



Incorporating learning styles in mastery learning classrooms
by Gary Hans Jacobsen

A thesis submitted in partial fulfillment of the requirement for the degree of Doctor of Education
Montana State University

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Abstract:

During the first semester of the 1985-86 school year, the researcher conducted an experiment in the Colstrip Public Schools in Colstrip, Montana. The study involved seventh grade students attending the Frank Britton Middle School. The problem of this study was to determine if student achievement could be improved and/or the number of remediations required for mastery reduced by incorporating Bernice McCarthy's 4MAT system of learning styles into initial instruction in mastery learning classrooms.

Six teachers, representing the subject areas of math, geography, art, industrial arts, and language arts, were chosen to participate in this study. Each teacher taught an experimental class and a control class. The teachers incorporated learning styles into initial instruction, using Bernice McCarty's 4MAT system, in the experimental group. The control groups were taught initial instruction without learning styles. At the end of the first semester the students were given a CRT achievement test to determine student achievement. The students were also given an attitude instrument to determine if there was a difference in attitude between the experimental and the control groups. The teachers recorded the amount of time taken for initial instruction. The teachers recorded the number of remediations required for the students to achieve mastery of the material.

An analysis of variance showed an improvement in achievement in industrial arts, but there was no improvement in achievement in any of the other subject areas. In math, language arts II, art, and industrial arts, there was a reduction in the number of remediations required for mastery, while in geography and language arts I there was no difference in the number of remediations between the experimental and the control group. There was no learning style preference-treatment interaction, nor was there any gender-treatment interaction. Based on this analysis, the researcher concluded that by incorporating learning styles into initial instruction in mastery learning classrooms, the number of remediations necessary for mastery could be significantly reduced.

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LEARNING CLASSROOMS

by

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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Date MAY 15, 1986

VITA

Gary Hans Jacobsen was born on February 15, 1949 in Sioux Falls, South Dakota. He attended Hamilton Public Schools, Hamilton, Montana, and graduated from Hamilton High School in June of 1967.

He received a Bachelor of Science degree from Western Montana College, Dillon, Montana, in 1972 and began a teaching career as a science teacher at White Sulphur Springs High School, White Sulphur Springs, Montana.

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ABSTRACT

During the first semester of the 1985-86 school year, the researcher conducted an experiment in the Colstrip Public Schools in Colstrip, Montana. The study involved seventh grade students attending the Frank Britton Middle School. The problem of this study was to determine if student achievement could be improved and/or the number of remediations required for mastery reduced by incorporating Bernice McCarthy's 4MAT system of learning styles into initial instruction in mastery learning classrooms.

Six teachers, representing the subject areas of math, geography, art, industrial arts, and language arts, were chosen to participate in this study. Each teacher taught an experimental class and a control class. The teachers incorporated learning styles into initial instruction, using Bernice McCarthy's 4MAT system, in the experimental group. The control groups were taught initial instruction without learning styles. At the end of the first semester the students were given a CRT achievement test to determine student achievement. The students were also given an attitude instrument to determine if there was a difference in attitude between the experimental and the control groups. The teachers recorded the amount of time taken for initial instruction. The teachers recorded the number of remediations required for the students to achieve mastery of the material.

An analysis of variance showed an improvement in achievement in industrial arts, but there was no improvement in achievement in any of the other subject areas. In math, language arts II, art, and industrial arts, there was a reduction in the number of remediations required for mastery, while in geography and language arts I there was no difference in the number of remediations between the experimental and the control group. There was no learning style preference-treatment interaction, nor was there any gender-treatment interaction.

Based on this analysis, the researcher concluded that by incorporating learning styles into initial instruction in mastery learning classrooms, the number of remediations necessary for mastery could be significantly reduced.

CHAPTER 1

INTRODUCTION

Today's typical classroom is quite different from classrooms that were prevalent during the early period of public education in this country. The Lancasterian school of the colonial period, delivered instruction to a large group of students, five hundred students or more, primarily by didactic lecture in a large lecture hall. Although not all schools were of the Lancasterian model, the primary method of instruction was teacher/book centered (Cremin, 1972). In today's classrooms, teachers use a variety of strategies for delivering instruction, ranging from lecturing to student generated inquiry approaches. Today's classrooms may be encompassed by four walls, or they may be outside in the open air. The classroom may be a fairly large lecture hall, or it may be a small science laboratory (Torshen, 1977).

Regardless of the strategy used to deliver instruction or the location of the classroom, generally the teacher will test the students to measure their achievement after a certain amount of time has passed or material has been covered. In many cases, without giving consideration to those students that have not achieved at high levels, the teacher proceeds to the next instructional unit. This has entrenched in the minds of many educators the idea that student achievement is normally distributed, which means that some students will achieve at high levels, some will achieve at low levels, and the vast majority of students will achieve in the middle range. Under this type of educational

system, instruction is delivered in such a manner that students are separated into groups on the basis of their aptitude. Students with high aptitudes achieve at high levels, and students with low aptitudes achieve at lower levels (Bloom 1976). Based upon this assumption, achievement and aptitude have a high positive correlation because time and instruction are kept constant. Aptitude, when considered in terms of IQ score, has been defined as the ability to learn, which generally means that some people will be able to learn well and others will not be able to learn as well.

In 1963 John Carroll suggested that aptitude was a function of time, and that rate of learning was a more important consideration when used to determine how well students learn.

In his book, Human Characteristics and School Learning, Benjamin Bloom (1976) outlined three characteristics that accounted for the variation in student achievement. These variables were preentry cognitive behaviors, affective entry characteristics, and quality of instruction. He suggested the variation in student achievement could be reduced if students were taught using a specific procedure, which he called learning for mastery (LFM). The components of Bloom's learning for mastery paradigm are: initial instruction, formative testing, remedial intervention, and retesting to achieve mastery. Bloom suggested that after no more than ten hours of instruction, approximately two weeks with a one hour class period, the teacher tests the students with a formative test. The formative test is to determine if the students are mastering the objectives of the lesson. For those students, who have mastered the objectives, the teacher assigns enhancement exercises, and for those students who have failed to master the objectives, the teacher reteaches those objectives that have not

been mastered. The reteaching should be done in a different manner than the way the objectives were initially taught. After reteaching the objectives not mastered, the teacher retests the students to determine if the students have mastered the objectives. This way the teacher makes sure that the students have the necessary preentry skills for the next unit of instruction. The fact that time and instruction are variables rather than constants in the mastery learning paradigm helps to reduce the effects of different learning rates on student achievement.

An underlying concept of mastery learning is the belief that all students are capable of learning and achieving at high levels. In a recent article James Block (1985: 2) wrote:

"Virtually all students can be equal and excellent in their learning, learning rate, and learning self-confidence, and that this equal excellence or "equality" can be generated with existing resources."

In order to work toward the idea that all students will achieve at high levels, teachers must make sure that students are given time and quality instruction. Time and instruction must be variables rather than constants if teachers are to help all students achieve mastery of the objectives for the class. Quality of instruction takes into consideration the variations that occur in the way students learn, perceive information, and receive information. To insure that each student receives high quality instruction, we need to teach in a variety of ways that will allow each student to best utilize his or her own way of receiving and perceiving information. Quality of instruction is greatly influenced by the particular mix of the student's characteristics, teacher, approach, and classroom organization (Keefe, 1979). Keefe has outlined a basic model of the school learning process as shown in Figure 1.

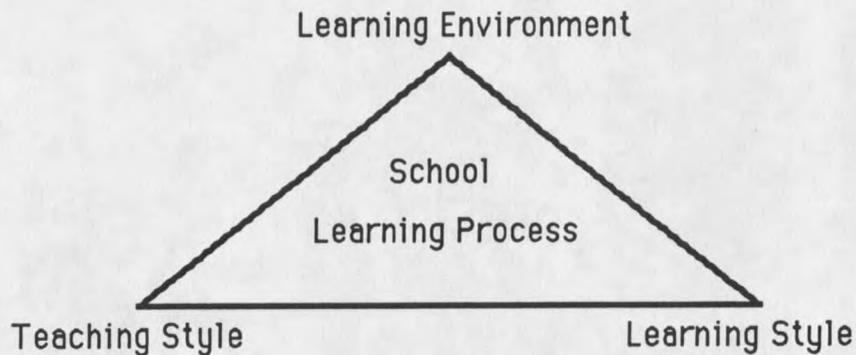


Figure 1. Applied Model of the School Learning Process

Bloom's Learning for Mastery paradigm does not address the various techniques and strategies that teachers use during instruction, nor does it take into consideration the various learning styles of individual students. Bloom's model of mastery learning is a generic model that does not restrict teachers in the way they present information, thus, teachers are free to use a variety of techniques in their teaching. Keefe explained that his model of the school learning process is a natural expansion of Bloom's concept of quality instruction. Keefe's model of the school learning process describes a three-way interaction between teaching style, learning style, and the learning environment. These three components, when combined together, make up the concept of quality instruction. It would appear that teaching and learning styles as applied to the mastery learning paradigm are worthy of consideration (Keefe, 1979).

According to Kolb (1984), the concept of learning styles has its roots in Jung's theory of psychological types representing different modes of adapting to the world and his developmental theory of individualism. Jung wrote that

people were classified along two bipolar continuums. He classified people on the continuum of thinkers to feelers, and on the continuum of sensors to intuitors. Jung believed that everyone was unique, and that we all learn and perceive differently. The concept of learning styles is complicated because it encompasses a variety of psychological and educational areas. As a result of this, there are many definitions of learning style. Kolb (1984:63) defines learning style as:

"Psychological types or styles are not fixed traits but stable states. The stability and the endurance of these states in individuals comes not solely from fixed genetic qualities or characteristics of human beings; nor, for that matter, does it come solely from the stable, fixed demands of environmental circumstances. Rather, stable and enduring patterns of human individuality arise from consistent patterns of transaction between the individual and his or her environment."

Cornett (1983) and Keefe (1979) proposed that learning styles fall into three general categories; cognitive styles, affective styles, and physiological styles. Cognitive styles are concerned with the ways we encode, decode, process, store, and retrieve information. Affective styles include emotional and personality characteristics of the students, i.e., motivation, attention, locus of control, interest, willingness to take risks, persistence, responsibility, and sociability. Physiological styles are involved with sensory perception, environmental characteristics, personal nutrition, and the optimum learning time (Cornett, 1983). These learning styles are consistent patterns of behavior, but with a certain range of individual variability which can change with age and experience.

There is an abundance of research literature in each of the three areas of learning styles. Because each of the areas of learning styles is, to a certain extent, unique, there is very little overlap in research among the areas of

learning styles. Research on field dependence/independence, a cognitive learning style, began after World War II, but research on learning styles did not receive a lot of attention until recently. There has been an upsurge in research on learning styles, particularly in the physiological area with the research by Kenneth and Rita Dunn of St. John's University. The results of research involving learning styles and achievement are mixed which indicated the need for further research to determine the effect of learning styles on the teaching/learning process.

Statement of the Problem

The problem of this research project was to determine if incorporating learning styles in initial instruction would improve student achievement and reduce the number of remediations necessary for mastery of the subject matter.

The research study compared a control group of students being taught using the mastery learning paradigm with an experimental group being taught using the mastery learning paradigm that addressed the different individual learning styles of the students during initial instruction. The study investigated the change, if any, in the students' attitudes following the adjustment for learning styles.

The study was conducted with seventh grade students in the Frank Britton Middle School at Colstrip, Montana, during the 1985-86 academic school year. The study ran from the beginning of the school year to the end of the first semester, which ended on the 17th of January 1986.

Need For The Study

When planned changes are anticipated within the school setting, one of the change axioms often employed to help bring about the change is the improvement of student achievement. Changes in the current instructional process or the adoption of a new instructional process will be more readily accepted if educators are shown that the change will result in improved student achievement (Owens, 1976). Most of the studies reviewed by the researcher dealt with what Block (1976) called "Type I research". This is research dealing with improvement of student achievement using mastery learning compared to the traditional method of instruction. In the review of research on mastery learning, the majority of the studies showed an improvement in student achievement, but there were a few studies where the result was no significant difference in student achievement (Block, 1976). These mixed findings indicated that further research to determine if mastery can improve student achievement was needed.

Although most research evidence showed that mastery learning resulted in an increase in student achievement, current research showed that combining mastery learning with other variables, such as improving preentry skills and enhanced cues, could increase the effectiveness of mastery learning. Schools are structured, both physically and organizationally, so that teachers generally use large group instruction. Benjamin Bloom (1984) has been working on what he called the "2 sigma problem." The 2 sigma problem involved searching for ways to make group based instruction as effective as individual tutoring. Students who were tutored in a one-on-one situation scored as much as two

standard deviations above the mean on an instrument measuring achievement. Bloom and his researchers conducted research on preentry behaviors. By raising necessary skills to a preentry criteria level, Bloom (1984) was able to improve student achievement. Bloom suggested that future research combine mastery learning with other variables, i.e. enhanced cues, to determine if student achievement could be further improved.

According to Rubenzer (1982), there has been little research to determine if teaching to specific learning styles of students will improve academic achievement. The results of the research studies that have been conducted in this area have been mixed. Both Dunn and Dunn (1980) and Hunter (1980), who have conducted research in the field of learning styles, called for more research in the area of improving student achievement using learning styles.

Block and Burns, in their 1976 review of research divided the research on mastery learning into four types of research, which they named Type I, Type II, Type III, and Type IV. Type I research is concerned with comparing student academic achievement between students taught with mastery learning and students that are not taught with mastery learning. Type II research deals with the affective aspects and time consequences of mastery learning compared to nonmastery approaches. Type IV research is concerned with teacher attitude and response to mastery learning. It is also concerned with various ways of introducing and implementing mastery learning into the school district. Type III research deals with component studies involving instructional objectives, learning unit size, unit pacing, unit social organization, unit feedback instruments, levels of mastery criteria, correctives, and grading policies. In his address to the annual meeting of the American Association of Research in

Education, Hymel (1983) suggested that the most fertile area for research with mastery learning is in Type III research. He specifically suggested that there was a need for someone to research the effect of learning styles during the remediation or enhancement phase of mastery learning.

General Questions to be Answered

The following questions were answered by this study:

1. Based on CRT (Criterion Referenced Test) achievement scores, was there any interaction between the experimental and control groups and high medium and low achievement grouping?
2. Was there a statistically significant difference in student achievement at the end of the semester between the experimental group and the control group, based on a CRT (Criterion Referenced Test) achievement test score?
3. Was there any interaction between the experimental and control groups and gender, based on CRT (Criterion Referenced Test) achievement scores?
4. Was there any interaction between the experimental and control groups and self-reported learning style preference, based on CRT (Criterion Referenced Test) achievement scores?
5. Was there a statistically significant difference in the students' general attitudes, at the end of the treatment, between the experimental group and the control group?
6. Was there a statistically significant difference in the amount of time spent on initial instruction between the experimental and the control groups due to consideration of students' learning style preferences?

7. Was there a statistically significant difference in the number of remediations between the experimental and control groups due to consideration of students' learning style preferences?

General Procedure

Of the three general areas of learning styles, the researcher chose to work with cognitive learning styles. Cognitive learning styles have developed from a bidimensional continuum to a quaternary approach that takes into consideration the combination of two or more styles (Keefe, 1979). Three basic models of the quaternary approach to learning styles are: Kolb's experiential model, McCarthy's 4MAT model, and Gregoric's phenomenological model. Of the three basic quaternary models, the researcher chose to work with McCarthy's 4MAT model. McCarthy's model advocates teaching all styles to all children. This can be applied to initial large group instruction as well as individual instruction. Teaching in a variety of ways, using different techniques, will help insure that initial instruction matches the individual student's learning style, which may reduce the need for remediation.

Permission was obtained from the school district in Colstrip, Montana, to conduct this research study in that system. Six teachers, all teaching seventh graders, volunteered to participate in this study. To control for differences in teachers, each teacher was assigned to teach a control class and an experimental class. The control class consisted of students being taught by mastery learning while the experimental class was taught with mastery learning combined with emphasis on learning styles. The learning styles were emphasized during initial large group instruction using Bernice McCarthy's

4MAT system of teaching to a group. Knowledge of the individual student's learning style preference can help to improve the individual remediations (Butler, 1984; Gregoric, 1979). The control and experimental classes were randomly assigned from the six classes taught by each teacher. The control and experimental classes were taught by seventh grade teachers who all used mastery learning as a delivery system and covered the subject areas of math, English grammar, geography, art, and industrial arts.

The Comprehensive Test of Basic Skills (CTBS) standardized achievement test was given at the end of the 1984-85 school year to all students K - 12. The results of the sixth graders, the incoming seventh graders, were analyzed to determine if there were any initial, statistically significant differences between the control and experimental groups.

Each student was required to respond to an attitude questionnaire, which measured the student's general attitude toward the class to see if there was any initial, statistically significant differences in student attitude between the control and the experimental group. The instrument used to measure attitude was the Comprehensive Assessment Program: School Attitude Measure, published by American Testronics (Dolan, 1985).

The students in the experimental group and the control group were given the Learning Style Inventory (LSI), developed by David Kolb, to determine the students' individual learning style preferences, but the individual learning styles of the control group were not reported to the teachers. This was to prevent the teachers from inadvertently teaching to specific styles in the control group.

The teachers provided instruction to the experimental and control groups during the first semester of the school year and then administered a

criterion-referenced achievement test, beginning the week of January 1, 1986, to the students in both the experimental and the control classes. At the end of the semester, the teachers administered a post test consisting of that part of the School Attitude Measure that measured student attitude toward mastery of subject matter to the students of the experimental and the control group.

The results from the CRT achievement test, the affective instrument, and the learning styles inventories were collected and tabulated. The data were analyzed using the MSUSTAT statistical package developed by Dr. Richard Lund from Montana State University.

Limitations

This study was limited in the following ways:

1. The treatment of incorporating learning styles into initial instruction was limited to those classrooms of teachers that volunteered to help in conducting this research project.

2. The course content was limited to the objectives developed by the Colstrip School District.

3. This research project was limited to the first semester of the 1985-86 school year in the Frank Britton Middle School in Colstrip, Montana.

4. This research project was limited to the subject areas of math, language arts, art, geography, and industrial arts.

Delimitations

The following delimitations were noted:

1. The population for the purposes of this study consisted of those students in the seventh grade at the Frank Britton Middle School in Colstrip, Montana.
2. There were six control classes and six experimental classes in this study.

Definition of Terms

The following terms were defined especially for the purpose of this study:

1. Formative Test- refers to a test designed for feedback after no more than ten hours of instruction. These are criterion referenced tests designed to check student progress on mastering specific objectives. These tests are keyed back to specific objectives with generally four or five items per objective tested.
2. Summative Test- is a criterion referenced test covering a specific domain of objectives, used to determine a grade.
3. Mastery Learning- refers to a process of instruction developed by Benjamin Bloom where time and instruction are treated as variables rather than as constants. With mastery learning, instruction is broken into small parts covering no more than ten hours of instruction with frequent formative feedback accompanied by intervention strategies to achieve mastery of specific objectives. The intervention strategies, which are reteaching or remediation strategies, are taught in a different manner than the manner during initial instruction. For students that have mastered the material the first time, the teacher assigns enrichment activities to broaden their knowledge of the subject

matter horizontally. After mastery of the enabling objectives, a final summative examination is given to determine mastery of the overall subject matter.

4. Retesting- refers to the evaluating of students after the intervention strategy during remediation to determine if the strategy was successful.

5. Type One Learners- these learners as described by the McCarthy inventory are innovative. They prefer to learn through a combination of feeling and watching.

6. Type Two Learners-these learners as described by the McCarthy inventory are analytical. They prefer to learn through a combination of watching and thinking.

7. Type Three Learners- these learners as described by the McCarthy inventory use common sense. They prefer to learn by thinking through concepts and trying things out for themselves--by doing.

8. Type Four Learners- these learners as described by the McCarthy inventory are dynamic. They prefer to learn by doing things and sensing concrete reality. They are interested in self-discovery.

The next step in this study was to conduct a review of the literature and research related to mastery learning and learning styles. This is found in Chapter 2.

CHAPTER 2

REVIEW OF THE LITERATURE

The following review of literature has concentrated on the major topics of development of mastery learning, learning for mastery and personalized systems of instruction, effectiveness of mastery learning, alterable variables with mastery learning; history and development of learning style, what is learning style, affective aspects of learning style, physiological aspects of learning style, cognitive aspects of learning style, phenomenological model, 4MAT system model, and brain research and learning style.

Development of Mastery Learning

The ideas underlying mastery learning are hundreds of years old. Mastery learning ideas have historical roots in the works of Comenius, Pestalozzi, Herbart and others (Torshen, 1977). As a result of this lineage, there are many versions of mastery learning in existence today, but they all operate under the same basic principles. Torshen (1977) credits men like J. Franklin Bobbitt, Ralph Tyler, Fred Keller, and Robert Mager with laying the foundation for mastery learning in the 20th century with their ideas on teaching to performance objectives and improving instruction in the classroom. The idea that aptitude was a function of time and that schools might not allow adequate

time for students to learn a task was put forth by John B. Carroll (1963:727) when he stated that:

"It may come as a surprise to some to be told that the schools may allow less than adequate time for learning any task, but second thought will make one realize that this is very often the case."

Some educators began to think that aptitude was a measure of the time needed to master a task, and not simply the degree to which a person could learn a task or idea. Carroll (1963) advocated that all schools look at aptitude as a function of time. Treating time as a variable rather than a constant will allow more students to accomplish a task. The school should recognize that ability of the students to understand instruction takes perseverance (time on task). The school should give all students an opportunity to learn, and students should receive quality instruction.

In his book, Human Characteristics and School Learning, Benjamin Bloom described a teaching/learning model that was later to become known as Mastery Learning (Bloom, 1976). The ideas developed by Bloom stemmed from the model of teaching described by Carroll more than ten years previous (Torshen, 1977). According to Bloom (1976), student learning is effected by three variables, each of which can be controlled in the classroom. Those variables that have the most impact on student achievement are cognitive entry behaviors, affective entry characteristics, and quality of instruction. Cognitive entry behaviors are prerequisite learnings needed to progress from one task or idea to another. Affective entry characteristics are the combined interests and attitudes toward the subject matter of the learning task. Quality of instruction is the combination of cues to the student, participation by the student, and reinforcement in the form of feedback. According to Bloom (1976), if these

three variables would interact with each other, they would have an additive effect; that is, if one is improved the others would also improve. Although many educators have changed or added to Bloom's original model of learning for mastery, the basic concepts of learning for mastery remain unchanged.

Learning for Mastery and Personalized Systems of Instruction

The International Association for the Evaluation of Educational Achievement has reported studies showing that achievement in math, language/literature, and science was strongly related to the student's reading comprehension and word knowledge. For students to achieve, they need to be competent in reading comprehension and word knowledge (Torshen, 1977). This statement introduces the idea of competency based education, the forerunner of mastery learning, which Torshen (1977:30) defined as: "Education where every student can arrive at the goals appropriate for him when he has access to appropriate instruction." Competency based education is individualized for each student, and the level of competency varies from individual to individual. Students in competency based education and mastery learning are expected to attain certain levels of achievement. There is, however, a difference between competency based education and mastery learning. Competency based education does not advocate a specific model of group based instruction with remedial activities whereas mastery learning does both. Torshen (1976:36) defines mastery learning as:

"A model used to structure curricula. This structure is designed to maximize the likelihood that each student will reach the performance levels essential for competence."

In his paper presented to the annual conference of the American Educational Research Association, Hymel (1983:12) outlined mastery:

"Mastery learning has been characterized repeatedly in the professional literature as encompassing (a) a set of optimistic assumptions regarding the capability of students to learn the contents of a course unit to a high degree of competency provided that the learning conditions are maximized, (b) an array of functions or purposes served by those instructional components comprising the preparatory, delivery, and evaluative tasks of diagnostic-prescriptive teaching, and (c) a taxonomy of research questions providing direction to the analytical and/or empirical investigation of learner-oriented and instruction oriented variables thought to be."

The variability among humans, both physically and mentally, is considerable and the traditional educational program accentuates this variability, but mastery learning accepts and works with the variability among humans to insure that all students achieve at high levels (Stronk, 1980). Mastery learning consists of six basic components. These are: objective writing, preassessment, instruction, diagnostic assessment, prescription, and post assessment.

The two main approaches to mastery learning that have evolved are Bloom's Learning for Mastery (LMF) and Keller's Personalized System of Instruction (PSI). The basic difference between the two approaches is that LFM is group based and PSI is totally individualized. Learning for mastery is used primarily in the public school systems, while the personalized system of instruction is used primarily in the college setting (Block, 1977).

In LFM you begin by defining mastery, which includes the writing of objectives, breaking the information up into smaller sequential units, and finally creating a summative examination with the level of mastery predetermined. The next step in LFM is the planning process. This includes the initial

instruction, feedback and corrective procedures(formative exams), and development of alternative instructional procedures for reteaching. The third step in LFM is teaching for mastery. Oftentimes students will not have been exposed to the concept of mastery learning; and therefore, students need to be oriented to mastery. This is followed by the initial instruction, formative evaluations, enhancement of students who master the task or unit the first time, reteaching those students who fail to master the task or unit the first time, and then retesting. Often the teacher in LFM will borrow time at the beginning of the school year and will regain the lost time by the end of the year. The final step in the LFM process is to determine whether the grade will be decided upon a single summative exam, a combination of summative and formative test scores, or some other means of assigning a grade. Each individual teacher must establish his/her own grading system, as a result of the differences in what is a fair assessment of a student's performance. This belief differs from teacher to teacher and no one can tell someone her/his belief is wrong.

With PSI, the first step is again to define mastery by dividing the course into small units (usually one week long), writing course objectives, establishing a grading policy of whether or not to give a summative exam, and establishing the number of units that constitute mastery. If a final summative exam is to be used, it is suggested that only about twenty-five percent of the final grade be established by the summative exam (Block, 1976). The second step in PSI is planning for mastery which includes developing materials (usually in the form of a study guide) for each individualized unit, creating feedback/correction procedures keyed to a study guide, developing proctor materials which outline how to administer and score unit tests, and finally developing a policy

statement for expectations. The third step in the PSI approach is the teaching for mastery where the students are given the policy statement and the units to be completed. The students then proceed through the units at their own pace. When a student finishes the unit, he/she gets a unit test from the proctor. If the student fails to master the unit the proctor gives the student a parallel study guide over the same material; and the student then goes over the material again. In PSI, the final step, grading for mastery, is established beforehand on the number of units completed by each individual student.

With the individual differences in human beings, educational programs must be adaptive to meet the needs of the individual students. Anderson (1979:141) said that: "Adaptive educational programs attempt to modify the instructional settings so that students with a variety of abilities can succeed." Learning for mastery should begin early in primary grades when students are not very far apart in academic achievement. At the same time, schools must be flexible in time, space (small group/large group), grouping (purpose/age), materials, and staffing patterns in order to implement learning for mastery (Harvey, 1977). Although not much work has been done in the psychomotor domain with mastery learning, there have been some articles written using mastery in the area of physical education. Ashy (1984:60) points out that: "While most human characteristics are randomly distributed in a population, effective instruction should produce a distribution quite different from the normal curve." In physical education, it is important that a hierarchy of tasks is built into the mastery model.

Mastery learning has been implemented in a variety of classes, subjects, and schools. Mastery is being used in divergent as well as convergent thinking

tasks. It is utilized in the handicapped, bilingual, and disadvantaged classrooms. Humanists, cognitivists, and behaviorists are using mastery learning. In short as Block (1979:115) noted: "When practitioners have decided to teach for mastery, they have not let the nature of their subjects, classes, colleagues, or schools get unnecessarily in their way." Mastery learning promotes cooperative individualism in student learning as opposed to selfish competition. This results in the ideals of a society based on the excellence of all participants rather than the excellence of the few (Block, 1979).

Learning for mastery programs typically include goals beyond the knowledge level along with providing opportunities for additional instruction to insure that all students are learning, . In addition to many of the other benefits of the mastery learning classroom, there is the added benefit of learning in a social setting (tutoring or small groups) which results in better cohesiveness within the classroom (Anderson, 1979). Peer tutoring can be an extremely effective strategy if the tutors provide cues as to what should be learned, have students take an active participation in the learning process, and reinforce the students through frequent feedback (Stronk, 1980). Some colleges and universities are setting up learning centers based on the mastery principle, which supplement regular instruction in the classroom. These learning centers provide tutors, mini-courses, resource material, and proctors for PSI courses. One such resource center in Georgia reported that grades and the passing of courses improved for over three hundred students during the year the resource center was utilized (Campbell, 1983).

Some people describe mastery as nothing more than good teaching, but there are differences. Mastery learning teachers plan for the whole year,

emphasize performance objectives, look more at the subject matter taught than the students who are taking the class, and create multiyear plans (Abrams, 1979). Mastery can reduce the pressure on teachers to have students do well the first time, creates less discipline problems, and motivates students to a higher degree.

Effectiveness of Mastery Learning

Cognitive Achievement

Probably the first question that teachers ask about mastery learning is, "Does it really work". Block and Burns in 1976 described four types of research studies that have been conducted or are being conducted throughout the world. Type I research, called Does it Work, deals with the cognitive aspects of mastery learning. In reviewing ninety-seven studies on general student achievement, they found that mastery learning students scored higher than non-mastery students 89 percent of the time, and significantly higher 67 percent of the time. These studies were conducted throughout the world and included sample sizes ranging from thirty to over seven thousand students usually split into two groups, a control group and an experimental group. In studies involving retention of material, mastery students in eighteen out of twenty-seven studies retained more material than did the nonmastery students. These eighteen studies were statistically significant at the .05 level.

Using the Iowa Test of Basic Skills during the 1976-77 school year, a report of the Chicago Mastery Learning Reading program using over two hundred students showed a 30 percent increase in the rate of learning. Other results showed that the faster students were not slowed down in their learning,

that there was a decrease in the variability of students achievement, and that the reading teachers liked the program (Smith, 1977). Similar studies conducted in New Orleans involving a program of mastery called the SCIP, Secondary Curriculum Improvement Program, showed an increase in reading and math scores after one year. This study was conducted on the entire school system K-12, which includes over 100,000 students (Geisert, 1979).

Most early research on mastery learning dealt with research studies that used an experimental design employing an experimental and control group. The reporting that one method is more effective than another method but not how much better, is called a box score reporting method. Box scores show that mastery was more effective than non-mastery in cognitive achievement, retention of material, and affective achievement. Recent meta-analysis showed mastery works and that it works very well. According to Burns (1979), mastery methods work equally well for both low and high aptitude students, but few studies indicated that mastery methods work equally well for different kinds of learning outcomes.

Affective Aspects of Mastery Learning

Generally, when a person is successful in accomplishing some task, she/he feels good about their accomplishments and himself/herself. Benjamin Bloom (1976), in developing his mastery learning paradigm, foresaw that improvement in the students' attitude would be an added benefit of mastery learning. Along with the good feeling of being successful, students also become more motivated to do the next task. Bloom (1976) claimed that in the traditional system students are judged according to others and that this judgment stays with the students from year to year. This judgment according to

others determines to a large extent how students feel about themselves. Bloom identified three areas of the affective domain that were effected by mastery learning. These three areas are: 1) Subject-related affect, 2) School-related affect, and 3) Academic self-concept. There is a direct correlation between the successful completion of a task and the way one feels about attempting the next task. If students are successful in one subject, oftentimes they begin to be successful in other subjects. Adequacy in accomplishing tasks is cumulative and in turn develops into an improvement in total school affect. Students are either successful in school or they are not successful, and successful students tended to stay successful while unsuccessful students tended to stay unsuccessful. Mastery students tend to be more successful than students under a traditional system (Block and Burns, 1976). With more success comes a better academic self-concept.

S. B. Khan (1969) completed a study with three junior high schools in the State of Florida. His study was to determine the degree of relationship between academic achievement and attitude towards school. With an N=1038, Khan found a predictive correlation of .70 to .80 between academic achievement and general attitude towards school. The less successful a student is in his/her academic endeavors, the poorer his/her attitude toward school.

In their Review of Research in Education, Block and Burns (1976) found that generally mastery learning students had a better attitude toward school in general, and they had a better academic self-concept.

Time Requirements With Mastery Learning

With his statement that time is a more important consideration in learning than is aptitude, John Carroll opened the door to a whole new way of thinking

about the teaching/learning process. Since that time there have been several research investigations measuring the amount of time needed to master a particular task. In one of these conducted by Lorin W. Anderson (1976), the research involved about ninety eighth graders in the midwestern portion of the United States. His conclusions were that with mastery learning, the ratio of time on task to criterion can be altered. A heterogeneous group became homogeneous in the amount of time on task they required to learn a particular task. He further stated that over sequential units, time on task to criterion differences among students are reduced. His study indicated that in a non-mastery group the differences in the amount of time required to master a particular task remained the same or increased.

Anderson's research investigations supported Benjamin Bloom's contention about time requirements and mastery learning. Bloom (1976) contended that differences between group members in the amount of time required to master a particular task will be reduced over time, and that the overall amount of time to master a particular set of tasks will be reduced. The major reason for this is that students will have the necessary preentry behaviors to successfully accomplish that particular task in a shorter period of time.

Block and Burns (1976), in their Review of Research in Education, found that mastery learning reduced the time differences between the fast learners and the slow learners. In their review of studies measuring the difference in the amount of time required to teach a particular task between a mastery learning group and a non-mastery learning group, the mastery learning class required 70 to 80 percent more time than did the non-mastery groups over a short period of time, but over the long haul, the time required for the mastery learning group

was reduced to 10 percent more time to 25 percent less time than the non-mastery group. Initially mastery learning requires more time than the traditional method, but over time the amount of time required for mastery learning will catch up with the traditional method of instruction.

Alterable Variables With Mastery Learning

Most of the recent research investigations concerning mastery learning did not deal with the success or failure of mastery learning by itself. There seems to be an assumption that mastery learning is a successful delivery system; and therefore, the focus of the current research is on the effects of other variables when used in conjunction with mastery learning. These variables can be anything that effects the teaching/learning process such as enhanced cues, learning styles, preentry behaviors, and team (group) instruction to name a few.

Glen Hymel (1983) made the statement that "Type III" research, mastery learning combined with some other variable, is the most fertile type of educational research today. Hymel advocated that research involving the students' individual learning style during the remediation and enhancement phases of mastery learning might be a possible area of research. Slavin and Karweit (1985) have been working on investigating the area of small group instruction combined with mastery learning. Their findings indicated that small group instruction by itself was better than small group instruction combined with mastery learning. However, they did not allow time to be a variable, but kept it constant which defeated the purpose of mastery learning. This does not eliminate small group instruction combined with mastery learning as a possible means of improving student achievement.

Benjamin Bloom (1984) has been working on what he calls the "2 sigma problem". Using one-to-one tutoring, students have consistently achieved scores on a standardized achievement test two standard deviations above the mean. Bloom has been researching ways to make group based instruction as effective as one-to-one tutoring. In his research Bloom compared tutoring, mastery learning, and conventional methods of instructional delivery. He found that tutored students scored two standard deviations above the conventional students, and mastery learning students scored one standard deviation above the conventional students. When mastery learning was combined with enhanced prerequisites, the students scored 1.6 standard deviations above the conventionally taught students. Another variable that was combined with mastery learning was parent/educator group meetings to help parents improve their methods of helping their children at home. Mastery learning combined with enhanced cues and parental participation resulted in students achieving 1.7 standard deviations above the conventionally taught students. Another area that has been investigated was the combination of mastery learning and higher mental thought processes. This area of research is only beginning with the possibility of much more research in the future.

Block (1984) stated that the four E's: excellence, equity, economy, and excitement, are four areas of education under attack today. Critics of education have said that we don't have excellence in our educational system today, that we have not prepared students to endure, and that we have let our standards slide backward. We need to extend equity to equal outcome for all students. We need increased funding, but at the same time educators need to take cost-effective actions. Finally we need to have excitement in education, which

may eliminate teacher burnout. Mastery learning may be a method of achieving some of these goals.

History and Development of Learning Style

The term, learning style, was probably coined in the United States by Herman Witkin in the early 1950's while doing research on frames of reference in determining individual perception of uprightness in a dark room. Though the term learning style is relatively recent, the idea of individual differences in the way people learn is very old. Aristotle developed mnemonic techniques of association and visual imagery to help some of his students learn material, which differed from the traditional aural method in use at that time. The Greeks divided the temperaments of individuals into two bipolar continuums described as sanguine to melancholic and choleric to phlegmatic (Cornett, 1983). In the seventeenth century, John Amos Comenius wrote about individualized learning, and in the nineteenth century, Johann Heinrich Pestalozzi wrote about individual differences in learning. Charles W. Elliot of Harvard University advocated that schools should develop programs of individualized learning to meet the needs of students that were not successful in the traditional school. Montessori's work in 1912 contained materials designed to promote sensory and motor development. At the turn of the century, German psychologists talked about individual differences in cognitive style (Sample, 1982). Charlton Washbourne, an administrator in the public schools of Winnetka, Illinois, proposed what was called the Illinois Plan to the school district in 1926. The plan was an approach to individualized learning for those students who were not successful in the regular classroom and for those who were labeled slow

learners (Keefe, 1979). In the late 1940's and 1950's, Herman Witkin began his studies on perceptual differences between individuals. Kagan, Moss, and Sigel in 1963 developed a test to categorize objects according to sensory perception. This test was the forerunner of the learning style inventories that were to materialize in the 1970's. The subject of learning styles has expanded into a broad area with researchers working with cognitive aspects, affective aspects, or physiological aspects of learning style.

What Is Learning Style?

There are many definitions of learning style, but research shows that learning style has some basic components. Learning style is generally considered to be stable and consistent over time, but it is not permanent. Witkin (1978) found that subjects showed self-consistency across situations and over long periods of time in their degree of reliance on the body or field in locating the upright position in a dark room. Learning style generally changes with maturity from concrete to abstract, and from dependency to independency (Cornett, 1983). Learning style varies from individual to individual and is not a reflection of a person's ability. Cornett (1983:9) defines learning style as: "A consistent pattern of behavior but with a certain range of individual variability." This definition of learning style takes into consideration the individuality of learning style and the consistency of learning style. Hunt (1979:27) feels that learning style is not a reflection of ability with his definition:

"Learning style describes a student in terms of those educational conditions under which he is most likely to learn. Learning style describes how he learns, not what he has learned."

Keefe (1979) noted that researchers have generally tended to concentrate on one of the three aspects because the subject of learning style was too broad for combined research. Global personality approaches, cognitive mapping, and school oriented approaches are three general ways of doing research on learning styles.

Global personality approaches are based on two bipolar continuums which intersect to determine how a person perceives information and how they process that information. The idea of a bipolar continuum that describes a person's personality is quite old. The Bhagavad Gita, written 2500 years ago, described four ways of practicing religion based on divisions of people. According to the Bhagavad Gita, people were active to passive and emotional to thoughtful in the ways they practice their religion (Frizzell, 1982). Jung was one of the first in modern times to describe personalities on bipolar continuums. Jung's idea was that people could be described in the terms sensation vs. intuition and thinking vs. feeling (Kolb, 1984). Most global personality bipolar continuums today can be described in terms of concrete experience to abstract conceptualization and active experimentation to reflective observation (McCarthy, 1980). Generally global personality research is classified as a cognitive aspect of learning style. The global approach has been useful in helping school personnel to become aware of the concept of learning styles.

Cognitive mapping is another method of studying learning style that has received much attention. Hill has done extensive work in the field of cognitive mapping and has identified 330 different types of people, while the Learning Skills Inventory (LIF) identifies over 22,000 different types of people. The problem with this method of studying learning style is that the amount of

information gathered is so overwhelming that it can't be practically applied. The only reason for using cognitive mapping is when you need to make decisions about individual cases that are considered special. In one study, Kusler (1979) had students respond to 224 statements by marking the statements true always, sometimes true, or rarely true. This provided a profile of the student as a learner, a thinker and a performer. The profile was divided into three major groups or areas that provided information about how the student takes in and processes stimuli and information, how the student's learning is affected by others, and how the student reasons to conclusions.

Recently the most popular way of studying learning style has been the school oriented approach. The oldest approach of this kind was the Individually Guided Education (IGE) plan developed by the University of Wisconsin about twenty years ago (Fizzell, 1982). More recently Dunn, Dunn, and Price have come to the forefront in this area of research. They contended that learning style is a product of five different stimuli with three to six elements to each stimuli. These stimuli are how the student reacts to environmental conditions, the emotional aspect of style, sociological needs, physical requirements, and psychological aspects. Psychological aspects were not part of the original model by Dunn, Dunn, and Price and were added only recently (Dunn, 1979). Fizzell's Schooling Style has thirteen variables which relate to about eighteen different programs. According to Fizzell (1982), no structure can meet all needs, therefore he recommends different types of schools for individual needs.

Application of the school oriented approach can be quite varied and some problems can occur. There are generally two camps in the schools as far as

modality learning styles are concerned. One camp feels that learning style is nothing but frill, and only about 30 percent of the students should and can achieve at high levels. Others feel that success in school is not predicated on IQ alone, but that instructional delivery that addresses the individual learning styles of students will improve student motivation and this could help bring about success. This camp believes that if the students' learning style is met, 75 to 85 percent of the students can achieve at high levels (Fizzell, 1982). The Dunns (1977) believed that how a student learns is perhaps the most important factor in his academic achievement. Others believed that students adjusting their learning style to meet the teaching style of the teacher, called "learning-to-learn", can help the students to become more independent in their learning. Style matching should be done in the lesson and not predetermined. It would be unrealistic as well as undesirable, to match learners with teachers, based on their learning styles, all the time. Rather, we should encourage the "flexing" capabilities of both teachers and students (Cornett, 1983).

Affective Aspects of Learning Style

The affective aspects of learning style are concerned with the emotional and personality characteristics of students. Keefe (1979:11) defines affective learning styles as:

"Affective learning styles are these same motivational processes viewed as the learner's typical mode of arousing, directing, and sustaining behavior."

Areas of concern in the affective dimension are conceptual level, motivation, attention, locus of control, willingness to take risks, persistence, responsibility, sociability, and group or individual learning. With this type of information,

teachers can decide such things as what type of reward works best, or whether group learning or individual learning will work best.

Conceptual level describes the amount of structure a student needs when performing various tasks. According to Hunt (1979), conceptual level has three stages or levels. The first stage, called the low stage, is characterized by the concrete impulsive learner that has a poor tolerance for frustrating situations. These students need much structure with directions specifying the tasks to be accomplished. The second stage, called the middle stage, is characterized by students that are concerned with rules, dependent on authority, and are categorical thinkers. These students need some structure, but like to make some decisions for themselves. The third stage, called the high stage, is characterized by students that are inquiring, self assertive, questioning, and have more alternatives. These students need little structure and like to make most of their decisions. Shumsky (1972) referred to the amount of structure required by students as Independence in Work.

Motivation is an emotional aspect of learning style which the Dunn's (1978, 1979) have identified as those students that are unmotivated and those students that are motivated. Unmotivated students need short assignments that are geared to their style. They need to be encouraged, given contract assignments, and their program should be individualized as much as possible. Motivated students can be given general directions, where to get help, and a time schedule for the completion of the task.

Attention, according to Shumsky (1972), is the amount of time that students will spend on a task without getting frustrated. With those students who have a short attention span, short assignments that can be completed quickly are

appropriate. With those students who have a long attention span, the assignment length does not matter unless it becomes impossible to complete in the specified time. The Dunns (1978, 1979) have labeled this aspect as persistence. These students will continue to work on a task until it is complete no matter how long it takes.

Locus of control describes a continuum of internality vs. externality as to the student's perception of the causality in behavior. The internal person thinks of himself as responsible for his own actions and behavior. The external person sees that behavior is beyond his control. Situations are out of his hands, controlled by luck or others (Keefe, 1979).

Risk Taking vs. Cautiousness is the propensity of some students to actively engage in tasks or situations that have a low probability and high payoff, whereas some students prefer situations and tasks that have high probability and low payoff (Keefe, 1979). Associated with risk taking is the students' reactions to new situations. Some students freeze when faced with a new situation and, therefore, need some aspects of the old situation to feel comfortable. Some students freeze when encountering new subject matter and will require individual help. Other students enjoy new situations and new subject matter (Shumsky, 1972).

Responsibility is a term that is used to describe some students who are answerable for doing their tasks and will get them done. Others need help, encouragement, and understanding to succeed. Success will help build responsibility.

Sociability and Grouping refers to the need of students for accomplishing their tasks individually or within groups. This varies considerably from

