: listening, vocabulary, reading, language, work-study, social studies, science, and mathematics. One purpose for which the instrument was designed was "to facilitate . . . decisions external to the classroom such as identifying strenghts and weaknesses of a group . . . and ascertaining the effectiveness of curricular or instructional innovations" (p. 721).

There were three mathematics skills subtests: Problem Solving Subtest, Computation Subtest, and Concepts Subtest. The Problem Solving Subtest covered single-step addition, subtraction, multiplication, and division problems. It also covered multiple-step problems utilizing combinations of operations. The Computation Subtest included whole numbers, fractions, and decimals with the four arithmetic operations. The Concepts Subtest covered basic concepts in these six basic areas: numeration, number sentences, whole numbers, fractions, decimals, and geometry and measurement. Scores obtained from the three subtests were combined to form a total math score which was the score used in this study.

A single wide-range test (Form 7) was developed to test skill development from low grade three to high grade nine. Levels were numbered to "correspond roughly to chronological age" (Hieronymus, Lindquist, and Hoover, 1983, p. 5). For instance, Level 10 corresponded to a developmental level that was average for a child 10 years of age. Form 7, Level 10, was administered to the treatment and control groups in March, 1984, and Form 7, Level 11, was administered to them in March, 1985. Level 10 was administered to all fourth graders in the Neosho School District in 1984 to aid in determining the quality of the math program. The total math percentile scores were also used for fifth-grade group placement. Level 11 was administered to all fifth-grade students to assist in the evaluation of the math program, as well as to determine the difference in the achievement of the IMS and the non-IMS groups. Those levels were chosen for grades four and five because they tested the skills/concepts which had been taught to that grade in the Neosho School System. The percentile score of each student was used to calculate the mean of the treatment and the control groups.

Hieronymus, Lindquist, and Hoover (1983) reported that the internal consistency reliability coefficients for the five subtests (reading, language arts, vocabulary, work-study, and math) range from .89 to .96. They did not state a specific reliability coefficient for math. The researchers explained the validity of their test by stating:

> The content specifications are based upon over forty years of continuous research in curriculum, measurement procedures, and interpretation and use of test results. . . . The item selection process involved a combination of empirical and judgmental procedures, including evaluation by representative professionals from diverse cultural groups (p. 2).

Piers-Harris Children's Self-Concept Scale

Results of the Piers-Harris Children's Self-Concept Scale were obtained to allow the comparison of the academic self-concept of the control and the experimental groups. The instrument was a self-report inventory used with students in grades 4 through 12. It consisted of a four-page booklet containing 80 first-person statements. The student circled "yes" if the statement described the way he felt about himself or he circled "no" if the statement did not describe how he felt about himself. The raw data were converted into stanines, percentiles, and T-scores. A total self-concept, as well as six cluster scores (Behavior, Intellectual and School Status, Physical Appearance and Attributes, Anxiety, Popularity, and Happiness and Satisfaction) were obtained (Mitchell, 1985b). The Intellectual and School Status Cluster measured the academic self-concept (Piers, 1984).

Recent studies showed that test-retest reliability coefficients for the Intellectual and School Status Cluster (academic self-concept) ranged from .42 to .96, with a mean of .73 (Mitchell, 1985b). "Internal consistency estimates for the total score range from .88 to .93" (Piers, 1984, p. 57).

> In another study using the scores from the original norm group, the internal consistency coefficient for the total scale was .90, with the cluster scales ranging from .73 to .81. Thus, the instrument appears to be highly reliable (Mitchell, 1985b, p. 1168).

The internal consistency coefficient for the Intellectual and School Status Cluster Scale (academic self-concept) was .78 (Piers, 1984).

"Estimates of the content, criterion-related, and construct validity of the Piers-Harris have been obtained from a number of empirical studies" (Piers, 1984, p. 57). When comparing the Piers-Harris with other instruments addressing the self-concept issue there was a range from r = .32 to r = .85.

Both reviewers in The Ninth Mental Measurements Yearbook, Volume II suggested that the Piers-Harris Children's Self-Concept Scale was useful as a research instrument when measuring treatment outcome:

> The Piers-Harris appears to be the best children's self-concept measure currently available. It is highly recommended for use as a classroom screening device, as an aid to clinical assessment, and as a research tool (Mitchell, 1985b, p. 1170).

"The authors are candid about the limitations inherent in the scale and offer specific cautions regarding interpretation" (Mitchell, 1985b, p. 1169). Piers (1984) stated that when interpretating a raw score, one must remember that the obtained score is an estimate of the student's true score. The obtained score varies as a "function of the reliability of the scale and the standard deviation of the scores" (Piers, 1984, p. 38). A Table of Confidence Intervals for Raw, Stanine, and T-Scores was given in the manual to assist with the interpretation of the total self-concept and the six clusters.

The cluster scale scores "were derived empirically through extensive factor analysis" (Piers, 1984, p. 38). The Intellectual and School Status Cluster (academic self-concept) reflected the student's "self-assessment of his or her abilities with respect to intellectual and academic tasks, including general satisfaction with school and future expectations" (Piers, 1984, p. 38). A high score on that cluster showed that the student reflected good feelings about himself and his school experiences. A low score could mean one of two things. If the student were a high achiever academically, a low score might indicate that the parents or the student himself have set unrealistic expectations for the student. The student felt that no matter what he achieved it was never good enough. On the other hand, if the student were a low achiever, a low score might indicate that he had internalized the low appraisal he was receiving from significant others. Piers also warned that the interpretation of any test should take into consideration all pertinent data about the student. One score does not give the whole picture.

Cox Math Attitude Index

The Cox Math Attitude Index (CMAI) was used to determine the difference in the attitude toward math of the experimental group and the attitude toward math of the control group. The CMAI consisted of 20 Likert-type statements which were answered by checking either "No," "Sometimes," or "Always" (Appendix D).

The author of the CMAI examined attitude toward the subject instruments prior to developing the instrument. The Anttonen Revised Hoyt Scale of Arithmetic Attitude, Arithmetic Attitude Scale, Arlin-Hills Attitude Surveys, and Attitudes Toward Arithmetic were read and studied. Information concerning the type of question, the way the student responded, and the reliability and validity reports of each instrument was studied.

The Anttonen Revised Hoyt Scale of Arithmetic Attitude instrument consisted of 28 questions about arithmetic which were answered by circling either "Yes" or "No." "The correlation of the elementary attitude scores with the Iowa Test of Basic Skills ranged from .22 to .37 for various subgroupings of fifth and sixth grade boys and girls" (Johnson, 1976, p. 969). A test-retest reliability of .46 was shown with a group of third-, fourth-, and sixth-grade students. The internal reliability coefficients from various studies of students in grades four through seven ranged from .88 to .92.

The construction of Dutton's Arithmetic Attitude Scale was unclear; therefore, the possibility of using similar test items on the CMAI was unwarranted. The instrument was administered to learners from grade three to adulthood and the test-retest reliability was .94 (Johnson, 1976).

The Arlin-Hills Attitude Surveys had four sections. Section 4 was "Attitude Toward Math," which consisted of 15 illustrated statements. Students responded by marking their degree of agreement with each statement based upon a four-point scale. Reliability was .88 on the math section. Validity was examined and supported (Johnson, 1976).

Dutton and Blum's Attitudes Toward Arithmetic instrument was a Likert-type scale composed of 25 third-person statements. The student responded to the items by checking either "Strongly Agree," "Agree," "Have no Opinion," "Disagree," or "Strongly Disagree." Johnson (1976) reported that the reliability coefficients was .84, but validity had not been developed.

After examining the aforementioned instruments, the author of the CMAI decided to develop a Likert-type scale composed of 20 items. The student would respond by checking either "No," "Sometimes," or "Always" (Appendix E). The responses were assigned a weight of one, two, or three; therefore, there was a possibility of a score of 60. The higher the score, the more positive the attitude was toward math. In some questions, the "No" received a weight of one, while in other questions the "No" received a weight of three. "Sometimes" was assigned a weight of two for all questions. "Always" was assigned a weight of either one or three (Appendix E).

The author utilized the expertise of a panel of educators consisting of a director of special services, an elementary counselor, a high school counselor, and a teacher of a fifth-eighth grade gifted program to examine the CMAI. Each panel member had a background in tests and measurements (Appendix E). Test items were changed, deleted, and added to the instrument until the author and each panel member felt that the content validity, criterion-related validity, and construct validity for the CMAI were supported (Appendix E).

The reliability coefficients were obtained through the utilization of Method 2, covariance matrix, on the IBM 3081D at the Oklahoma State University computer laboratory at Stillwater, Oklahoma. The reliability analysis revealed alpha = .8793 (Appendix E).

Data Collection

Data pertinent to the study were collected at two points in time. In March, 1984, the Iowa Test of Basic Skills (ITBS) was administered to the fourth-grade students in the Neosho School District. The fourth-grade teachers administered the ITBS in their classrooms as a group project. The Director of Elementary Education sent the tests to the Riverside Publishing Company to be machine scored. Students' total math scores served as the placement instrument to assign them to a fifth-grade classroom, which ultimately placed them in either the control or treatment group.

The second time for data collection was in March, 1985. At that time, the fifth-grade teachers at Neosho's Intermediate School administered the ITBS to their students. Total math scores were used to compare the achievement of the control (non-IMS) and the treatment (IMS) groups. The principal administered the Piers-Harris Children's Self-Concept Scale to the students in each of the eight fifth-grade classrooms. Data were obtained from the results of the Piers-Harris to compare the academic self-concept of the control group with the academic self-concept of the treatment group. The principal also administered the CMAI to all fifth graders in their math classrooms. Results of the CMAI were then collected to compare the attitude toward the subject of the IMS group with the attitude toward the subject of the non-IMS group.

Design and Analysis of Data

Three statistical tools were used to analyze the data that were gathered after the treatment period. The t-test was utilized to determine whether differences between the control and experimental groups were significant in academic achievement, academic self-concept, or attitude toward math. Also, an ANOVA Repeated Measure Analysis was used to test the significance of the difference in achievement gains of the two groups. Finally, Multiple Regression analysis of variance was used to obtain the correlation of all the dependent variables.

The t-test used in this study was a:

> Statistical model designed to determine whether two groups, as represented by their means, are significantly different. . . . Slightly different t formulas are used depending on the particular sample data under analysis. Typically, the data are first treated by an F ratio to determine whether the variances of the two population groups are significantly different. F values, like t values, are interpreted for significances from a probability table (Popham and Sirotnik, 1973, pp. 133-134).

The pooled variance t-test formula was used because $N_1 \neq N_2$ (see Figure 7).

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\frac{n_1 - 1 \quad S_1^2 + n_2 - 1 \quad S_2^2}{n_1 + n_2 - 2} \quad \frac{1}{n_1} + \frac{1}{n_2}}$$

Figure 9. Pooled Variance t-Test Formula

A statistical computer package was used on the IBM 3081D at the Oklahoma State University computer laboratory at Stillwater, Oklahoma, to compute the pooled variance t-test. The .05 level of significance was accepted by the researcher as a prerequisite to the rejection or acceptance of the null hypotheses. This .05 level of significance was necessary to establish whether there was a significant difference in achievement, academic self-concept, or attitude toward math between the students taught with IMS strategies and those students who were not exposed to IMS methods.

Popham and Sirotnik (1973) suggested that rather than analyzing the achievement gains by subtracting the pretest scores from the posttest scores and then performing the t-test, one should perform the ANOVA Repeated Measure Analysis on the pre- and posttest scores for the treatment and the control groups. They stated that the analysis of variance (ANOVA) was a better growth indicator when one was assessing the effects of an educational principle or practice. After the analysis of variance (ANOVA) was computed on the IBM 3081D at the Oklahoma State University computer laboratory, the test of significance was performed by looking in the F Table (Popham and Sirotnik, 1973). The 0.05 level of confidence was used.

The analysis was twofold. Besides analyzing the variables separately to determine if IMS were a successful learning strategy, it was also important to analyze the relationship among the three variables. "The ultimate goal of a science of behavior for education is to isolate and understand more fully the nature of relationships among educational variables" (Popham and Sirotnik, 1973, p. 64). For the purpose of this part of the study, it was important to know how achievement was related to academic self-concept and attitude toward math. Was there a correlation, and, if so, was it positively or negatively correlated? If a student scored high on the Iowa Test of Basic Skills, would he also score high on the Piers-Harris and/or the CMAI, or would he score low on the Piers-Harris and/or the CMAI?

The Multiple Regression correlational statistical tool was used to understand the correlation of all the dependent variables of this study (Pre-Iowa, Post-Iowa, Academic Self-Concept, and Attitude Toward Math). "The strength and direction of a relationship between two variables is described by the value of r which ranges from a perfect relationship of $\pm$ 1.00 to a nonexistent relationship of zero" (Popham and Sirotnik, 1973, p. 80). The circumstance dictated what value of r was necessary to show that a strong relationship existed between two variables. After the correlation wass computed, a statistical table was consulted to determine the statistical significance of r. The 0.05 level of confidence was used for this study.

Summary

This chapter was a discussion of the methodology used to investigate the problem stated in Chapter I: Is the Instructional Management System (IMS), as advocated by the Missouri Commissioner of Education and the State Board of Education, an effective instructional system as implemented by fifth-grade math teachers in one school district? The design, sample, and instrumentation were described in this chapter. The method of data collection, the selection of the statistical tools, and the analysis of the data were also examined.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

Introduction

The purpose of this study was to provide information which would enable educators to make decisions concerning the utilization of the IMS based upon theory and empirical evidence. To achieve the purpose of this study, three outcomes (academic achievement, academic self-concept, and attitude toward the subject) were investigated.

Demographic characteristics and the statistical analysis of the treatment and control groups before treatment were discussed. To analyze the effects of IMS upon the academic achievement, academic self-concept, and attitude toward the subject of fifth-grade math students, three null hypotheses were formulated and tested. Finally, results of the analysis of data relative to the hypotheses, as well as additional data concerning students' affective domain were presented.

Effective Learning Gauges

Various gauges were used to determine the effectiveness of a learning strategy or pattern. Three gauges were presented for the purpose of this study. One important measuring gauge was whether or not the students achieved academically (Mallory, 1982). A second measure was whether the students had a positive or negative academic self-concept. An effective learning strategy/pattern enhances the students' academic self-concepts, according to Koehn (1983). Bloom (1981) stated that a student's attitude toward the subject was an important factor in his learning and his continued interest in learning; therefore, he suggested, a third measure of an effective learning strategy was whether or not it promoted a positive attitude toward the subject. Those three gauges (academic achievement, academic self-concept, and attitude toward the subject) were chosen for this study.

Demographic Characteristics and Analysis Before Treatment

The sample for this study consisted of 173 fifth-grade students in the Neosho R-V School District at Neosho, Missouri. One hundred of the students were male; 73 were female. Eighty-seven students were in the treatment group, while 86 were in the control group. The students were representative of the low, middle, and high academic ability groups. Since Neosho and the surrounding community is not a part of a Standard Metropolitan Area, and because the community has the diversified life-style of a typical small rural town, one would assume the students also represented the low, middle, and upper socioeconomic strata.

The mean achievement scores collected from the pretest of the Iowa Test of Basic Skills were used to discover if mean difference and/or population variability existed between the two groups before treatment of the IMS strategy to the experimental group. The t-test statistical tool was used (Table V).

There were no significant difference in the mean achievement scores of students placed in the treatment and control groups at the .05 level of confidence. The standard deviation was large for both groups, which supported the fact that the population within each group was heterogeneous.

TABLE V

COMPARISON OF MEAN ACHIEVEMENT SCORES OF STUDENTS PLACED FOR MATH INSTRUCTION

Group	Number	Standard Deviation	Mean	F Value	t
Treatment (IMS)	87	21.982	67.4598		
				1.10	.04*
Control	86	23.015	67.3256		

*Not significant at the .05 level because with 171 degrees of freedom, t = 1.960.

Source: L. R. Gay, Educational Research Competencies for Analysis and Application (1981).

Test of Hypotheses

The t-test was used to determine if any of the three null hypotheses were supported. ANOVA Repeated Measure Analysis was also used on the Iowa Test of Basic Skills scores for additional information pertaining to Hypothesis I_0.

Hypothesis I_0. There is no statistically significant difference between the math achievement of the IMS experimental group and the non-IMS control group of fifth-grade students.

The mean was 67.4598 for the IMS group on the pre-ITBS and 67.3256 for the non-IMS group. The post-ITBS mean was 66.5862 for the IMS group and 61.3488 for the non-IMS group. The mean gain from March, 1984, to March, 1985, was -.8736 and -5.9767 for the IMS and non-IMS groups, respectively.

The mean gain scores of the treatment and control groups were subjected to the t-test to determine if there was a significant difference in the math achievement of the two groups (Table VI). An F-test produced a value of 1.58, which was significant at the 0.05 level of confidence. The pooled t-test was used to test whether a significant difference existed in achievement gain between the IMS and non-IMS groups. According to the probability chart, the t-value should be equal to or greater than 1.960 to be significant at the 0.05 level (Gay, 1981). The t-value obtained by comparing achievement gains of the two groups was 2.16; therefore, the null hypothesis was rejected.

Popham and Sirotnik (1973) suggested that the traditional posttest minus pretest difference score analysis was not the most sound way to assess change in education. They stated that a better way was to utilize a repeated measure design; therefore, an analysis of variance was performed (Table VII).

The obtained value of F for pretest posttest was 8.35, and the obtained value of F for pretest posttest by treatment was 4.67. According to the F probability chart, the obtained F value needed to be equal to or greater than 3.90 to be significant at the 0.05 level of confidence (Popham and Sirotnik, 1973). Again, the null hypothesis was rejected because the obtained F was larger than the tabled value of F (Appendix G). There was a significant difference in the achievement of the two groups.

TABLE VI

COMPARISON OF MEAN GAIN IN ACHIEVEMENT SCORES
OF STUDENTS TAUGHT BY TWO METHODS

Group	Number	Standard Deviation	Mean	F Value	t
Treatment (IMS)	87	13.667	-0.8736		
				1.58	2.16*
Control	86	17.205	-5.9767		

*Significant at the 0.05 level because t = 1.960 when df = 171.

Source: L. R. Gay, Educational Research Competencies for Analysis and Application (1981).

TABLE VII

ONE-WAY ANOVA FOR IOWA PRE AND POST SCORES
FOR TREATMENT AND CONTROL GROUPS

Source	SS	df	MS	F
Within	20622.78	171	126.54	
PrePost	1006.07	1	1006.07	8.35*
Treatment by PrePost	563.15	1	563.15	4.67*

*Significant at the 0.05 level because F = 3.90 when df for within group is 272 and df for between groups is 1.

To determine where the difference lay, the sample was split into three ability groups (low, middle, and high) (Appendix G). The pre-Iowa score was used to split the treatment and control groups, since it should contain less bias. The t-test was performed on the Iowa gain to analyze whether the significant difference was between the two low groups, the two middle groups, and/or the two high groups (Appendix G).

An F-test produced a value of 1.65, which was not significant at the 0.05 level of confidence. The pooled t-test was used to test whether a significant difference existed in achievement gain between the low-treatment and the low-control groups. According to the probability chart, the t-value should be equal to or greater than 2.01 to be significant at the 0.05 level (Gay, 1982). The t-value obtained by comparing achievement gains of the low ability groups was 0.77; therefore, there was no significant difference (Table VIII).

TABLE VIII

COMPARISON OF MEAN GAIN IN ACHIEVEMENT SCORES OF STUDENTS IN THE LOW-ABILITY GROUP

Group	Number	Standard Deviation	Mean	F Value	t
Treatment	27	14.172	4.8148		
				1.65	0.77*
Control	31	18.217	1.4839		

*Not significant at the 0.05 level because t = 2.01 when df = 56.

Source: L. R. Gay, Educational Research Competencies for Analysis and Application (1981).

The students in both low ability groups showed a positive gain; however, there was no significant difference between the two groups. Apparently it made little difference which instructional strategy was utilized with them.

An F-test produced a value of 1.75, which was not significant at the 0.05 level. The pooled t-test was used to determine whether a significant difference existed in achievement gain between the middle-treatment and the middle-control groups (Table IX). The t-value obtained by comparing achievement gains was 1.34 and the tabled value was 2.01; therefore, there was no significant difference at the 0.05 level of confidence. Apparently, the students in the middle-ability group did not benefit significantly as a result of using the IMS learning strategy. Both groups showed a loss in achievement when analyzing their mean gain scores. The IMS group had a smaller loss than did the non-IMS group. The loss for the treatment group was 3.1935; for the control group, the loss was 9.6190.

An F-test produced a value of 1.38, which was not significant at the 0.05 level. The pooled t-test was utilized to test whether a significant difference existed in achievement gain between the high-treatment and the high-control ability groups (Table X). The t-value obtained by comparing achievement gains was 2.40, which was greater than the tabled value for df = 61; therefore, there was a significant difference at the 0.05 level of confidence.

When analyzing the significant difference which existed between the IMS group and the non-IMS group, one must note that the significant difference was between the top ability groups. Both groups had a loss; however, the reader will note that the treatment group had a significantly smaller loss than did the control group. The mean gain in achievement scores for the IMS group showed a smaller loss from pre- to post-Iowa than did the mean gain achievement scores for the non-IMS group. The IMS group had a loss of 3.6897, whereas the non-IMS group had a loss of 10.5294.

TABLE IX

COMPARISON OF MEAN GAIN IN ACHIEVEMENT SCORES OF STUDENTS IN THE MIDDLE-ABILITY GROUP

Group	Number	Standard Deviation	Mean	F Value	t
Treatment	31	14.851	-3.1935	1.75	1.34*
Control	21	19.630	-9.6190		

*Not significant at the 0.05 level because t = 2.01 when df = 50.

Source: L. R. Gay, Educational Research Competencies for Analysis and Application (1981).

Hypothesis II_0. There is no statistically significant difference between the self-concept scores of the IMS group and the non-IMS group.

A comparison was made of the mean academic self-concept scores of the control and treatment groups. The results of the Piers-Harris were utilized for this analysis. Results of this instrument showed a mean of 11.8046 for the treatment group and 11.6977 for the control group. An F-test produced a value of 1.25, which was not significant at the 0.05

level of confidence; therefore, the pooled variance t-test was used to test for significant difference in self-concept. The t-value obtained by comparing the mean scores was 0.19, which is not significant; therefore, the null hypothesis was supported (Table XI). Those students exposed to IMS for the duration of this study did show a slight gain; however, the gain was not large enough to validate the utilization of IMS as a better instructional strategy.

TABLE X

COMPARISON OF MEAN GAIN IN ACHIEVEMENT SCORES OF STUDENTS IN THE HIGH-ABILITY GROUP

Group	Number	Standard Deviation	Mean	F Value	t
Treatment	29	10.272	-3.6897		
				1.38	2.40*
Control	34	12.046	-10.5294		

*Significant at the 0.05 level because t = 2.00 when df = 61.

Source: L. R. Gay, Educational Research Competencies for Analysis and Application (1981).

Hypothesis III_0. There is no statistically significant difference in the attitudes toward math between the IMS group and the non-IMS group. An F-test produced a value of 1.21, which was not significant at the 0.05 level; therefore, the pooled variance t-test was used to test for significant differences in attitudes toward math. According to the probability chart, the t-value should be equal to or greater than 1.960 to be significant at the 0.05 level (Gay, 1981). The t-value obtained by comparing the mean score of the treatment group to the mean score of the control group was -1.01; therefore, the null hypothesis was supported (Table XII). Although there was no significance between the two groups, the control group scored higher than the treatment group on the CMAI, which meant the non-IMS group may have had a more positive feeling toward math than did the IMS group (Appendix G).

TABLE XI

COMPARISON OF MEAN ACADEMIC SELF-CONCEPT SCORES
OF STUDENTS TAUGHT BY TWO METHODS

Group	Number	Standard Deviation	Mean	F Value	t
Treatment (IMS)	87	3.947	11.8046		
				1.25	0.19*
Control	86	3.532	11.6977		

*Not significant at the .05 level because t = 1.960 when df = 171.

Source: L. R. Gay, Educational Research Competencies for Analysis and Application (1981).

TABLE XII

COMPARISON OF MEAN ATTITUDE TOWARD MATH SCORES
OF STUDENTS TAUGHT BY TWO METHODS

Group	Number	Standard Deviation	Mean	F Value	t
Treatment (IMS)	87	7.924	34.0230		
				1.21	-1.01*
Control	86	7.201	35.1860		

*Not significant at the .05 level because t = 1.960 when df = 171.

Source: L. R. Gay, Educational Research Competencies for Analysis and Application (1981).

Additional Data

As stated earlier, one of the outcomes of analyzing the data of this study was to discover if there was a correlation between the variables. Was there a significant relationship between achievement and academic self-concept? Was there a significant relationship between achievement and attitude toward the subject? To determine these relationships, the Multiple Regression correlational statistical tool was used. Results of the Multiple Regression (Appendix G) are shown in Table XIII.

Summary

Chapter IV included a review of the purpose and the variables of this study. It also included a presentation of the demographic characteristics and the statistical analysis of the treatment and control groups before treatment was administered. Next, the statistical tools were described. Three null hypotheses were tested. Statistical evidence presented indicated that there was a significant difference in the academic achievement of the IMS and the non-IMS groups. The IMS groups achieved better than the non-IMS group. Further analysis showed that there was a different result for different ability groups. There was a significant difference in the academic achievement of the high ability group. The IMS group outperformed the non-IMS group. No significant difference existed between the mean achievement score of the middle-ability IMS group and the middle-ability non-IMS group or between the low-ability IMS group and the low-ability non-IMS group. The two methods of teaching fifth grade math produced no significant differences in academic self-concept or attitude toward math at the 0.05 level of confidence. Additional information indicated that there was a significant correlation between academic achievement and academic self-concept, academic achievement and attitude toward math, and academic self-concept and attitude toward math.

TABLE XIII

CORRELATION OF ALL DEPENDENT VARIABLES

	Pre-Iowa	Post-Iowa	Academic Self-Concept	Attitude Toward Math
Pre-Iowa	1.000	.761	-.410	.167
Post-Iowa	.761	1.000	.466	.204
Academic Self-Concept	.410*	.466*	1.000	.294
Attitude Toward Math	.167	.204*	.294*	1.000

*Significant at the 0.01 level when df = 171.

Source: W. J. Popham and K. A. Sirotnik, Educational Statistics Use and Interpretation (1973).

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The purpose of this study was to provide information which would enable educators to make decisions concerning the utilization of IMS, an instructional system based upon an integration of Carroll's (1963) learning model and Bloom's (1976) learning theory. This integration was known as mastery learning (ML) in the literature. To achieve the purpose of this study, three gauges of effective learning (academic achievement, academic self-concept, and attitude toward math) were analyzed. Three null hypotheses were tested to determine if statistically significant differences existed between the mean academic achievement gains, the mean academic self-concepts, and/or the mean attitudes toward math of the IMS and the non-IMS groups. An analysis of variance was performed on the three variables to make statistical comparisons between all pairs of variables. It was also noted whether or not growth was in an expected direction. The summary of those analyses and the conclusions and recommendations based upon those analyses were reported in this chapter.

Summary

It was determined after reviewing the literature that an insufficient amount of empirical research had been conducted concerning IMS.

Since IMS is a strategy based upon ML theory, ML empirical studies were examined.

ML is a technique wherby students are "given all the time and instruction necessary to master each simple skill or learn each bit of knowledge" (Mallory, 1982, p. 5). Students were not to advance to the next skill until they demonstrated mastery of the first skill. Guskey (1985) stated that ML is an instructional technique which

> involves organizing instruction, providing students with regular feedback on their learning progress, giving guidance and direction to help students correct their individual learning difficulties, and providing extra challenges for students who have mastered the material (p. xiii).

Articles and empirical studies were reviewed which suggested that ML was a positive force in academic achievement. Limited statistical evidence was available which supported the ML approach when investigating the effects of ML upon academic self-concept or attitudes toward the subject. Studies were reviewed which indicated that self-concept and achievement were positively correlated (Brookover, Thomas, and Patterson, 1964), attitude toward the subject and academic achievement were positively correlated (Bloom, 1977), and attitude toward the subject and academic self-concept were also positively correlated (Ludwig and Maehr, 1967).

A study was conducted during the 1984-85 school term to provide empirical data concerning IMS. The study tested three null hypotheses. One hundred seventy-three fifth-grade math students in the Neosho, Missouri School District were chosen as the sample. They were placed into two pods based upon their March, 1984, Iowa Test of Basic Skills results. Students of low, middle, and high academic ability were placed into each pod. Pod A, the experimental group, was subdivided into four groups. Two of the groups were taught by teacher Q and two groups were taught by teacher R. IMS was utilized. Pod B, the control group, was also subdivided into four groups. They were instructed by teachers S and T.

In March, 1985, three instruments (Iowa Test of Basic Skills, Piers-Harris Children's Self-Concept Scale, and Cox Math Attitude Index) were administered. Data collected from those instruments were analyzed to determine if there were any significant differences in academic achievement, academic self-concept, and/or attitude toward the subject between the IMS and non-IMS groups.

Three statistical tools were used in the analysis. First, the t-test was utilized to determine whether significant differences existed between the groups for any or all of the variables. Second, an ANOVA Repeated Measure Analysis was used to test the significance of the difference in achievement gains of the two groups. Finally, Multiple Regression Analysis of Variance was used to obtain the intercorrelations of all the dependent variables.

Statistical evidence presented indicated that Hypothesis I_0 was rejected at the 0.05 level of confidence. There was a significant difference in the achievement of the two groups, as evidenced by the results of the administration of the Iowa Test of Basic Skills. Further analysis showed that the significant difference was between the IMS high ability group and the non-IMS high-ability group, but not between the two middle-ability groups or the two low-ability groups. The results showed that the IMS high group outperformed the non-IMS high group.

Hypotheses II_0 and III_0 were supported. There was no significant difference in academic self-concept between the IMS and the non-IMS groups at the 0.05 level of confidence. Neither was there a significant difference between the two groups when analyzing attitude toward the subject.

Additional evidence indicated that there was a significant correlation at the 0.01 level of confidence between academic achievement and academic self-concept, academic achievement and attitude toward math, and academic self-concept and attitude toward math. These findings replicated the findings of Brookover, Thomas, and Patterson (1964), Bloom (1977), and Ludwig and Maehr (1967).

Conclusion

There was a significant difference at the 0.05 level of confidence in the academic achievement of the treatment and control groups. The treatment (IMS) group outperformed the control (non-IMS) group, as evidenced by the results shown on the Iowa Test of Basic Skills gain scores; however, neither group gained significantly over the previous year. Level 10 of the ITBS was given to the students in March, 19843, when they were in the fourth grade. Level 11 of the same test was administered in March, 1985, when those students were fifth graders. There was a mean gain of -0.8736 for the IMS group and a mean gain of -5.9767 for the non-IMS group. Further analysis showed that the significant difference was between the top-ability groups, not the middle- or low-ability groups.

There was no significant difference between the IMS and non-IMS groups in academic self-concept mean scores. Based upon the research evidence reported in this study that academic achievement and academic self-concept are positively correlated, one would expect the mean score to be higher for the IMS group, since this group outperformed the non-IMS group on the ITBS. The standard deviation was 3.947 for the IMS group and 3.532 for the non-IMS group. The means were very close for the two groups also (11.80 for the IMS group and 11.70 for the non-IMS group). There was not enough difference in the academic self-concept mean score of the two groups to conclude that IMS was a more effective learning strategy than the traditional strategy used in the control group. In fact, these data suggest that IMS may have been detrimental to academic self-concept.

There was no significant difference in the attitude toward math between the treatment and control groups. Here again, based upon the evidence that academic achievement and attitude toward the subject are positively correlated, one would expect the attitude toward math to be more positive with the treatment group. This was not the case. According to the posttest data, the control group had a more positive attitude toward math than did the treatment group. The standard deviation for the treatment group was 7.924, and the standard deviation for the control group was 7.201. The means were 34.02 and 35.15 for the treatment and control group, respectively. Possibly, IMS was detrimental to the student's attitudes toward math.

Subject to the scope, limitations, and assumptions of this study, and based upon the results of the study, one would conclude that the IMS did not serve as an unusually successful learning strategy.

Implications

At the conclusion of this study, some implications became apparent. The following is a discussion of those implications:

Before initiating IMS (or a similar learning strategy based upon ML) on an extensive scale, educators need to conduct a longitudinal study to determine the long-range effects on students' academic achievement, academic self-concept, and attitude toward the subject. They need to answer the following questions:

1. Are the students in the low-, middle-, and high-ability groups achieving at a higher level than they would be achieving without IMS?

2. Do the students have a positive self-concept?

3. What happens to the self-concept of the student who is always the last one to be permitted to go to the next skill? Does he feel defeated, or is his self-concept enhanced because he finally learned the task at hand?

4. What happens to the student's attitude toward the subject if he is subjected to feedback-correctives over a long period of time while the others explore new concepts? Does he become disenchanted with the subject, causing him to become unmotivated to learn that particular subject? Does he develop a yearning to study the subject further because he feels he has finally mastered some skills pertaining to that discipline and he now has the confidence to believe he can master kindred skills?

Another implication derived from the findings lies in the fact that if disciplines could be categorized as cognitive or affective, then math and science would be cognitive, whereas language arts and social studies would be affective. Math, a cognitive discipline, was utilized for this study. The outcomes supporting or rejecting the three hypotheses might have been different had an affective discipline been used.

When too much focus is placed upon the cognitive domain, the affective domain often gets neglected. Educators, meeting the societal pressure for better achievement scores, might forget to consider the whole child. There are emotional needs to be satisfied for the student as his academic achievement is enhanced.

Recommendations

Based upon the conclusions and implications of this study and the researcher's belief that there is more involved in the learning process than the student merely mastering cognitive objectives advocated by his intructors, the following recommendations for educational practice and further research are proposed:

Educational Practice

An emphasis should be placed upon the growth of each student. If he is already in the top group, then educators must provide challenging experiences to keep him from stagnating as he marks time taking IMS formative tests. Those tests prove only that he has attained the same mastery which is expected of the low and average student. His time could be spent learning new concepts/skills instead of taking tests. As educators assist in the growth of each student, they need to become cognizant of a variety of ways to enhance the student's self-concept and attitude toward the subject, in addition to his academic achievement.

There is no single instructional management system which is best for every student. It would be wise to require more courses such as Psychology of Human Development and Psychology of Learning in the teacher certification programs. If the teacher understands the needs of the individual child and how he learns, it would be an easier task to select the proper instructional plan for that child.

Perhaps the Iowa Test of Basic Skills did not test the objectives which were taught to the Intermediate fifth-grade students. If that were the case, it is possible that an accurate assessment was not made of their academic achievement. One might administer a criterion-referenced test (CRT) as the pre- and posttests instead of the ITBS. Then the students would be tested over the material they had studied and which they were expected to learn. The items on the CRT would cover the objectives proposed by the curriculum committee (administrators, teachers, parents, and students).

Research

Research should be conducted analyzing the effects of IMS upon the three variables in other disciplines. IMS, as implemented by the two math teachers at Intermediate, might be beneficial to students when utilized in other subject areas such as language arts or social studies. It should be noted if the students were affected differently according to whether they were in the low-, middle-, or high-ability group.

Educators need to initiate studies to explore academic self-concepts of those students who have to use feedback-correctives in math and/or other subject areas. Some students who need correctives are in the low-ability group; however, some are in the middle and high groups. They hurry through their formative tests, making careless mistakes. To analyze students' academic self-concept successfully, these steps should be followed:

1. Administer the Piers-Harris Children's Self-Concept Scale as a pretest.

2. Keep an accurate record of whether or not each student has to use feedback-correctives.

3. Administer the Piers-Harris as a posttest.

4. Compute the difference in the mean scores of those utilizing and those not utilizing feedback-correctives.

5. Perform a t-test on the mean academic self-concept scores to determine whether a significant difference exists.

Educators must also conduct empirical research to determine the attitude toward the subject of those students who usually have to remain on a given task longer than the others. Again, a pretest and posttest (CMAI) are administered. The students who use feedback-correctives are compared with those who do not use correctives by performing a t-test on the mean attitude toward math scores. The object of performing the t-test is to determine whether a significant difference exists in the attitude toward math between the group using correctives and the group not using feedback-correctives.

In summary, this study supported the idea that more empirical research is needed before initiating IMS or a similar learning strategy based upon ML. It is important to conduct longitudinal studies to determine the long-range effects on students' academic achievement, academic self-concept, and attitude toward the subject before deciding to use IMS on an extensive scale. If IMS is no better than the other strategies/instructional management systems being used, then the educational community must continue searching for a way to transfer knowledge and skills to students in a more efficient manner.

This study also supports the thought that IMS might be the best method for some, but not necessarily all, students. If this statement is true, then it is important to discover which students benefit and which ones do not. Educators must utilize a variety of strategies. To advocate one set of objectives, one learning strategy, one mastery level, and one consequence for all students is promoting inequality of educational opportunity. In order for teachers to provide the proper learning strategy with each student, they must be given the freedom to make curriculum decisions. For instance, the teacher could decide whether to give a paper and pencil test or a hand-signal assessment of the mastery of a skill. All students would not be expected to take the same formative test. Neither would they be expected to master the same objectives.

The teacher could decide which students needed which objectives after investigating their abilities, stages of development, and needs.

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APPENDIXES

APPENDIX A

INSTRUCTIONAL MANAGEMENT OBJECTIVES

NEOSHO R-5 SCHOOL DISTRICT
MATH PERFORMANCE OBJECTIVES

GRADE 5

SETS & NUMERATION — STRAND 1

M-5-1. Use the correct symbol to show a given number is greater than (>), less than (<), or equal to (=) another number to 100,000.
M-5-2. Write and orally identify numbers to 100,000.
M-5-3. Write the number that comes before, after, between any number to 10,000.
M-5-4. Identify the place value of each digit in a 5, 6, and 7 digit number. (i.e. 2,367,921; the three is in the hundred thousands place)
M-5-5. Write the ordinal number word of any set first to eighteenth. (i.e. OOOXO; the letter X is the fourth letter from the left)
M-5-6. Round a 4-digit number to the nearest thousand. (i.e. 6,284 is rounded to 6,000)
M-5-7. Round a 3-digit number to the nearest ten. (i.e. 486 is rounded to 490)
M-5-8. Write and orally identify a number word to 100,000. (i.e. three thousand two hundred twenty-one is identified as 3,221)

OPERATIONS: WHOLE NUMBERS — STRAND 2

M-5-9. Add two 4-digit numbers with multiple regrouping. (i.e. 3,984 + 4,937 = 8,921)
M-5-10. Subtract two 4-digit numbers with multiple regrouping. (i.e. 4,843 - 2,956 = 1,887)
M-5-11. Compute estimates of addition/subtraction by rounding 3-digit numbers to hundreds. (i.e. 328 + 467 = 300 + 500 = 800)
M-5-12. Multiply a 2-digit number by a 2-digit number, regrouping. (i.e. 36 x 58 = 288 + 1800 = 2,088)
M-5-13. Multiply a 3-digit number by a 2-digit number, regrouping. (i.e. 865 x 49 = 7785 + 34600 = 42, 385)
M-5-14. Divide a 3-digit number by a 1-digit number, regrouping (i.e. $3\overline{)426}$)
M-5-15. Divide a 3-digit number by a 1-digit number with remainders. (i.e. $3\overline{)710}$).
M-5-16. Divide a 3-digit multiple of ten by a multiple of ten divisor. (i.e. 240 ÷ 60 = 4)
M-5-17. Compute the average of a set of up to six 2-digit numbers. (i.e. 34 + 28 + 99 + 58 + 72 + 15 = 306, $6\overline{)306}$ = 51)

MATH PERFORMANCE OBJECTIVES

OPERATIONS: FRACTIONS, DECIMALS, AND PERCENT — STRAND 3

M-5-18. List all the factors of any whole number from one to fifty. (i.e. the factors of 42: 1,2,3,6,7,14,21,42. The factors of a number are all the possible numbers that could be multiplied together to obtain a specific number. In the example above the specific number is 42.)

M-5-19. Identify the greatest common factor of two seperate numbers to fifty. (i.e. the factors of 9: 1,3,9, the factors of 18: 1,2,3,6,9,18. The common factors of 9 and 18 are 1,3,9. The greatest common factor is 9)

M-5-20. Arrange fractions with like denominators in ascending or descending order. (i.e. 5/8, 4/8 3/8, 6/8, 7/8, 2/8, 1/8, 8/8. Ascending: 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8, 8/8. Decending: 8/8, 7/8, 6/8, 5/8, 4/8, 3/8, 2/8, 1/8.)

M-5-21. Give a fraction that is equivalent to a given fraction. (i.e. Fractions that are equivalent to 2/3 are $\frac{2}{3} \times \frac{2}{2} = \frac{4}{6}$ $\frac{2}{3} \times \frac{3}{3} = \frac{6}{9}$ $\frac{2}{3} \times \frac{4}{4} \; \frac{8}{12}$

4/6, 6/9, and 8/12 are all equivalent to 2/3)

M-5-22. Rename and write fractions in lowest terms (i.e. $\frac{6}{8} \div \frac{2}{2} = \frac{3}{4}$

M-5-23. Find the least common multiples for two numbers. (i.e. multiples of 2: 2,4,6,8,10,12,14, 16, 18..., multiples of 3: 3.6.9.12.15.18..., common multiples of 2 and 3: 6,12,18 the least common multiple of 2 and 3: 6)

M-5-24. Add two fractions with like demoninators and express the answer in simplest form. (i.e. 1/8 + 5/8 = 6/8, simplest form: 6/8 ÷ 2/2 = 3/4)

M-5-25. Subtract fractions with like denominators and express the answer in simplest form. (i.e. 5/12 - 1/12 = 4/12, simplest form 4/12 ÷ 4/4 = 1/3)

M-5-26. Add two mixed numbers (with fractions that have like denominators) and express the answer in simplest form. (i.e. 4 3/8 + 2 1/8 = 6 4/8 = 6 1/2)

M-5-27. Subtract two mixed numbers (with fractions that have like denominators) and express the answer in simplest form. (i.e. 7 5/6 - 3 3/6 = 4 2/6 = 4 1/3)

M-5-28. Rename mixed numbers as improper fractions. (i.e. 3 1/4 = 13/4)

M-5-29. Rename improper fractions as mixed numbers. (i.e. 7/3 = 2 1/3)

M-5-30. Multiply a fraction by a fraction and express answer in simplest form. (i.e. 2/3 x 4/8 = 8/24, simplest form: 8/24 ÷ 8/8 = 1/3)

M-5-31. Write and orally identify the place value of a number in a decimal through hundredths (i.e. 0.76, 6 is in the hundredths place)

Math Performance Objectives - Grade 5

M-5-32. Add decimal numbers to hundredths. (i.e. 3.45 + 0.89 = 4.34)

M-5-33. Subtract decimal numbers to hundredths. (i.e. 6.81 - 2.67 = 4.14)

M-5-34. Rename and write a decimal number as a common fraction. (i.e. .75 = $\frac{75}{100}$

M-5-35. Demonstrate skill in rounding a decimal to the nearest whole number.
(i.e. 25.86 is rounded to 26, 3.45 is rounded to 3)

Measurement — Strand 4

Linear

M-5-36. Measure and record lengths to the nearest eighth inch and centimeters.

M-5-37. Demonstrate ability to measure using customary units, (inches, feet, yards).

M-5-38. Convert measurements and record. (i.e. 42 in. = __yds. __in.)

M-5-39. Identify the symbol for: millimeter, centimeter, meter, kilometer.

M-5-40. Identify the symbol for millimeter, centimeter, meter, kilometer.
(i.e. mm, cm, dm, km)

M-5-41. Add and subtract customary linear units without regrouping.
(i.e. 5 yards 2 feet 2 inches + 1 yard 0 feet 9 inches = 6 yards 2 feet 11 inches,
7 yards 2 feet 9 inches - 5 yards 1 foot 6 inches = 2 yards 1 foot 3 inches)

Volume

M-5-42. Convert measurements & record. (i.e. cups, pints, quarts to gallon)
(i.e. 20 c. = 10 pt.; 4½ pt. = 9 c.; 5 pt. = 2½ qt.; 3½ qt. = 7 pt.; 8 qt. = 2 gal.;
2 3/4 gal. = 11 qt.)

M-5-43. Identify and write abbreviations for: milliliter, liter. (i.e. ml, l)

M-5-44. State and write that 1000 milliliters = 1 liter; that 1000 cubic centimeters = 1 liter.

Time: Clock

M-5-45. Tell/write time to the nearest second.

M-5-46. Rename periods of time using days, hours, minutes, seconds. (i.e. Time: 36 hours 45 minutes 15 seconds coverts to 1 day 12 hours 45 minutes 15 seconds.)

Mass

M-5-47. Define and determine appropriate use of pound and ton. (i.e. 16 oz. = 1 lb., 2000 lbs. 1 ton. A watermelon is weighed in pounds, a large truck is weighed in tons)

M-5-48. Convert ounces to pounds; pounds to tons.

M-5-49. State and write that there are 1000 grams in one kilogram.

M-5-50. Identify and write abbreviations for gram (g.) and kilogram (kg.)

Math Performance Objectives - Grade 5

Money

M-5-51. Count change from the purchase price to $10. (i.e. Purchase price $7.79; the customer gives the cashier $10.00. The amount counted back to the customer is counted as $7.79 one penny given; $7.80, two dimes; $7.90, $8.00 two dollars, $9.00, $10.00)

M-5-52. Compute the price of one item when given the price of several. (i.e. 2 for 79¢ = 40¢)

M-5-53. When given the total price for several like items, compute the price of a single item. (i.e. You have 5 items that cost 3 for 89¢, how much is one? $3\overline{)89}$ = 26 1/3¢ The cost for one is 27¢.)

M-5-54. Compute discounts given in terms of fractions and compute sale prices.

M-5-55. Read sales-tax tables and then compute total costs. (i.e. The amount of sale is $.38. The tax table is as follows: Sales Tax Table (5%)

Sale	Tax
.01 - .09	.00
.10 - .29	.01
.30 - .49	.02
.50 - .69	.03

The tax is $.02. The total cost is $.40.)

Temperature

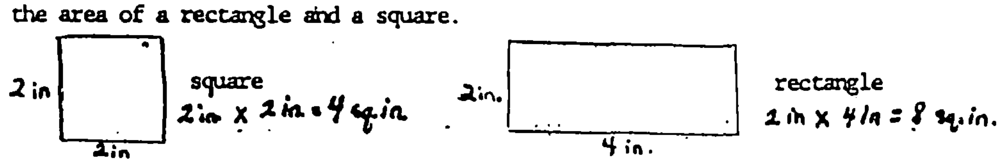
M-5-56. Read temperature to nearest degree above/below zero on Fahrenheit thermometer.

M-5-57. Identify freezing and boiling point on Celcius

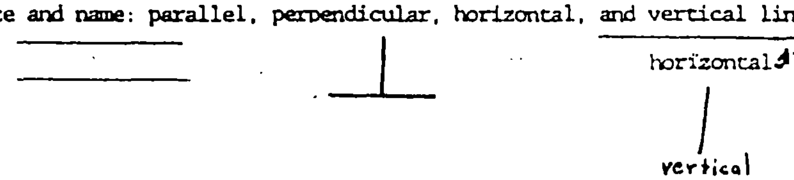
Geometry — Strand 5

M-5-58. Identify the parts of a circle: radius, diameter, center, circumference. (ie. NOTE: a dotted line or arrow indicates the part being identified.)

M-5-59. Find the area of a rectangle and a square.

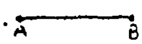


M-5-60. Recognize and name: parallel, perpendicular, horizontal, and vertical lines.



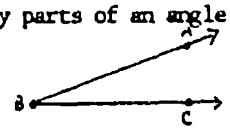
MATH PERFORMANCE OBJECTIVES - GRADE 5

GEOMETRY — STRAND 5 (CONT.)

M-5-61. Name points on a given line segment. (i.e. 

segment AB or BA or $\overline{AB}$ or $\overline{BA}$)

M-5-62. Identify parts of an angle: vertex, ray.

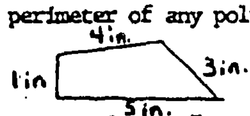
(i.e. 

$\overline{BA}$ is a ray
$\overline{BC}$ is a ray
end point B is the vertex of angle ABC)

M-5-63. Identify acute & obtuse angles. (i.e. 

acute angle (always measures <u>less</u> than 90°) obtuse angle (always measures <u>more</u> than 90°)

M-5-64. Find the perimeter of any polygon.

(i.e. 

1 in. + 4 in. + 3 in. + 5 in. = 13 in.)

PROBLEM SOLVING — STRAND 6

M-5-65. Solve one-step story problems of addition and subtraction of fractions with like denominators.

M-5-66. Solve story problems involving addition or subtraction of decimal numbers.

M-5-67. Solve weight & length story problems using the English system of measure involving any of the four basic operations.

M-5-68. Solve 2-step story problems involving money using the four basic operations.

M-5-69. Solve story problems involving time to the quarter hour.

M-5-70. Estimate the answer to story problems involving addition, subtraction, and multiplication.

SPECIAL TOPICS — STAND 7

CHARTS AND GRAPHS

M-5-71. Extract data from simple tables and graphs to use in problem solving.

COMPUTER SCIENCE

M-5-72. Be able to dicuss the history of the computer (Early Computer, "Modern" computers, applications, and the development of some computer language.)

M-5-73. Be able to develop a short picture program and prepare a story board for each.

MATH PERFORMANCE OBJECTIVES - GRADE 5

COMPUTER SCIENCE (CONT.)

M-5-74. Be able to explain the counter statement X = X + 1, and variations of it.

M-5-75. Be able to explain the order of operations as a computer would solve a math problem, including the use PF parenthesis, and be able to solve examples of such problems.

M-5-76. Be able to explain how to use variables and constants in a formula such as A = 1 *W and P = 2L + 2W.

M-5-77. Be able to explain the relations "less than, equal to, and greater than", and use them in math statements.

M-5-78. Students should use and understand these computer terms: ROM, RAM, DOS.

M-5-79. Students should be able to write BASIC programs, using the following statements: Print & Run, Let, Input, GoTo, In-Then, On-GoTo, Read-Data, String Data (A$), End/Stop, Formulas (Variable/Constants), Relations (Less Than, =, Greater Than).

APPENDIX B

SPECIFIC OBJECTIVES

Grade 5

NEOSHO PUBLIC SCHOOL DISTRICT

MATH PERFORMANCE OBJECTIVES

Performance Objectives	Mastery Percent	To Test Objective	Skill Area	Code No.
Convert measurements & record. (i.e. cups. pints, quarts to gallon) (i.e. 20 c. = 10 pt; 4½ pt. = 9 c.; 5 pt. = 2½ qt.; 3½ qt. = 7 pt.; 8 qt. = 2 gal.; 2 3/4 gal. = 11 qt.)	80%	M-5-T-42	MEASUREMENT: LINEAR, VOLUME, TIME, MASS, MONEY, TEMPERATURE.	M-5-42

Instructional Materials References	Media References
Heath Mathematics, pages 276, 277	

APPENDIX C

FEEDBACK-CORRECTIVES AND ENRICHMENT

M-5-42

Suggested Activities

1. If a sink is available, allow pupils to experiment with capacity measurements to discover and reinforce relationships among units.

2. Discuss the illustration with pupils. Ask "Why are there rings around sets of two cups? When you change cups to pints do you multiply or divide? Why do you divide?" The answers to these questions should lead to the fact that every two cups equal one pint and we need to figure the number of twos there are and see if there are any left over. Discuss more situations converting inches to feet.

3. Make an equivalents chart for measuring liquids.

2 cups (c)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)
8 pints	= 1 gallon

4. Supply or ask pupils to bring assorted bottles and jars. Try to find a few that will hold precisely a cup, pint, quart, and gallon. Label each container with letter or color code display the bottles. Ask pupils to list their estimate of which ones might hold a gal.

APPENDIX D

FORMATIVE TEST A, B, C

M-5-42

NAME:	POSSIBLE SCORE	CRITICAL SCORE	PUPIL SCORE
OBJECTIVE: M-5-42	10	8	

Complete:

1. 2 gallons = ____________ quarts
2. 5 quarts = _____________gallons
3. 4 quarts = _____________ gallon(s)
4. 2 gallons 1 quart = __________ quarts
5. 10 quarts = ____________ gallons
6. ______cups = 1 quart
7. ______cups = 1 pint
8. 14 cups = _____ pints
9. 18 pints = _____ quarts
10. 11 pints = _____ cups

APPENDIX E

COX MATH ATTITUDE INDEX

DIRECTIONS: Read each sentence. Decide if it is true for you none of the time, sometimes, or always. Put an X in the column that is true for each sentence.

COX MATH ATTITUDE INDEX

	no	sometimes	always
1. Math is fun.			
2. Math is my favorite subject.			
3. I wish math class were longer.			
4. Math makes me think.			
5. Last year I liked math.			
6. I enjoy doing my math homework.			
7. I hate math.			
8. Math problems are too easy.			
9. I make low grades in math.			
10. Math is more fun than other subjects.			
11. I make good grades in math.			
12. Other subjects are more interesting than math.			
13. Math problems are too hard.			
14. I wish math class were shorter.			
15. We should have more math classes.			
16. Next year I will enjoy math.			
17. I hate doing math problems at home.			
18. It is fun to think up new math problems.			
19. Math is boring.			
20. My parents like math.			

APPENDIX F

SCORING THE COX MATH ATTITUDE INDEX, RELIABILITY ANALYSIS OF CMAI, VALIDITY OF CMAI, CREDENTIALS OF PANEL

SCORING THE COX MATH ATTITUDE INDEX: The number in each box indicates the value assigned to that particular response.
DIRECTIONS: Read each sentence. Decide if it is true for you none of the time, sometimes, or always. Put an X in the column that is true for each sentence.

COX MATH ATTITUDE INDEX

	no	sometimes	always
1. Math is fun.	1	2	3
2. Math is my favorite subject.	1	2	3
3. I wish math class were longer.	1	2	3
4. Math makes me think.	1	2	3
5. Last year I liked math.	1	2	3
6. I enjoy doing my math homework.	1	2	3
7. I hate math.	3	2	1
8. Math problems are too easy.	1	2	3
9. I make low grades in math.	3	2	1
10. Math is more fun than other subjects.	1	2	3
11. I make good grades in math.	1	2	3
12. Other subjects are more interesting than math.	3	2	1
13. Math problems are too hard.	3	2	1
14. I wish math class were shorter.	3	2	1
15. We should have more math classes.	1	2	3
16. Next year I will enjoy math.	1	2	3
17. I hate doing math problems at home.	3	2	1
18. It is fun to think up new math problems.	1	2	3
19. Math is boring.	3	2	1
20. My parents like math.	1	2	3

RELIABILITY ANALYSIS - SCALE (ATTITUDE)

Number of Cases = 173.0

Statistics for	Mean	Variance	Standard Deviation	# CF Variables
Scales	34.6012	57.3574	7.5735	20

Item-Total Statistics

	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
MATHA101	32.4046	52.3818	.6342	.4937	.8705
MATHA102	32.6185	49.2024	.6665	.5555	.8667
MATHA103	32.8960	50.3612	.5860	.5057	.8700
MATHA104	32.0347	55.5918	.1822	.1053	.8818
MATHA105	32.3468	52.2860	.3859	.2751	.8776
MATHA106	32.8786	50.8166	.6131	.4908	.8693
MATHA107	33.1272	51.1349	.7146	.5898	.8674
MATHA108	32.9306	55.4486	.2065	.1609	.8811
MATHA109	33.1965	54.5774	.2922	.5903	.8791
MATHA110	32.6821	50.8576	.6255	.5253	.8690
MATHA111	32.3699	54.3391	.3246	.5881	.8782
MATHA112	33.5202	52.4952	.4355	.3864	.8753
MATHA113	33.4740	55.5647	.2129	.2432	.8807
MATHA114	33.5202	48.7510	.6887	.6354	.8657
MATHA115	33.0173	50.6683	.5372	.4458	.8719
MATHA116	32.5376	50.6221	.6269	.5208	.8688
MATHA117	33.5434	51.3542	.4804	.3758	.8740
MATHA118	32.5260	51.3554	.4842	.3387	.8738
MATHA119	33.2601	50.4843	.6764	.5706	.8674
MATHA120	32.5376	53.5872	.2669	.1290	.8821

Reliability Coefficients 20 Items

Alpha = .8793

Standarized Item Alpha = .8769

VALIDITY REPORT FOR COX MATH ATTITUDE INDEX

We, the undersigned, examined the 1985 version of the Cox Math Attitude Index. We made suggestions for changes, deletions, and additions to enhance the validity of the instrument. A positive report is given for content validity, criterion-related validity, and construct validity of the CMAI if administered to fifth grade students.

NAME TITLE

Edgar L. Brown, Director of Special Services

Judith H. Dixon, Teacher of the Gifted

Jakala Long, High School Counselor, SPE

Alice Daspit, Elementary Guidance Counselor

CREDENTIALS OF PANEL

Edgar Brown, Director of Special Services at Neosho, has held this position for 18 years. He has also had clinical testing and diagnosis experience. Mr. Brown has an MS in reading and an Ed.S. in special education. He is considered an expert among his peers, as far as testing and interpreting test data is concerned.

Judith Dixon, teacher of the gifted, has an excellent background in testing and measurements. She is certified to administer the WICS-R and is working on the state certification for psychological examiner.

Jahala Long, high school counselor, has an MS in guidance and counseling and is certified as a school psychological examiner. Mrs. Long is proficient in testing and analyzing test data.

Alice Daspit, elementary guidance counselor, holds an MS degree in guidance and counseling. She is also a certified school psychometrist.

APPENDIX G

COMPUTER PRINTOUTS OF ANALYSES OF

IOWA, CMAI, AND PIERS-HARRIS

29 MAR 86 T-TEST ON IOWA GAIN SCORE AND ALL OTHER DEPENDENT VARIABLES
09:10:56 OKLAHOMA STATE UNIVERSITY IBM 3081D MVS/SP 1.3

T - T E S T

GROUP 1 - TRT EQ 1.
GROUP 2 - TRT EQ 2.

VARIABLE	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	F VALUE	2-TAIL PROB.	POOLED VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.	SEPARATE VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
IOWAGAIN												
GROUP 1	87	-0 8736	13.667	1.465	1.58	0.034	2.16	171	0.032	2.16	161.87	0.032
GROUP 2	86	-5.8767	17.205	1.855								
PREIOWA												
GROUP 1	87	67.4598	21.982	2.357	1.10	0.672	0.04	171	0.969	0.04	170.44	0.969
GROUP 2	86	67.3256	23.016	2.482								
POSTIOWA												
GROUP 1	87	66.5862	22.171	2.377	1.13	0.569	1.51	171	0.134	1.50	170.09	0.134
GROUP 2	86	61.3488	23.583	2.543								
SCHSC P-H SCHOOL SELF-CONCEPT												
GROUP 1	87	11.8046	3.947	0.423	1.25	0.306	0.19	171	0.851	0.19	169 34	0.851
GROUP 2	86	11.6977	3.532	0.381								
MATHATTD COX MATH ATTITUDE INDEX												
GROUP 1	87	34.0230	7.924	0.850	1.21	0.378	-1.01	171	0.314	-1.01	169.81	0.314
GROUP 2	86	35.1860	7.201	0.776								

29 APR 86 T-TEST ON PRE- POST- & IOWA GAIN ON LOW, MID, HIGH
18:21:17 OKLAHOMA STATE UNIVERSITY IBM 3081K MVS/SP 1.3.4

SCOREGRP: 3.00 HIGH SCORE ON PRE-IO

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GROUP 1 - TRT EQ 1.
GROUP 2 - TRT EQ 2.

VARIABLE	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	F VALUE	2-TAIL PROB.	POOLED VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.	SEPARATE VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
IOWAGAIN												
GROUP 1	29	-3.6897	10.272	1.907	1.38	0.393	2.40	61	0.019	2.43	61.00	0.018
GROUP 2	34	-10.5294	12.046	2.066								
PREIOWA												
GROUP 1	29	90.5862	5.597	1.039	1.03	0.930	0.73	61	0.467	0.73	59.16	0.468
GROUP 2	34	89.5588	5.517	0.946								
POSTIOWA												
GROUP 1	29	86.8966	10.058	1.868	1.82	0.110	2.58	61	0.012	2.64	59.92	0.011
GROUP 2	34	79.0294	13.561	2.326								

29 APR 86 T-TEST ON PRE- POST- & IOWA GAIN ON LOW, MID, HIGH
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SCOREGRP: 2.00 MIDDLE SCORE ON PRE-

\- T - T E S T -

GROUP 1 - TRT EQ 1.
GROUP 2 - TRT EQ 2.

VARIABLE	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	F VALUE	2-TAIL PROB.	POOLED VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.	SEPARATE VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
IOWAGAIN												
GROUP 1	31	-3.1935	14.851	2.667	1.75	0.162	1.34	50	0.185	1.27	35.01	0.211
GROUP 2	21	-9.6190	19.630	4.284								
PREIOWA												
GROUP 1	31	69.2258	6.965	1.251	1.01	0.957	-0.37	50	0.714	-0.37	42.93	0.715
GROUP 2	21	69.9524	7.003	1.528								
POSTIOWA												
GROUP 1	31	66.0323	15.481	2.782	1.67	0.196	1.16	50	0.253	1.10	35.58	0.279
GROUP 2	21	60.3333	20.043	4.374								

29 APR 86 T-TEST ON PRE- POST- & IOWA GAIN ON LOW, MID, HIGH
18:21:17 OKLAHOMA STATE UNIVERSITY IBM 3081K MVS/SP 1.3.4

SCOREGRP: 1.00 LOW SCORE ON PRE-IOW

- T - T E S T -

GROUP 1 - TRT EQ 1.
GROUP 2 - TRT EQ 2.

VARIABLE		NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	F VALUE	2-TAIL PROB.	POOLED VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.	SEPARATE VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
IOWAGAIN	GROUP 1	27	4.8148	14.172	2.727	1.65	0.197	0.77	56	0.445	0.78	55.34	0.438
	GROUP 2	31	1.4839	18.217	3.272								
PREIOWA	GROUP 1	27	40.5926	12.601	2.425	1.02	0.963	-0.17	56	0.865	-0.17	55.07	0.865
	GROUP 2	31	41.1613	12.736	2.287								
POSTIOWA	GROUP 1	27	45.4074	17.714	3.409	1.24	0.581	0.56	56	0.579	0.56	55.94	0.577
	GROUP 2	31	42.6452	19.727	3.543								

* * * * * * A N A L Y S I S O F V A R I A N C E * * * * * *

TESTS OF SIGNIFICANCE FOR POSTIOWA USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG OF F
WITHIN CELLS	20611.78134	171	120 53673		
PREPOST	1006.06936	1	1006.06936	8.34658	004
TRT BY PREPOST	563.14929	1	563 14929	4.67201	.032

STANDARD DEVIATIONS FOR DEPENDENT VARIABLE POSTIOWA

ERROR TERM	STD. DEV.
WITHIN CELLS	10.97892

29 Mar 86 CORRELATION OF ALL DEPENDENT VARIABLES FOR ALL SUBJECTS

09: 10: 52 OKLAHOMA STATE UNIVERSITY IBM 3081D MVS/SP 1.3

****MULTIPLE REGRESSION****

	MEAN	STD DEV	LABEL
PREIOWA	67.393	22.436	IOWA TEST OF BASIC SKILLS
POSTIOWA	63.983	22.968	IOWA TEST OF BASIC SKILLS
ACAS-C	11.751	3.736	PIERS-HARRIS SCHOOL SELF-CONCEPT
ATTDMATH	34.601	7.573	COX MATH ATTITUDE INDEX

N OF CASES = 173

CORRELATION:

	PREIOWA	POSTIOWA	ACAS-C	ATTDMATH
PREIOWA	1.000	.761	.410	.167
POSTIOWA	.761	1.000	.466	.204
ACAS-C	.410	.466	1.000	.294
ATTDMATH	.167	.204	.294	1.000

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VITA

Bonnie Fern Cox

Candidate for the Degree of

Doctor of Education

Thesis: INSTRUCTIONAL MANAGEMENT SYSTEM: HOW IT AFFECTS ACHIEVEMENT, SELF-CONCEPT, AND ATTITUDES TOWARD MATH OF FIFTH-GRADE STUDENTS

Major Field: Educational Administration

Biographical:

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Professional Experience: Elementary Teacher, 1956-1965, Newton County, Missouri; Elementary Teacher, 1965-1980; Neosho, Missouri; Principal, Neosho, Missouri, 1980 to present.