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THE MASTERY LEARNING MANUAL

CHAPTER ONE
INTRODUCTION TO MASTERY LEARNING

INTRODUCTION BY CARLA FORD

The Baltimore City Public School system, long concerned with issues of improving learning and enhancing children's feelings of success and competency, has, over time, attempted to define and apply teaching procedures believed to be of value in the educational process. One such strategy, conceptualized by Benjamin Bloom as "Mastery Learning", has received favorable attention from our school system due to its positive impact on learning and self-esteem. Of particular interest to us are: (1) the identification of ways to enhance the learning process; and (2) the design, development and implementation of supporting staff development activities.

Over the last five years, the Baltimore City Public Schools and the Prevention Research Center of the Johns Hopkins School of Hygiene and Public Health have been working together to implement an enhanced Mastery Learning program in schools throughout the Eastern District. The "Mastery Learning Manual" represents our collective thoughts concerning concepts, procedures and methods found to be most effective in utilizing and applying Mastery Learning as an instructional strategy. Insomuch as results from the first years of study show that this strategy was indeed successful in increasing learning, this manual is viewed as an important step in institutionalizing concepts of the model.

I am grateful to the administrators and teachers whose participation in the project enable us to test ideas and develop this manual. A special note of appreciation is extended to Mrs. Vera A. Newton, early childhood specialist, for her outstanding contributions to the development of the model, training of staff, preparation of this manual, and dedication to children and families throughout the Baltimore City Public Schools.

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PERSPECTIVE ON TRAINING: MASTERY LEARNING IN THE ELEMENTARY SCHOOL

This training is developed for elementary school teachers interested in implementing mastery learning in their classrooms. It will cover recent theory and research in mastery learning, a critical analysis of current mastery learning programs, the development of teaching strategies necessary to implement mastery learning, and actual material preparation associated with a mastery learning program.

The goals of the training are:

1) To reinforce and strengthen knowledge in the following:

    a) Clearly stating objectives and instructional goals
    b) Ensuring clear linkage between objectives, teaching, and testing
    c) Communicating high expectations for success
    d) Packaging small, sequenced instructional units
    e) Maintaining the basic teach-test-correct-test cycle
    f) Pre-setting unit mastery standards
    g) Keeping clear and updated records of student progress in a form understandable to the students, and providing immediate feedback
    h) Committing to staff development and assuring successful implementation

2) To develop a more group-based approach to mastery such that the entire class do not proceed to the next unit until the majority of students have fulfilled the learning objectives of the current unit (80% achieving 80%-85% of objectives). Therefore, more than one formative test may be necessary to assure such a standard has been achieved.

3) To develop a flexible corrective process tailored to specific weaknesses of students.

    The key to the effectiveness of mastery learning lies in systematic provision and use of correctives. Corrective instruction, by its very nature, must be targeted toward particular learners and particular learning problems or difficulties. This process will be flexible in terms of:

    a) Time:

    The time line for correctives will allow for the likelihood of more time needed for the corrective process during the early units and more efficient use of time with each additional unit. The efficiency results from students meeting the prerequisites and therefore displaying increased time-on task.

b) Grouping Strategy:

The grouping strategies will include whole group instruction, small group instruction, peer tutoring, and individual tutoring. Decisions will be made in light of formative testing item analyses and available resources. The grouping of students for correctives will depend solely on formative test feedback with allowed movement from mastery to non-mastery subgroups. Group membership should not remain stable.

c) Variety:

A major goal of training and development will be to increase the variety of correctives available to the teacher. These correctives, clearly linked to specific objectives and test items, will focus on alternatives to previous instructional techniques.

A systematic linking of objectives, test items, error prescriptions, and correctives will be developed and reinforced through an instructional management model.

Students who attain mastery on the first formative test will be involved with extended learning opportunities in the same subject, or preferably, they will be involved in peer tutoring of the non-mastery students.

4) To familiarize the teacher in the theory, assumptions, and applied research on mastery learning. In addition, the specific teaching strategies will be the focus of an extensive staff development and follow-up period.

CHAPTER TWO
AN OVERVIEW OF MASTERY L EARNING

PHILOSOPHY AND RATIONALE OF MASTERY LEARNING

Those interested in using the mastery learning approach first need to understand that it has two components.

One component of mastery learning is its educational philosophy -- its set of beliefs about learning and teaching. These beliefs are what shape the methods of mastery learning and the attitudes of the teachers who use the mastery approach. This section is devoted to explaining these beliefs.

The other component of mastery learning is its method of instruction. Mastery learning involves a set of clear steps for selecting content, teaching, and determining students' progress. None of these steps is new in itself, but as a package they are extremely effective in enabling most students to learn well. These various steps will be enumerated later in the manual.

The beliefs on which mastery is based are very different from what many educators were taught over the years about learners and learning. They are bold, optimistic statements, and to some they might at first seem naive and even foolish. The reader is asked to suspend doubts and to remain open to these beliefs. Experience indicates that the teacher who firmly rejects the mastery philosophy while using the mastery method of instruction will find the program quite mechanical and soon give up. The teacher who enthusiastically embraces the mastery philosophy brings the method alive and produces startling results in the classroom. And the teacher who is somewhere in the middle-- who isn't sure about the beliefs, but is willing to try the method and remain open-- becomes a believer over time as a result of what happens with his or her students.

Basic Assumptions

The belief system of mastery learning starts from two basic assumptions:

1) *Virtually all students can learn all important academic content to a level of excellence.*

2) *The primary function of schools is to define learning objectives, and to help all students to achieve them.*

These assumptions imply that an effective teacher or school system will *not* produce a bell-shaped curve of student learning, with a few good students, many mediocre ones, and a substantial proportion of failure. Instead, the measure of effectiveness of teachers, schools, or school systems will be how close they can come to getting 95% of their students up to the levels that are now reached by only about a tenth of the students.

The main developer of the theory and practice of mastery learning has been Benjamin Bloom, an educator at the University of Chicago. In the preface to his recent book, *Human Characteristics and School Learning,* Bloom explains the stages of belief that he went through before arriving at the assumptions explained above. These seem worth describing because they are the stages many will experience in moving from the beliefs that are now generally accepted to those of mastery learning.

The first stage Bloom describes is one where he believed that some students are good learners and that's how it will always be. The good learners can learn more in terms of both quantity and quality -- that is, they can cover more material, learn more complex content, learn faster, and retain better than poor learners. What follows from this belief is an educational system that tries to sort the good learners from the poor ones, and to teach each group that which it is capable of learning. In such a system, the difference in achievement between the good and poor learners grow greater with every year the students are in school.

The above is a fairly accurate description of what happens now in most American schools. Bloom, however, says this is not what has to happen -- it is simply a result of what most educators believe and the way they teach.

The second stage Bloom describes is one where he believed that all students can eventually learn and retain equally complex or difficult material, but that some will learn much faster than others. This belief would suggest an educational system where the really important content is taught to everyone (with some taking longer than others to learn it), and then the faster learners get lots of enrichment.

Early mastery learning approaches were based on the above belief. However, after years of research with these approaches, Bloom found to his surprise results that led him to his third, and current, set of beliefs. He found that, if students are given favorable learning conditions, even the differences in their rate of learning disappear. In other words, if the schools do their job right, 95% of all students are capable of learning the same amount of material to the same level of difficulty at the same rate and with the same attitude toward learning. This is the belief statement that is now the central core of mastery learning. Bloom states it this way: "most students become very similar with regards to learning ability, rate of learning, and motivation for further learning -- when provided with the favorable learning conditions."

Individual Differences

Many people who are trying to understand mastery learning become confused at this point about what the approach is saying about individual differences. Do Bloom and the other supporters of mastery learning really believe that all students are the same? Don't they see the different skills that even preschoolers bring with them to the classroom? Don't they read the literature about different learning styles? Don't they recognize and value each child's uniqueness? Isn't there something un-American about seeking to make individual differences in learning vanish?

The answer to this set of questions has several parts. First, advocates of mastery learning are well aware that students now enter school with different skills, and that there exist great differences in achievement between different school systems, schools, and classes. Their point is that these differences are not inevitable -- rather, they are a product of the way our society, homes, and schools operate.

Second, mastery learning advocates agree that children may have different styles of learning. They agree that children may need to learn in different ways, but that does not have to result in different levels, rates, or attitudes toward learning.

Third, they point out that what looks like a difference among students in rate of learning is usually really a difference in proportion of time spent on task. In a typical 45 minute period, "good" students might spend 90% of the time really learning, while "slow" students might be spending only 33%. Again, then, these differences can be made to vanish if educators can find teaching approaches which increase the "slow" learners' time on task.

Finally, mastery advocates are not trying to deny or eliminate each person's uniqueness. They agree that people have different personalities, preferences, values, perspectives, strengths, and problems, and that these are healthful differences. However, they see no reason why these have to translate into achievement differences which then put many people at a great disadvantage throughout their life.

Another way of looking at this belief is this. Any group of students will always enter a learning situation with a great many individual differences in everything from preparation in the subject, to learning style, to personality. Teachers can regard these differences as important in determining success, and use them to excuse different levels of achievement at the end of the learning experience. Or, they can assume that all students can achieve at the same high level, and use knowledge of their differences to help determine the most

	ROLE SYSTEM	
GOAL SYSTEM	Role Constrained (fixed time/ sin opportunity)	Role Flexible (multiple opportunity)
Goal Implicit (vague referenced assessment; private variable standards)	Traditional School Practice	Humanistic Developmental Approach
Goal Directed (criterion referenced assessment; public fixed standards)	Minimum Competency Testing Accountability	Mastery Learning

Figure 2.1 A framework of Organizational Variables that Affect Instructional Operations

effective ways to help each student learn. The second approach is the way mastery learning looks at individual differences.

Bloom makes a similar point in his books when he talks about America's commitment to equality of educational opportunity. What he says is that phrase has traditionally been interpreted to mean that all children, despite their differences, should get equal educational *inputs.* This system results in greatly different levels of achievement. The mastery approach calls for educators to reinterpret "equality of educational opportunity" to mean a commitment to equal educational outcomes. Each child should have a lesson, a class, a level of schooling that will ensure approximately equal chances to succeed in the years to come.

Organizational Perspective

From an organizational perspective mastery learning represents a shift from the time and role based structure of student task assignment in traditional school practice to an outcome and goal based one. In traditional schools students proceed on a fixed schedule and student certification is vague-referenced and privately defined. In the mastery learning systems, however, student assessment is criterion referenced (based on students' achieving stated goals) and publicly defined, and students get multiple opportunities to master stated learning objectives.

Figure 2.1 shows how instructional models are constrained by their student evaluation/certification/promotion system and how mastery learning and traditional school practice fall under these constraints. We see that mastery learning takes us from an exclusionary instructional model, where success and advancement are reserved for those who can meet whatever vaguely defined standards in a predetermined amount of time on their first attempt, to an inclusionary model where access to success is open for all.

Group-Paced vs. Individualized Instruction

Given the above description, one might assume that mastery learning would be most effective as an individualized program. It is certainly possible to individualize with mastery, and many mastery approaches are based on such a system. However, the mastery approach advocated by Bloom and by this manual is based on group-paced instruction.

Group-paced instruction basically means trying to move the whole class through a body of content together. It can include whole-group presentations, work with small groups or student teams, and help for individual students. However, small group work and help for individuals will almost always be done with the goal of bringing these students to the same level as the rest of the class. The overall objective will be for the class to master content together.

For students who are well-prepared and master quickly, group-pacing means that they will spend time doing enrichment activities, as well as helping other students who haven't mastered. These enrichment activities are an extension of the concepts the whole class is working on, and allow the students both to reinforce the concepts and to apply them in new ways.

Individualized learning, on the other hand, means that all students are taught in one style (usually through a programmed or highly structured set of materials). Most importantly, they are allowed to proceed at their own rates. This means that students with stronger entry characteristics and/or students who learn well independently end up learning far more than their classmates. Students who are just as capable but whose style of learning is different often fall further and further behind.

This program advocates group-pacing for several reasons. First, philosophically, the program starts with the goal of equalizing educational outcomes. The goal is not to "move every child at his or her own pace"; the goal is for every student to master the same body of knowledge.

Second, group-paced instruction builds a strong sense of community in the classroom, and a climate that is supportive of learning. Students become committed to the goal that everyone will master, and give one another strong encouragement, help, and recognition.

Finally, group-paced instruction is more practical than individualization. Good individualization requires a degree of preparation and a pupil-teacher ratio that are simply not realistic.

Group-paced instruction has definite advantages in terms of equalizing educational outcomes, of building group feeling in the classroom, and of being efficient and practical. Bloom is quick to point out, however, that it also has what he calls "built-in error." That is, no one lesson can ever be just right for all 33 students in the room. For that reason, a key feature of the mastery approach is diagnosing these errors, and correcting them right away. These "correctives" will be explained later on in the manual.

Basic Elements of the Approach

It seems useful to outline here the elements of mastery instruction and to relate them back to the rationale explained above. All of these steps are described in detail in chapter 3, with many examples, so the discussion of them at this point will be brief. The steps are presented in the order experienced by the student; they are implemented by the teacher in a somewhat different sequence.

Element I: Define what is to be learned

This element refers to the second basic assumption of mastery -- that the primary task of schools is to define what should be learned, and to see to it that all students reach this level. The learning objectives are at this point determined by the individual teacher, using whatever curriculum guides, textbooks, or level tests are available. What is important is that both the teacher and the students understand and focus on the objectives.

Element II: Teach the material

Initial teaching in a mastery classroom will look much like that of any effective teacher. Material may be presented through lectures, demonstrations, discussions, films, or whatever approach the teacher finds most appropriate. However, two other features will be evident. First, goals for the lesson will be clearly stated. This provides the cues that Bloom says are part of quality instruction. Second, the teacher will explicitly let the students know that s/he believes all the students can learn the material well, and expects them to do so.

Element III: First Formative test

After all the material for the unit has been presented (which might take one class period or several weeks), the teacher gives a formative or practice test to see what the students have and haven't learned. This test does not count toward a grade; rather, it is a way of letting both the students and the teacher know where more work is needed. This is the step that provides the feedback needed and identifies the errors in group instruction.

Element IV: Learning alternatives

Next, students are provided with learning alternatives. Those who had trouble with the formative test will be re-taught in new ways to correct the errors of the group instruction. Those who have already mastered the material will participate in enrichment activities, and/or help other students.

Element V: Second Formative Test (or Retest)

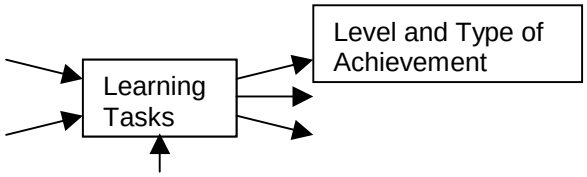
After the learning alternatives have been completed, the teacher gives a second test on the same material. Assuming that most of the students master, the class is then ready to move on to new material. (Additional steps for dealing with students who still haven't mastered will also be discussed.)

Element VI: Summative Test

This test is given every several units. It is designed to test students' overall learning thus far. It will tell the teacher how much the students have retained.

THE THEORY OF LEARNING IN MASTERY LEARNING

The mastery philosophy has a theory of learning that helps to explain the difference between what happens now in schools and what could happen. Bloom summarizes the theory in the following chart:



Bloom describes the learning process through three categories: the characteristics of the student, the instruction, and the learning outcomes.

Important student characteristics are of two types. First, there are "cognitive entry behaviors," which means the student's degree of preparation in the particular subject being taught. This does *not* mean generalized intelligence or general school preparation - concepts that Bloom feels are not useful in looking at how a student does in a particular learning experience. Second, there are "affective entry characteristics," or how the student feels about him or herself as a learner, about the particular subject being taught, and about school in general.

In looking at instruction, Bloom identifies four key factors that determine the quality of instruction for a given learner: 1) cues about what is to be learned; 2) encouragement of student participation; 3) reinforcement of learning, and 4) feedback about correct and incorrect responses. (These will be explained when we discuss the components of mastery learning in more detail.)

In terms of learning outcomes, he sees three important categories: First, there is the level and type of achievement that results from the learning experience. Second, there are the affective outcomes-- the student's attitude toward what went on, and toward future work in that subject.

The charts below illustrate the way this theory describes the progress of two different students through the same learning experiences -- say, long division. In this example, Shirley comes to the situation with positive cognitive and affective entry characteristics. She is well-prepared in terms of her skills in number facts and the concept of division. She thinks of herself as good at learning math and has a positive attitude toward math class and school. Judy, on the other hand, is poorly prepared in terms of number facts and the concept of division, sees herself as a poor math student, and dislikes math class and/or school.

If both students receive similar instruction, it is clear that the learning outcomes will be very different. Shirley will in all likelihood come out with a positive attitude. Judy, however, will probably learn slowly, spend less time on task, achieve limited success, and leave the experience feeling even more negative than she did when she started. Unless changed, this process will be repeated lesson after lesson, day after day, year after year.

It is easy to see that the eventual difference between Shirley's and Judy's math achievement is likely to be very large. What is significant about Bloom's approach is that he does not think it useful to explain that difference by saying that Shirley is more intelligent than Judy. He says instead that the learning conditions were more favorable for Shirley than for Judy. These factors are more useful to focus on, because they are ones that the teacher can do something about.

The mastery approach seeks to erase the difference between Shirley's and Judy's learning outcomes at several points in this process. It starts by assuming that Judy is as capable of learning the material as Shirley is, but that Judy's cognitive and affective entry characteristics must be improved. This means that it is the teacher's job to help her upgrade the skills that are prerequisites for learning long division, and to offer encouragement that will help her have a more positive view of her ability to learn the material. Then the approach calls on the teacher to be sure that the instructional methods are ones that reach not only Shirley, but Judy as well. This may mean teaching the same material more than once, and in different ways. Given this kind of mastery approach, Judy can come out with as much knowledge as Shirley and with a whole new attitude toward learning math. After several such positive experiences, Judy should be learning as quickly as Shirley.

MASTERY LEARNING RESEARCH AND PRACTICE

Previous implementations of Mastery Learning in school environments, such as the Chicago Mastery Reading Program for primary schools and the program by the City Colleges of Chicago, have proven successful in many areas. Some of the more significant findings to come form these field studies of mastery learning are as follows:

1. Properly implemented, mastery learning strategies have been useful in increasing the level of achievement of students who meet the minimum standards of participation. Higher levels of retention and future application of skills have been documented. One critical finding is that general measures of aptitude fail to predict summative achievement within the mastery strategy, demonstrating that feedback and corrective strategies can overcome the specific history of the learner.

2. Many studies have attempted to study more than the achievement outcome of the learner. Particularly exciting are the results which demonstrate the level of involvement and the use of time under varying instructional conditions. These studies have shown that the investment of extra time early in the sequence is balanced by a payoff of more effective use of time at the later stages of learning. Moreover, this higher degree of active learning time is due to the student's internalization of instructional processing skills, such

as ability to evaluate, correct, and reward one's own learning. The student tends to have more control over his/her learning and becomes more self-reliant in the processing of instruction.

3. Finally, there are important affective consequences. Using mastery learning techniques, the learner tends to become more interested in the content being learned and feels more competent as a learner. This research has paralleled the findings of positive affective consequences under direct teaching approaches of compensatory education interventions (Project Follow Through). In addition, recent evidence suggests that extended time under mastery conditions during the primary school years can have an impact on more general affective characteristics which parallel the dimensions of positive mental health. It is likely that these concerns, the motivation for future learning and the impact on personal adequacy, will have an effect comparable to the cognitive outcomes of the mastery strategy on the student's adaptation to future learning experiences.

THE CHICAGO MASTERY LEARNING READING PROGRAM

Included in this section of the manual is an overview of the mastery learning reading program implemented in Chicago in 1981. While there are minor elemental and procedural differences between the Chicago and Baltimore programs, the substantial similarities between the two, both in terms of their underlying philosophies and in the key process of the teach-test-reteach-retest cycle, far outweigh the differences. We include the Chicago Mastery Learning Reading (CLMR) program here as an example of how this philosophy and methodology have been successfully implemented in another district.

One difference in the two programs is their relative structuredness. The Baltimore perspective allows much more flexibility for the teacher -- and it also requires more teacher planning. However, despite not having the manuals and books, the Baltimore teacher might wish to adopt or work into his/her own plan some of the activities and/or techniques mentioned in the CMLR overview -- such as SQUIRT, for example. The reader will find that many of these suggestions are echoed in other parts of this manual and are consistent with the Baltimore perspective. CMLR might even serve as a model for a teacher's in-class implementation.

THE PRC MASTERY LEARNING FIELD TRIALS

From 1985-1988, a large scale field study of the effectiveness of the enhanced mastery learning training was conducted within the Baltimore City Public Schools. The major focus of the study was the impact of the enhanced mastery learning training on student achievement, concentration, and self reports of depression. The enhanced mastery learning training utilized the materials covered in this manual in the context of thirty hours of staff development and the provision of a variety of supplementary materials to the reading curriculum. The study demonstrated that such training could have a positive impact on achievement and to a lesser extent on concentration and depression. However, a link between improved achievement and decreased levels of depression was noted, suggesting the possibility that continued improvement in achievement through mastery learning could result in important mental health outcomes.

The report of these short-term impact analyses can be found in the appendix.

CHAPTER THREE
THE CORE MASTERY LEARNING COMPONENTS

PREPARING STUDENTS AND PARENTS FOR MASTERY LEARNING

Even though mastery learning probably incorporates elements of teaching which you have previously used, it will be important to inform the students right from the start that this will be a mastery learning classroom and that it will be different from many other classes they have been in. One might say, for example:

"Students, this year we will be using a different approach from what you might be used to. This is a mastery learning classroom. That means that I will be operating under the strong belief that each and every one of you can learn whatever is taught here. You will all learn each topic we study so well that on the tests everyone is expected to get an A or a B. I want you to know that I believe each of you is capable of learning to a mastery level. That means I will be pushing you very hard, but it also means that if you try, if you follow the assignments and are here, there is no reason why you can't achieve mastery.

"You're probably wondering how this is going to work. There are several important steps which aren't really all that mysterious. First, I'm going to tell you very clearly exactly what it is I want you to learn. I'll be doing this every day so no one should be confused about what we are studying. Second, after we learn our lessons, I'll give you a practice test, but the purpose of this test is only to let you know precisely what you've learned and what you haven't learned yet. Then you'll have a chance to study what you don't know, but this time you'll study it differently. Maybe you'll use a different book, or maybe one of your classmates will explain it to you. The fourth step is the retest -- everyone gets a chance to take a second test and I'm pretty sure by that point you'll almost all be ready to achieve mastery. And if by some chance you haven't gotten it yet, then we'll find a way for you to learn some more and then take a third test. Your grade will be based on the last test you take; the practice test or tests will just be to used to show you and me what you have learned and what you still need work on."

The methods teachers can use to explain how mastery learning will work depends on the grade level. Some teachers have used bulletin boards and posters to publicize and emphasize that theirs is a mastery learning class. These posters can contain simple slogans like, "Mastery learning means YOU will achieve excellence." Other teachers have used the first day of class to walk through the steps in mastery learning with the students.

Many teachers use charts to record the class's progress in mastery learning. Some charts show the percentage of students getting mastery on each unit while other charts list each student's name and place an "M" beside it for each unit where mastery is achieved. Another teacher uses a piece of construction paper for each unit, listing the topic and then writing the name of each child who achieve mastery.

The important thing is to let students know: (1) that this is a mastery class; (2) what mastery learning is and how it works; and (3) that you will be keeping close watch on how

well the class does. It will enhance the process if the class develops a real spirit about both individual mastery and that of the whole class.

The effectiveness of the mastery approach can be further enhanced by enlisting the understanding and support of the parents. There are various ways to do this. Some teachers have sent a letter home explaining the basic aspects of mastery learning and how they, the parents, can help. Other teachers have explained mastery learning to the parents at the end of the first report period when conferences are held. Another means would be to call a class meeting of the parents at the beginning of each school year. In the cases of the letter and the class meeting, it is necessary to secure the permission and support of the building administrator. When informing the parents about mastery, the teacher should not give them the sense that their children are being experimented on. Rather, s/he should emphasize the goals and methods of the approach, just as was done with the students.

Parents can be helpful by asking their students questions about the subject matter content which has been specified by the teacher. Probably the most helpful thing parents can do is to assist their children in reviewing the first formative test and to see what still has to be learned. In a few cases, for example, teachers have operated under a fixed schedule so that parents know to look for the first test, say, every other Thursday evening.

While it is helpful to explain mastery learning to the parents and to enlist their support, it should be noted that the success of this approach does not depend upon their involvement. Students can achieve mastery even if their parents do not take an active role in the process. Mastery has been reached by many students whose parents were uninformed and non-supportive.

It is quite possible that some parents of better prepared students will indicate that they don't want their child held back by other students. In this case it will be useful to indicate to them three things: (1) the research evidence has shown that in the long run mastery benefits not only the poorly prepared students, but the entire class; (2) students who achieve mastery will be provided with enrichment sheets, projects, and exercises that will enhance their in-depth learning; and (3) the chance to help others enhances a student's sense of self and develops in him/her a valuable social skill.

CREATION AND ORGANIZATION OF OBJECTIVES

The first task in planning a mastery learning course is to define exactly what the students are expected to learn and at what level this learning is to take place. These *learning objectives* are an important part of any form of teaching, but they are fundamental to mastery learning. Not only do they serve to focus instructional activities, but in mastery learning they also serve as a basis for developing formative tests and corrective activities.

Teacher Decision Making

The first step in defining objectives for a mastery learning course is to identify the final learning goal. The teacher (or curriculum developer if this is not the same person), within the institutional constraints of his/her school district, has to decide at what level his/her students are to be able to perform at the end of the year or term. There are several factors that will influence this decision. Figure 3.1, based on the work of Richard J. Shavelson, illustrates how teachers make preinstructional decisions.

Teachers can use information, or cues, that they have of their students. This information can come from sources such as previous class performance, informal observation, and reports from other teachers. Teachers can use these cues about students to determine their interests, preparedness in the subject area, and other entry characteristics.

Preinstructional decisions about what and how to teach can also be influenced by teachers' personal educational beliefs and cognitive styles. Teachers can have widely varying opinions on which cognitive skills are important, or the relative importance of affective goals (how the students feel about content, themselves, and others) and cognitive goals (subject matter knowledge). Such differences will affect their decisions relative to their final goal.

Shavelson's model suggests that the nature of instructional tasks is another source of influence on instructional decisions. The fact that a particular text or curriculum is available may make some instructional strategies more appropriate than others. Curriculum packages may also tend to make some student cues more important than others.

Teachers must be aware of how they make decisions, not just operate on some vague theories. Just as important, teachers must consciously monitor progress toward their goals. Making decisions on long term objectives is a dynamic process. Student feedback during the course of the year, either through explicit comments or subtle behavior, may legitimately change some goals as new student cues are discovered.

Learning Units

After determining the final learning goal, the teacher must identify the specific elements of this goal. What specifically must a student know or be able to do in order to be considered to have achieved the level defined in the final learning goal? Ideally, each of these elements can be taught as a single unit or will have natural breaks where units can begin and end.

Next, the teacher must sort these learning units into some order of presentation. In determining the starting point and the general schedule for the course, the teacher must consider not only the relative importance of the elemental objectives, but also their logical sequencing. For example, it is necessary to determine whether some of these objectives involve skills that must be mastered before one can pursue another objective. Other considerations for the first or early units include brevity, types of skills needed, probability of success, and anxiety-arousal properties.

Unit Objectives: Table of Specifications

Once one has decided how the material for the course of a year will be placed into units and how these units will be sequenced, one has to determine what the specific objectives are for each unit. Table 3.1 gives a list of types of content that the teacher might want each student to know for each unit. However, when organizing the objectives for a unit the teacher must determine not only what content and what types of content the students are to know, but also what the student is expected to be able to do with it.

According to Benjamin Bloom there are several categories or levels of learning, with knowledge being just the lowest of these. Table 3.2 gives a list of the different levels of educational objectives. Thus, if a teacher would like his/her students to be able to apply a certain content element to a different situation, s/he will have to list application of that content as one of the learning objectives; s/he would have to teach application of that content.

When preparing learning objectives many teachers have found it helpful to use a *table of specifications.* Figure 3.2 shows an example of one such table. Thus, preparing the objectives for a unit involves no more than listing all the terms, all the facts, the concepts, the rules and principles, and the processes and procedures that the teacher expects the students to know by the end of the unit, and then indicating whether s/he expects them to also be able to perform translations, applications, analyses and/or syntheses on the content presented.

The table of specifications can also be used to illustrate relationships among content elements. Figure 3.3 shows three learning tasks with different degrees of interrelatedness. The teacher might find that in some units there is hardly any relationship among the content elements, while for others there is a complex structure of interrelatedness. A particular translation, for example, might involve understanding of two processes and three facts, which in turn depends on knowing the definitions of several terms. And that ability to translate might be required to make a certain application. By drawing lines between related elements the teacher can keep track of all these relationships so that s/he can develop them for the students.

If a unit is fairly long, the teacher might want to put a date next to each term, fact, etc. for when s/he wants to introduce that objective. It is important that the teacher have a clear and specific idea -- and clearly convey to his/her students that idea -- of not only what the unit objectives are, but what the lesson objectives are *for* each day.

The table of specifications will also aid in preparing the formative tests. One key to mastery learning is that the formative test must be a diagnostic as to how well the students have grasped the learning objectives. It must test for only the knowledge and performance stated in the objectives, and it must test for all the knowledge and performance stated in the objectives. It is a good idea, then, to prepare the formative test about the same time that one prepares the learning objectives for a unit, using the table of specifications as a sort of checklist of material to be included in the tests.

A table of specifications can also be useful as a guide during teaching activities. It can help the teacher to focus on what is to be taught. However, it does not free the teacher from developing lesson plans. Just having objectives of what the students should learn is not enough; it is still up to the teacher to determine how s/he and his/her students will achieve those objectives. Thus, included with the learning objectives should be information on how the unit will proceed . Will it involve lectures, films, class participation, etc.? The teacher will find that having his/her learning objectives clearly delineated will aid in selecting methods of instruction.

Whatever method the teacher decides to use in planning the unit s/he must realize the usefulness of precise and measurable learning objectives. The objectives help the teacher focus and stay on task, but, in addition, when a student knows precisely what s/he is expected to learn, and when s/he knows how and when these objectives are achieved, his/her learning is greatly enhanced.

INITIAL PRESENTATION

This phase of the mastery learning format is under the teacher's control. The individual teacher decides how the lesson will be taught and how many periods it will take. Usually s/he follows much of what s/he has typically done in the past when teaching this unit. His or her own experiences with what approach went well previously is most important. (Generally, teachers have found that if they are doing a one week unit, the initial presentation takes 2-3 periods while that for a two-week unit will take approximately 6-7 periods.)

Though the mastery learning program allows total freedom for the teacher regarding curriculum and instruction, studies have shown that there are certain teacher behaviors that either help or hinder students in achieving academic gains. The reader is encouraged to look carefully over the guidelines to developing high expectations and Gage's "teacher should" statements and included in sections 3b and 3c of this chapter.

3a. Presenting the Lesson

First Day

On the first day of each unit, mastery teachers begin by presenting an overview of the unit which is very explicit and specific. They let the students know what content is to be learned and what operations (translation, application, etc.) are to be performed on this content. Furthermore, they tell them how teacher and student will know if they really know and understand the ideas and skills which were taught. ("I will know that you have mastered this when you are able to...")

It is also useful to tell the students how the unit will proceed. This means indicating whether the unit will include lectures, films, teamwork or whatever. At the secondary level, an outline or a schedule including the materials to be used would be helpful. Another useful announcement is the planned dates for the formative tests. Finally, it is useful to explain why this unit is important and how it ties in with other units.

Some teachers use the bulletin board as a means for highlighting the unit, even emphasizing some of the more important skills and concept. Other teachers hand out copies of their table of specifications, including their lesson plans for that unit, but they must be sure to go over the table with the students. Either mode can be useful in summarizing the unit in preparation for the test and in helping students who were absent.

Each Day

1. First Step in Each Day's Lesson: State Goals

Mastery learning depends on the students having a clear idea at the start of each lesson what it is they will be learning that day. Once again, the mastery teacher is specific and explicit. Also, s/he makes sure to include that component of the goal statement that indicates what it is the student will be able to do. ("Today we are going to learn the first step in adding decimals, and you and I will know you have learned it because you will be able to do the five problems I give you in 10 minutes.")

Some teachers write the goal for the day on the board. They read it, have students read it and/or copy it in their notebooks, or whatever; but in some very explicit way the students must know right from the top what they are expected to learn. This is similar to the practice many teachers have of writing the "goal for today" or the practice of using behavioral objectives.

Stating the goal once will not suffice in most cases. The students will probably find it very helpful if the goal is repeated and expressed in different ways several times throughout the lesson.

One of the things mastery teachers have said over and over again is how helpful it has been to them and to their students to be very clear each day about the goal for that particular lesson. Doing this helps to organize them and encourages them and the students to focus and to use their time well.

It is useful to keep in mind five criteria for effective goal statements:

a) Be specific.
b) Have a behavioral component: "You will be able to..."
c) Be clear -use language that makes sense to the students.
d) Use language that has a pep talk tone to it.
e) Focus on what is to be learned and not what is to be covered.

There are other points to be made about goal statements. Sometimes when doing a "discovery" lesson the teacher does not want to say right away what the learning for today is. In this case, it is vital to express the learning in clear and specific terms at the end of the lesson.

Also, there are times when the teacher is just introducing a concept or skill and will want to say something to the effect: "Today, we're going to introduce the theory. This is

a difficult concept, and it will take some time to understand it. I expect that you will be pretty confused still at the end of the lesson. Don't be upset about that now."

Third, mastery teachers often refer back to the unit goals when they state the lesson goal. This helps the students place the lesson in context and identify later where they got confused on a test.

Teachers sometimes question the point of expressing specific goal statements to students. They feel that by telling students specifically what they have to learn, they are making it too easy for them or giving it away. The whole point of mastery learning, however, is that the mastery teacher wants all students to learn; s/he wants to make the learning possible to all. She is not interested in weeding students out.

The mastery teacher is reminded that his/her goals will not be limited to rote learning. They can and should include abstract ideas and higher-order thinking processes. For example, "Today you will be learning to think critically about new ideas. By the end of the period, you should be able to write down two specific questions about a new topic."

2. Second Step in Each Day's Lesson: Present the Lesson

The teacher presents the lesson the way s/he would normally. The thing to keep in mind is to teach toward one's objectives, perhaps using the table of specifications to help one focus.

Some people are under the misapprehension that mastery learning means day-in, day-out dry, routine teaching. Any instructional approach, including mastery learning, requires creative, varied, appropriate teaching strategies and materials. In writing their mastery units, teachers generally consider what it is they are going to teach, think back to previous experiences with the content, and then decide on materials and techniques that are appropriate, interesting, and relevant. Some goals to keep in mind include (a) attracting the students' attention, (b) getting students involved in the learning process, and (c) encouraging the students to keep them actively engaged in the learning process for a period of time sufficient for learning to occur.

3. The Third Step in Each Day's Lesson: Summarize

One of the steps which many teachers fail to reach in their lessons is summarizing. Often, the lesson takes longer than anticipated. Papers and books are collected and assignments given without any time being available for review.

There is much evidence around now, both hard data and anecdotes of classroom experiences, that using a brief period of time at the end of the lesson for summarizing can

be extremely helpful to the learning process. Learning is reinforced if students have to express in some form what it is that they learned that day -- or even what it is that they still do not understand. While it is best for each student to make his/her own summary, it is also clear that just listening to another's summary is helpful.

Summarizing is another important procedure in mastery learning that helps students (and teachers) be very clear about what it is that they are expected to learn, and to monitor progress.

There are many different ways to encourage students to summarize the day's lesson. Students can write a sentence or two in their notebook; they can orally complete the sentence stub: "Something I learned today in Biology is..."; they can share with a partner their learning for the day; they can keep a daily written log of what they've learned. Or, the teacher can summarize the lesson; s/he or the students themselves can state what learning they saw other students achieving; s/he can keep an "I think I saw you learn" poster for each class; etc. In addition, or instead, the teacher can ask a series of questions, some of which can be answered by a show of hands. For example, "What did we learn today? Who thinks that he or she didn't get it? Where is the confusion?"

3b. Developing High Expectations

This manual has stressed the fact that for mastery learning to work in the classroom, the teacher must be willing both to accept the basic assumptions of mastery learning and to implement the methodology. Just to go though the motions is *not* enough. There must be some understanding of the theory, and there must also be belief that all students really can master the subject. Thus, in addition to knowing the theory and implementing methodology, working on conveying positive expectations is another important role for the teacher.

There has been increasing evidence that expectations play an important role in the teaching-learning process. When teachers (and others such as parents, administrators, and peers) expect high achievement from students, the students are likely to perform well. When expectations are low, the students often respond by performing poorly. The expectations becomes a self-fulfilling prophecy.

Three recent highly acclaimed studies of effective schools all pinpointed expectations as a major factor in helping students achieve greater academic gains. These three studies are: 1) the Brookover study of Michigan schools; 2) the Edmonds study of effective schools; and 3) the Ritter study of London inner city secondary schools. In addition, recent summaries of expectations research by Earline Sloan and E. Jacobsen and R. Rosenthal show that the great majority of research studies now demonstrate that expectations do make an important difference. Finally, widely recognized practitioners like Marcus Foster also state that high expectations are a necessary ingredient in the move to help schools raise the academic achievement level of students.

Given the powerful effect of the expectations dynamic, the question becomes how to help teachers convey expectations that are high. One way of doing this is to encourage teachers to develop the attitude that students are capable of high achievement -- that is, to encourage them to adopt the underlying assumptions of mastery learning. However, there is a second way to encourage teachers to convey high expectations that is even more specific and direct. Researchers have identified the specific teacher behaviors and school policies and practices that convey expectations that are high and expectations that are low. The behaviors are ones that teachers can learn to identify in themselves and to change. Thus, teachers can make helpful changes not only at an attitudinal level, but at a behavioral level as well.

Low expectations are a powerful negative force. Summaries of hundreds of classroom observations show some teachers conveying low expectations all day long, and others conveying high expectations to one group and low expectations to another without being at all conscious that they were treating the groups differently. Experience indicates that when these behaviors are changed, the effect on student learning is very positive. There are teachers who have changed some of their expectation behaviors and dramatically raised the achievement level of many students.

Before describing those behaviors which convey high expectations, two general comments need to be made. First, the teachers reading this list should not assume that each and every one of these is applicable to them and their situation. By presenting a fairly lengthy list the manual is attempting to indicate the breadth of the topic, but it is leaving it up to the reader to determine which, if any, are ones s/he needs to look at. Second, behaviors which convey expectations can be fairly subtle and sometimes unconscious. They often reflect a teacher's own school experience and/or the norms of the school s/he works. Because these behaviors are often unconscious, the teacher might want to get some "outside" observations of his or her teaching. That outsider's view can come from student observations and feedback, from fellow teachers' observations from a video of the class, and from the teacher's own notes.

1.) Use of Time

Teacher Behaviors That Convey High Expectations	Teacher Behaviors That Convey Low Expectations
• Start on time	• Start late, end early
• Few interruptions	• Many interruptions
• Demand that students be on task	• Allow students to be off task
• Specific, challenging time limits	• Open-ended time limits

The teacher with high expectations conveys the attitude that time is very valuable, and must not be wasted. This happens in several ways. First the teacher maximizes time spent on learning by starting promptly, allowing few interruptions, and handling noninstructional duties (like taking roll) very quickly. Second, the teacher insists that the students be actually involved in learning - not daydreaming or fooling around. Third, the teacher sets clear time limits for tasks: "Here are ten questions to be completed before the bell rings."

The teacher with low expectations conveys a "What's the use in hurrying?" kind of attitude. This teacher tends to get started late, to permit many interruptions, and to tolerate behavior that is off the learning task (especially when that behavior is not disruptive). Another way this teacher may express low expectations is by failing to impose challenging time limits. This gives students the message that they aren't expected to get much accomplished -and they respond accordingly.

2.) Goal Stating and Summarizing

Teacher Behaviors That Convey High Expectations	Teacher Behaviors That Convey Low Expectations
• Goal Statements are -Frequent -Clear -Specific -Challenging	• Goal Statements are -Infrequent -Unclear -General -Unenthusiastic

Teachers who expect students to do well tend to make, both at the beginning and the end of the lesson, many more statements that indicate what the students are expected to learn. When these statements are frequent, clear, specific, and challenging, they carry the message that the teacher expects results, and they guide the students in their learning.

When their expectations are low, teachers tend to indicate what pages and exercises are to be done, but not what skills or concepts are to be learned or to be studied this period. The message conveyed is more like, "Keep yourself busy," than, "Here's what I expect you to *learn.*

3. Input

Teacher Behaviors That Convey High Expectations	Teacher Behaviors That Convey Low Expectations
• Lots of input	• Little input
• High proportion of new material	• Little new material; much review
• Challenging work	• Easy work

A teacher with low expectations for a class takes 10-15 minutes to start a lesson, puts an assignment on the board with almost no explanations, does much review, and ends the lesson well before the bell. One gets the overwhelming impression of "What's the use?".

With a different class for whom expectations are high, a teacher demands that the whole class come to attention immediately, tells them what they have to learn today, provides many explanations of the new material, does some reviewing, and summarizes the lesson, as well as assigns homework that s/he expects to be done or else.

Over time the effects of this differential treatment are substantial. Students of whom teachers have high expectations end up receiving more time on input, and more challenging input. In contrast, students of whom little is expected have little access to new learning. Under these circumstances it is clear that the achievement level of the two groups will grow further and further apart.

4.) Types of Questions

Teacher Behaviors That Convey High Expectations	Teacher Behaviors That Convey Low Expectations
• More questions • More higher-order questions	• Few questions • Rote questions

With students of whom they expect a lot, teachers tend to ask a variety of questions, including many higher order questions. Examples of the latter category are: Under what circumstances?; How can you tell?; What are the possible values?; What are the effects of?; What evidence can you find?; and Why?

With students of whom they expect little, teachers tend to ask predominantly rote type questions which can be answered in one or two words or a short sentence. This means that these students are not encouraged to do much thinking, nor are they given an opportunity to show that they might know more than the teacher suspects. The message conveyed is "Why ask them when they won't know it anyway?".

5.) Wait Time. Pursuing Questions

Teacher Behaviors That Convey High Expectations	Teacher Behaviors That Convey Low Expectations
• Wait Time: Wait 3-6 seconds after a question • Pursuing Questions: Pursue if answer is wrong or incomplete	• Wait Time: Wait under 1 second af a questions • Pursuing Questions: Move on if answer is wrong or incomplete

Wait time refers to the amount of time the teacher gives a student to answer a question. Believe it or not, the teacher with low expectations tends to give the student less than 1 second between asking the question and going on to someone else. Teachers with high expectations tend to wait 4-5 seconds. Waiting conveys the message, "I know you can come up with the answer." Moving on suggests, "You'll never get it..

In addition, after a student has answered, teachers with high expectations tend to wait a few more seconds to see if the extra time won't induce students to add more or to amplify their answer. If the answer is wrong, they stick with the student and try to help him or her come up with the right answer. On the other hand, a teacher with low

expectations tends to move on to another student when s/he hears a wrong answer, or an answer that is incomplete.

6.) Encouraging Students to Express Confusion

Teacher Behaviors That Convey High Expectations	Teacher Behaviors That Convey Low Expectations
• Set climate where students aren't afraid to ask	• Climate where students are afraid of looking stupid
• Give students a clear sense of what they are supposed to be learning	• No clear sense of what students are to be learning
• Demand that students be on task	• Allow students to be off task
• Specific, challenging time limits	• Open-ended time limits

A key factor in promoting learning is creating an atmosphere in which students feel free to express confusion or make mistakes. Teachers with high expectations encourage and allow students to admit confusion. A key to success of mastery learning lies in identifying students' confusion about a concept as soon as it occurs, and then correcting it right away.

With students not expected to learn, the expression of confusion is not accepted as a positive sign. When a student gets a wrong answer, the question is not rephrased, nor is the student encouraged to ask questions.

7.) Feedback

Teacher Behaviors That Convey High Expectations	Teacher Behaviors That Convey Low Expectations
• Feedback -Frequent -Specific -Immediate -Differentiated -Recognizes progress	• Feedback -Infrequent -Vague -Delayed -Undifferentiated -Ignores Progress

Teachers with high expectations tend to give lots of very specific feedback to students' oral and written responses. If something is wrong, they let the student know

what it is. Teachers with low expectations tend to give less feedback, and when they do, it is likely to be vague. For example, on a written test they will just give a grade, but not indicate what was wrong or why. In effect, they are saying, "I really didn't even expect you to be able to say anything," or, "It's not worth the effort to correct this paper."

Teachers with high expectations also make their feedback immediate. Tests, homework, and class work are marked in class or returned the next day. Teachers with low expectations about a class or group or student tend to return papers days or even weeks later. Such feedback on their work is almost worthless to the students.

Another key difference is that feedback from teachers with low expectations is often undifferentiated - that is, it doesn't let the student know whether the response was right or wrong. Typical examples are comments like, "Nice try," or no comment at all. When their expectations are high, teachers are much more likely to let the student know whether the answer is right or wrong. Another aspect of this is that teachers with high expectations tend to give balanced feedback that recognizes progress at the same time that it identifies errors. ("You've mastered _. Now what you need to work on is .") When teachers have low expectations, if they give differentiated feedback, it tends to emphasize the negative.

8.) Nonverbals

Teacher Behaviors That Convey High Expectations	Teacher Behaviors That Convey Low Expectations
• Facial expression	• Dull or negative expression
• Eye contact	• Little eye contact
• Use of names	• Limited action zone

Teachers give off many nonverbal cues which say either, "I know you can do it," or, "I've given up on you." When teachers have high expectations, they smile more at the students, maintain more eye contact, and call them by name more often.

Repeated observations also indicate that teachers who move about a classroom tend to place themselves physically close to those individuals or groups they believe are better students. The teacher tends not to stand close to those students s/he are nor capable of not learning a much.

CONCLUSION

This section has provided a description of the behaviors by which teachers convey high or low expectations. We have seen how teachers' expectations and behaviors have a strong impact on the students' attitude and on the overall structure of the class.

Teachers can make significant improvements by targeting one or two behaviors that they want to change. The reader is encouraged to select a couple of behaviors to work on while implementing the mastery units.

3c. Gage's "Teacher Should" Statements

The following are some teacher behaviors that the teacher can use to promote better learning:

Teachers should have a system of rules that allows pupils to attend to their personal and procedural needs without having to check with the teacher.

Teachers should move around the room a lot, monitoring pupils' seat work and communicating to them an awareness of their behavior while also attending to their academic needs.

When pupils work independently, teachers should insure that the assignments are interesting and worthwhile, yet still easy enough to be completed by each third-grader working without teacher direction.

Teachers should keep to a minimum such activities as giving directions and organizing the class for instruction. Teachers can do this by writing the daily schedule on the board, insuring that pupils know where to go, what to do, etc.

In selecting pupils to respond to questions teachers should call on a student by name before asking the question, as a means of insuring that all pupils are given an equal number of opportunities to answer questions.

With less academically oriented pupils teachers should always aim at getting the child to give some kind of response to a question. Rephrasing, giving clues, or asking a new question can be useful techniques for bringing forth some answer from a previously silent pupil or one who says "I don't know" or answers incorrectly.

During reading group instruction teachers should give a maximal amount of brief feedback and provide fast-paced activities of the "drill" type.

One way to sum up many of the implications of the research, as embodied in these "teacher should" statements, is to say that teachers should organize and manage their classes so as to optimize "academic learning time" -- time during which pupils are actively and productively engaged in their academic tasks. And one way to do this is to avoid time-wasting activities, such as waiting in line to have papers corrected or to receive further instructions.

FORMATIVE TESTING

While the initial presentation provided by the teacher might be appropriate for many of the students, usually, there will be some who because of different learning styles or entry characteristics will not master the material initially. The purpose of the formative test then, is to quickly and systematically identify these students, and, more specifically, to identify what the particular areas of problem are, so that appropriate correctives can be applied to them.

4a. Development and Selection of Formative Tests

In the teach-test-correct-test cycle of mastery learning there should be at least two formative tests prepared for each unit. The second test will be given to those students who did not show mastery on the first formative test after the correctives have been implemented. Depending on the teacher's judgment, sometimes, it might be necessary to prepare more than two tests if a substantial portion (more than 20%) of the class still do not master after the second test.

It is vital that all the formative tests for a given unit be parallel in structure. The test format and type of content should be consistent. For example, if the first test was multiple choice, the students should not be expected to write essay answers on the retest. The type of content and format of a test usually affect the cognitive levels involved, and if the teacher wants his/her students to use a particular cognitive skill for a that unit, then such skills should be explicit in the lesson objectives and all the tests should test for it. Generally, teachers develop the different sets of test for a unit at the same time. This makes it easier to check for different structure among the tests.

Criteria for Effective Formative Tests

There are five criteria that should be kept in mind as the teacher begins to develop formative tests.

Criterion 1) The test should be a valid. systematic measure of the objectives the teacher chooses. To be valid it must really measure the learning objectives the teacher is after. This means that s/he must be sure all the objectives s/he sets are tested. It also means that the teacher must not test things that were not in the objectives. If the teacher is using a table of specifications for the objectives, this becomes a matter of matching test items with items in the table. If the test does not match the original objectives, one or the other must be changed to bring them into line. Beyond matching test items with objectives,

validity also means that the teacher feels sure that a student who does well on this test has in fact learned the content s/he set out to teach -- and one who does poorly has not.

The other important word in this criterion of an effective mastery test is "systematic.. This means that the test should be carefully designed so that the teacher gets information about each student for each content objective -- not just a general impression of how the student or class is doing overall. This aspect is especially important when teachers are using non-written tests. In order to make oral or observation tests systematic, teachers in the past have found it useful to make a chart with the names of all the students and the objectives. That way, they can keep careful track of what has and hasn't been learned by each student.

Criterion 2) The format of the test should be manageable. It is vital that feedback in the mastery approach be given very quickly. Students cannot start their learning alternatives until they know what they have and haven't mastered. Therefore, it is very important that the tests be designed for quick marking. That means that the students get them back the same day or the next day. Since tests occur with regularity, it is also important that they not be too time-consuming or unwieldy, so as not to take away from valuable instructional time. Rarely should it take more than 20-30 minutes to administer a mastery test to the entire class.

To cover all the material in a learning unit in a mastery test in less time, it might be more practical to use "objective" type items rather than essay items, unless, of course, the learning objectives require the free response format of an essay test. Using objective items will also facilitate quick marking for immediate feedback. Once in a while, the teacher may wish to use a test that is more time-consuming -- say, oral questions for each student -- but, unless the class is small or the teacher has aides, s/he probably cannot afford to do this too often. This is not said to discourage creativeness; it is simply a caution to be realistic.

Criterion 3) The test should provide specific. useful feedback to the teacher and the student. In other words, the test should direct the teacher and the student as to what corrective learning the student needs. The teacher needs to be sure that once the test has been evaluated, both s/he and the student will have a clear sense of what the student already knows, and what the student still needs to work on. An overall grade won't provide this -- the student needs a much more specific sense of what was wrong. In a math test, this may mean asking students to show their work as well as their answers so that the teacher can indicate where they went wrong. In social studies, it may mean indicating what objectives each question refers to so that the students know what to study.

This criterion is also meant to emphasize the point that the test results will not be just for the teacher to see, but for the student also. If the tests are well written,- and if students are then encouraged to use them to find out what they know and don't know, the mastery tests can be a major factor in helping students "learn how to learn."

Criterion 4) The test format should not require skills that cannot be assumed, or that are not part of the goals. In many situations, this will be the hardest criterion to meet. The teacher may not be able to achieve this criterion completely every time, but s/he should certainly make it a goal.

This criterion is probably best explained by an example. Imagine a high school social studies class where many students have almost no writing skills. Imagine that this class has been doing a unit on the Civil War where the objective is for the students to learn three major causes of the war and to discuss each with supporting evidence. Suppose that the class does this through a wide variety of approaches, including not only the use of the textbook, but also films, discussions, and role plays. Then the students are given an essay test. It is possible that every student may have mastered the social studies content objective -- yet many of them will likely fail to show mastery because of their lack of writing skills. Furthermore, learning alternatives which focus on the content won't help -- if the retest is also an essay, the students will fail again.

The above is a prime example of a test that required skills that the students could not be assumed to have had, and that weren't part of the unit objectives. The result is an invalid test, frustrated students, and a frustrated teacher. Other examples come quickly to mind -math tests that require a lot of skill in reading for instance.

In all such cases the teacher is faced with two options. One is to change the test format so that it does not require skills the students lack. This may mean moving to multiple choice questions, reading the test aloud, or allowing some or all of the students to take some or all of the test orally. A teacher who chooses this kind of option would be saying in effect, "My job is to teach social studies, not writing. If the students have learned about the Civil War, they've mastered, whether they can write or not." (In this case, of course, the teacher will have to keep in mind our earlier cautions about not making the test format unrealistically time-consuming, and about keeping the test systematic.)

A second option is for the teacher to decide to teach the students the skills they need to use the test format in question. In the above example, the teacher would be saying, "Sure, I'm a social studies teacher. But writing a decent essay is a crucial skill for students, and I'm going to go nuts all year if these students don't know how to do it. So my objective for the unit is not just that they be able to discuss three causes of the Civil War, but that they be able to do so in writing. For me, that means full paragraphs with a flow of ideas and a minimum of mechanical errors. And I'm willing to teach essay writing as part of the unit, and reteach it after the formative test to those who know the content but still have trouble writing."

This kind of choice is clearly ambitious -- and clearly helpful for the student. It may be that early in the year the teacher will want to choose two or three key formats, and take the time to give the students the skills these formats require. However, teachers who

choose to stick more narrowly to the assigned content must be sure that they in fact test that content -- not reading and writing skills.

Criterion 5) The scoring system should be a valid reflection of the teacher's priorities and definition of mastery. After the teacher has designed a test, s/he needs to assign points to various sections and decide on the score that will constitute mastery. To decide what score equals mastery, s/he needs to make a judgment. A student who achieves mastery should have a real understanding of the material, and be ready to move on. This might mean what is usually thought of as A or B level work.

Research indicates that for teachers scoring on a basis of 100%, somewhere between 80% and 90% is the best criterion level of mastery. Above 90% can be too frustrating; below 80% may not be seen as any challenge. However, each teacher will be the judge for his or her classroom. It is important that the students know what score will be mastery from the beginning of the unit.

Once the teacher has determined the score that equals mastery, s/he needs to double-check how s/he assigned points to various sections of the test. S/he may not want to weigh all parts equally. If there is one section that is absolutely critical and the mastery score equals 80%, the teacher might make that section worth 25% or more -- that way, any student who misses it would be below mastery. On the other hand, items that are not critical might be given 5%-10%. That way, a student who misses several such items would not have mastered, but those who miss only one or two would be okay.

4b. Administering the Formative Test

The mastery teacher gives the first formative test as soon as the unit has been completed. S/he does not wait until s/he is sure that everyone has learned all the content. The point of the test is to give the students and teacher immediate and specific feedback as to what has been learned and what has not.

It is vital that this feedback be immediate. The test should be returned preferably that same day, or at the very latest the next day. In some cases the teachers have the students mark each other's papers. This gets the job done immediately and it saves paperwork. Teachers have found various ways to cut down on cheating in the marking process. Some teachers pass out specially colored pencils which are used only for marking. Others have the students fill out duplicate answer sheets when taking the test. They collect the second sheet and spot check it at home as a way of keeping the process honest.

Many teachers feel most comfortable in marking the papers themselves. In this case it is most important that the papers be returned the next day. No matter who marks the papers, it is imperative that both the students and the teacher learn where the mistakes were made. One of the most important steps in the whole mastery learning

strategy is the one that teaches the students to analyze their own test results. They have to find out what they didn't learn and what they did. By doing this, students learn to learn. This skill then becomes useful to them in every learning situation they will ever be in. One useful approach is to have the class first practice this on some sample tests, and then move on to analyzing their own tests and telling the teacher where they went wrong. Mastery learning demands that students stop the practice of just looking at the number right or wrong and then putting the paper aside.

Teachers must also use these test results as a guide for what to do next. Some teachers go right through the test with the class, asking how many got each item right (or wrong). This should help disclose where the weaknesses are. They can then reteach those areas where the most misunderstanding is.

At the same time it is important for the teacher to emphasize the real purpose of the formative test. "It's great if you've achieved mastery, but don't be devastated if you didn't. Remember, the purpose of this test was to find out what you know and what you still need to learn. Tonight and tomorrow are your opportunities to fill in the gaps because you still have the chance to show me and yourself that you do know it."

Many teachers have found it helpful to use the term "mastery" instead of "pass." One teacher used only the terms "mastery" and "nonmastery" -- grades were not used at all. The emphasis was on achieving mastery; grades were used only at report card time.

Generally, if 90% or more of the students achieve mastery on the first formative test, the teacher can feel comfortable in moving on to the next unit. It is advisable to make some provision for further help for the 1-3 students who didn't attain mastery -either through group tutoring, time the teacher can find to work with them alone, or help from a resource teacher. Even if the teacher can't provide more instruction, s/he can encourage them to review on their own. Then some provision should be made for these students to take a second test. This need not happen during regular class time; study halls, lunch periods, or before school are other times that many teachers have found workable.

Should a second formative test, or retest, be necessary, it should be given after the initial nonmastery students have completed their correctives. It is not necessary for those who demonstrated mastery on the first test to take the retest. As with the first test, the teacher wants to get the results back as soon as possible.

4c. Analyses of Formative Tests / Recordkeeping

Mastery learning will not work if the teacher and each student do not know which specific objectives are preventing that student from achieving mastery. In order to do corrective work one has to know specifically what is wrong first. Ideally, the test will be designed for easy and quick analysis, perhaps by the student him/herself. For example,

the corrective recommended for each missed item can be written on the test, or the teacher can hand out a "correctives sheet" after the test. This sheet would simply indicate the number of each item on the test and the objective tested by each item, along with possible corrective activities for reviewing material relative to that objective.

It is important for the teacher to have more than a vague idea of how each student is doing. S/he should, at any time, be able to pinpoint the specific problems for each student. Thus, it is imperative that teachers keep detailed and updated records of not only students' scores, but also the specific test items that each student missed.

Figures 3.4 and 3.5 give examples of how such records can be kept. The grid-type format allows for quick referencing on which students missed which items. The summaries on the bottom and on the right give the number of students who got each item right (or wrong) and each individual student's total score for the test. The item totals are helpful to the teacher in determining particularly troublesome areas of the unit. If a substantial portion of the class missed any item, s/he will have to determine if the problem is inherent to the content (too complex for the grade level, perhaps?), in how the test item was phrased, or in the teacher's original presentation of the material. S/he might deem it worthwhile to re-present the lesson for the corresponding objective to the entire class in some other manner.

Teachers should also keep records of what type(s) of corrective work was assigned to each student. If a particular strategy doesn't work, s/he could try another, or perhaps a particular strategy has worked well with a particular student in the past.

4d. Using Multiple Sources of Formative Tests

CORRECTIVES

5a. Strategies for Reteaching

The group approach to mastery learning assumes that in almost all cases, there will be some students who have not achieved mastery after the initial presentation and formative test. Thus, it is imperative that those students who did not achieve mastery have the opportunity to work on their mistakes immediately.

Using the formative test item results for feedback, and depending on the resources available, the teacher can provide any number of corrective activities. It is important to provide as wide a variety of corrective activities as possible not only to allow students some individual choice, but to accommodate different learning styles as well.

Following is a quick checklist of possible activities. Each is briefly explained in Appendix A, A Mastery *Learning Handbook,* in the section headed by "Correctives."

- Reteaching
- Using the course textbook
-Using alternative textbooks
-Using alternative materials
-Using workbooks
-Using academic games
- Using small study group sections
- Using individual tutoring
-Using learning kits
- Using learning centers and laboratories
- Using computer-assisted instruction

These activities can be categorized, with considerable overlap, into three groups: things to be done with the teacher; things to be done with a friend; and things to be done by oneself. Table 4.1 in Appendix A indicates the possible categories each activity can be placed in. When the teacher is choosing a corrective activity for a student, or when s/he provides that student with possible activities to choose from, it may be helpful to first determine which category of activities the student will benefit from the most, or which categories would fit best within the teacher's own time management. It is important, of course, that each student gets to sample activities from each category.

What Constitutes an "Alternative Strategy"

Whatever corrective activity the teacher uses, it is essential that students who have not achieved mastery have the opportunity to learn the material in a way different from the initial presentation. When one teaches a person in a one-on-one situation, and the person does not get it, one naturally tries to explain the material in a different way the second time. This is where individual differences are important. The mastery teacher was able to reach some students with a particular strategy; now s/he must try alternative strategies to take into account the individual differences in learning style of those other students in the room. As much as possible s/he will direct energy toward those areas of the unit that are least understood.

The difference can be either in the means of presentation or in the means of involvement. Thus, the teacher might choose to re-present the content in a different fashion. If s/he used the lecture approach the first time, s/he might now use a film or filmstrip. If s/he used an abstract approach before, s/he might now use a more hands-on approach. Whatever the approach, there should be some change in the method or style of presentation.

Perhaps even more important than re-presentation is re-involvement. That means there will be a different way for students to be involved with each other and with the teacher. Peer tutoring has been found to be especially effective at this juncture in mastery learning. In some cases students are able to explain a concept or skill in ways that other students will be able to grasp more easily.

Class Management during Corrective Instruction

Since most students have not had the opportunity to do corrective type work and are not familiar with it, the teacher needs to carefully manage the administration of correctives, especially during the early units.

The approach used by the Shallow Intermediate School in Brooklyn provides a typical example of how corrective activities are managed. The teacher will likely want to tailor this strategy to his/her individual style and personality.

Immediately after the formative test the students mark each other's papers. Papers are returned and then the teacher ascertains by a show of hands which items they got right and which items produced the most problems. With 80% as the standard for mastery the class is then divided into two groups: those who achieved mastery and those who didn't. The students who mastered work on enrichment (See next section.) while the other students begin to work on their mistakes. This happens in three ways:

1) The teacher circulates among the nonmasters and helps individual students or small groups of students (activities to be done with the teacher).

2) Students use the test as a guide to what to study (activities to be done by oneself). It is specified explicitly on the test, "If you missed this question, then you need to refer to _____."

3) Students who achieved mastery volunteer to help those who did not (activities to be done with a friend). In some cases the teacher asks a particular "mastery" student to help a particular "nonmastery" student.

Corrective work not finished during class is generally assigned as homework. However, the teacher might wish to spend more class time on correctives during the early units. Taking the time to familiarize the students with the corrective process will make the process that much more efficient in the later units.

For teachers whose choice includes option (1) we have included in section 5b a guide to small group instruction in beginning reading. Although most traditional teachers are already familiar with many of the principles listed, we think it will be useful for them to look through the guide for tips on either how to run such groups if they have never done it, or how to improve their instruction if they have.

5b. Anderson, Evertson, and Brophy's (1982) Revised Principles for Small-Group Instruction in Beginning Reading

General Principles

1. Reading groups should be organized for efficient, sustained focus on the content.

2. All students should be not merely attentive but actively involved in the lesson.

3. The difficulty level of questions and tasks should be easy enough to allow the lesson to move along at a brisk pace and the students to experience consistent success.

4. Students should receive frequent opportunities to read and respond to questions, and should get clear feedback about the correctness of the performance.

5. Skills should be mastered to over-learning, with new ones gradually phased in while old ones are being mastered.

6. Although instruction takes place in the group setting, each individual should be monitored and provided with whatever instruction, feedback, or opportunities to practice that he or she requires.

Specific Principles

Programming for Continuous Progress

1. *Time.* Across the year reading groups should average 25-30 minutes each. The length will depend on student attention level, which varies with time of year, student cognitive entry behaviors, and the skills being taught.

2. *Academic focus. Successful reading instruction* includes not only organization and management of the reading group itself (discussed below), but effective management of the students who are working independently. Provide these students with appropriate assignments; rules and routines to follow when they need help or information (to minimize their needs to interrupt you as you work with your reading group); and activity options available when they finish their work (so they have something else to do).

3. *Pace*. Both progress through the curriculum and pacing within specific activities should be brisk, producing continuous progress achieved with relative ease (small steps, high success rate).

4. Error rate. Expect to get correct answers to about 80% of your questions in reading groups. More errors can be expected when students are working on new skills (perhaps 20-30%). Continue with practice and review until smooth, rapid, correct performance is achieved. Review responses should be almost completely (perhaps 95%) correct.

Organizing the Group

5. *Seating.* Arrange seating so that you can both work with the reading group and monitor the rest of the class at the same time.

6. *Transitions.* Teach the students to respond immediately to a signal to move into the reading group (bringing their books or other materials), and to make quick, orderly transitions between activities.

7. *Getting started.* Start lesson quickly once the students are in the group (have your materials prepared beforehand).

Introducing Lessons and Activities

8. *Overviews.* Begin with an overview to provide students with a mental set and help them anticipate what they will be learning.

9. *New words.* When presenting new words, do not merely say the word and move on. Usually, you should show the word and offer phonetic clues to help students learn to decode.

10. *Work assignments.* Be sure that students know what to do and how to do it. Before releasing them to work on activities independently, have them demonstrate how they will accomplish these activities.

Insuring Everyone's Participation

11. *Ask questions.* In addition to having the students read, ask them questions about the words and materials. This helps keep students attentive during classmates' reading turns, and allows you to call their attention to key concepts and meanings.

12. *Order turns.* Use a system, such as going in order around the group, to select students for reading and answering questions. This insures that all students have opportunities to participate, and it simplifies group management by eliminating handwaving and other student attempts to get you to call on them.

13. *Minimize call-outs.* In general, minimize call-outs and emphasize that students must wait their turns and respect the turns of others. Occasionally, you may want to allow call-outs to pick up the pace or encourage interest, especially with low achievers or students who do not normally volunteer. If so, give clear instructions or devise a signal to indicate that you intend to allow call-outs at these times.

14. *Monitor individuals*. Be sure that everyone is checked, receives feedback, and achieves mastery. Ordinarily, this will require questioning each individual student, and not relying on choral responses.

Teacher Questions and Student Answers

15. *Focus on academic content.* Concentrate your questions on the academic content; do not overdo questions about personal experiences. Most questions should be about word recognition or sentence or story comprehension.

16. *Use word-attack questions.* Include word-attack questions that require students to decode words or identify sounds within words.

17. *Wait for answers.* In general, wait for an answer if the student is still thinking about the question and may be able to respond. However, do not continue waiting if the student seems lost or is becoming embarrassed, or if you are losing the other students' attention.

18. *Give needed help.* If you think the student cannot respond without help, he or she may be able to reason out the correct answer if you provide help by simplifying the question, rephrasing the question, or giving clues.

19. *Give the answer when necessary.* When the student is unable to respond, give the answer or call on someone else. In general, focus the attention of the group on the answer, and not on the failure to respond.

20. *Explain the answer when necessary*. If the questions requires one to develop a response by applying a chain of reasoning or step-by-step problem solving, explain the steps one goes through to arrive at the answer in addition to giving the answer itself.

When the Student Responds Correctly

21. *Acknowledge correctness* (unless it is obvious). Briefly acknowledge the correctness of response (nod positively, repeat the answer, say "right," etc.) unless it is obvious to the students that their answers are correct (such as during fast-paced drills reviewing old material).

22. *Explain the answer when necessary.* Even after correct answers feedback emphasizing the method used to get answers will often be appropriate. Onlookers may need this information to understand why the answer is correct.

23. *Use follow-up questions.* Occasionally, you may want to address one or more follow-up questions to the same student. Such series of related questions help the student to integrate relevant information. Or you may want to extend a line of questioning to its logical conclusion.

Praise and Criticism

24. *Praise in moderation.* Praise only occasionally (no more than perhaps 10 correct responses). Frequent praise, especially if nonspecific, is probably less useful than more informative feedback.

25. *Specify what is praised.* When you do praise, specify what is being praised when this is not obvious to the student and the onlookers.

26. *Use correction, not criticism.* Routinely inform students whenever they respond incorrectly, but in ways that focus on the academic content, and include corrective feedback. When it is necessary to criticize (typically about 1% of the time that students fail to respond correctly), be specific about what is being criticized and about desired alternative behavior.

PROVIDING ENRICHMENT FOR MASTERS

It is necessary to have planned some form of interesting and worthwhile activity for those students who do achieve mastery after the formative test. Before listing these alternatives, it is equally important to describe what should not be done.

In the group based approach to mastery learning the class as a whole moves together through the units. Thus, students who achieve mastery are not to move on to the next unit. Nor should they learn additional material for the unit under study H the teacher feels that material is important enough for all to learn. (Such material should be in the original unit objective.) - Finally, enrichment time, though the activities should be rewarding and exciting, is not fun and games time, nor is it free time.

The following list describes briefly various kinds of activities that teachers have used:

a) Most teachers have found it helpful to have master students help those students who have not yet achieved mastery. In some cases this is on a voluntary basis without much encouragement by the teacher. Other teachers indicate to the class very explicitly that everyone has a responsibility in this class to help others and that one is expected to help. In other classes where students have been working in teams or groups, members of the same group help each other understand what was missed.

b) Enrichment sheets are used extensively by many teachers. These are worksheets that the teacher has prepared in advance. These activity sheets can present problems related to the unit but are generally more difficult and challenging in new ways for the student. In other instances the activity sheets can be related to the general subject of the course but are not directly related to the unit.

c) In some school districts the students work on the same concept or skill but at various high cognitive levels. Thus, if the class were working with a unit on causes of the Civil War at levels of retention, analysis, and application, the enrichment assignment might present a problem at the synthesis or evaluation

level. However, the mastery teacher must make sure that not only mastery teachers ever get to work on the higher order level skills. It is important to be sure that all students are exposed to work at the different cognitive levels.

d) Depending on the time allocated for enrichment some teachers set up special projects for students to complete. Sometimes these are short term and relate directly to the unit being studied. Other times these are long term projects which the student works on whenever s/he achieves mastery on the formative test. The latter allows the teacher not to have to prepare enrichment work for each unit, and it also encourages students to do well on the first formative test in subsequent units.

e) A few teachers have used the enrichment time as an opportunity for students to work on units on which they had failed to achieve mastery. Students keep folders of all their work from previous units. When they achieve mastery and have time available, they go back and study a previous unit so that they can take another test and, hopefully, achieve mastery this time. If the teacher uses this strategy, it is important to make certain that the students are made to feel that they are being rewarded, or that they are being given an opportunity. They should not feel that doing well on the formative test only means that they have to go back and do dull work from a previous unit.

MOVING ON TO THE NEXT UNIT

The Baltimore plan for mastery learning takes the position that at least 80% of the students must achieve at least 80%-85% of the objectives before moving on to the next unit. However, the final decision rests with the teacher. It might be the teacher's judgment, for example, that a particular unit is so basic that mastery of it is necessary for learning subsequent units. This may be especially true during the beginning of the year. In such cases the teacher might feel it necessary that closer to 100% of the students must achieve mastery before moving on. Requiring more students to master at the beginning of the year also gives the students a success experience that will show that mastery is possible for all.

On the other hand, the realities of the classroom are that teachers are under external time constraints. Some teachers might find themselves in the position that they can only allow "X" number of days for correctives before giving the retest and then moving on. However, one thing to keep in mind when deciding whether to devote extra time to a unit is the experience of many teachers that, in the end, the extra time is worthwhile. They were able to get many more students to really understand and grasp the subject. Moreover, research and teacher experience demonstrate that teachers who take extra time to ensure mastery early in the year end ,p covering as much material as teachers who keep moving on. Because students have succeeded and mastered the basics of the course, the class is able to move along that much more quickly during the later units, and the amount of extra time needed diminishes quickly.

DEALING WITH PERSISTENT NONMASTERS

There are three important themes to keep in mind and express explicitly for students who have not achieved mastery. The first is the attitude, "You have not achieved mastery yet" The nonmastery students should know that they still can achieve mastery and that the teacher expects them to do so. They can be given the option of achieving mastery on their own time, or special tutoring can be provided by a student tutor, the teacher, or a resource teacher or parent.

Another point is that the mastery teacher makes a big fuss over students who make substantial gains between the first and second formative tests, for example, from 30 to 60. Even though they have not achieved mastery yet, or even passed, the teacher wants them to recognize the gain that has been made. S/he wants them to keep trying because improvement is possible for them and mastery can be achieved.

Finally, teachers have found that an important message to all students in mastery learning is that the ultimate responsibility for achieving mastery rests with them. The teacher is providing all the means, but they must be there in class, they must do the work, ask for help, take a third or fourth test on their own time, or even complete a project that demonstrates mastery. Mastery is possible for all, and it is up to you, the students, to achieve it.

THE SUMMATIVE TEST

Summative tests are major exams designed to evaluate learning over a substantial portion of the year. Whereas formative tests are used primarily to pinpoint problems that students might be having for each unit, summative exams test for learning acquired over three, four, or even more units. Thus, summative tests are much broader in scope than formative tests.

Design of Summative Tests

Summative test items are usually very similar to formative test items. In fact, many teachers develop items for the summative test as they're developing the formative tests for each unit. Again, the table of specifications can be used to check for correlation between objective items and test items. Some teachers even re-use items from the formative tests on the summative tests.

A major difference in content between summative and formative tests is the level of generalization. Everything that is important to learn in that unit is included in a formative test. But since a summative test covers several units, to do the same in this case would be impractical time-wise. Thus, summative tests focus on those concepts that are central to learning in the course. They focus on broad abilities and larger course outcomes rather than specific details of each learning unit.

Some teachers might want to use the summative exams to assess knowledge across units of instruction. If the teacher wants to do this, then s/he must make sure that such skills are included in his/her stated learning objectives and are taught. The students will need training in integrating information or in relating current learning to that in previous units (an objective, if unit sequencing is done properly, that ought to be taught anyway).

Administering the Summative Test

Summative tests can be used as midterm or final exams, or whenever the teacher feels they are necessary. Since they cover several units' worth of material, they will be longer than formative tests and require more time to administer. Because of this they should be administered less frequently than formative tests.

Because the content of summative tests is somewhat different from that of formative tests, the students need to be told explicitly what these differences are. The students should realize well beforehand that the test they're about to take will be different from what they're used to. In addition, since summative tests require some different skills (e.g. long term memory, ability to pick out what's important), students should receive training in these skills before the first summative test.

Analyses of Summative Tests

Like formative tests, summative tests are criterion-referenced, meaning results from them are judged in terms of specific learning objectives, not in relation to how the student did compared to the rest of the class. Thus, if the teacher were assigning grades, and 90% was A level work, then even if a huge majority of the students got 90% or above, all of them should get A's. It is up to the teacher to design a test that ensures that a student who gets 90% has reamed at least 90% of the objectives.

In addition to evaluating students' overall learning, results from summative test can also aid a teacher in his/her instruction. For example, if a large proportion of students missed a particular item, and if the teacher determined that the item was valid both in phrasing and in objective being tested, then the teacher will question why the objective or concept was taught unsuccessfully, and might want to revise the procedure.

CHAPTER FOUR
CASE EXAMPLES

CHAPTER FIVE
CHECKING IMPLEMENTATION

Planning a mastery learning program does not end after implementation. Schools and school districts have given up on mastery learning programs not because of inherent flaws in the program, but because of problems or misconceptions in implementation. Hopefully, this training and this manual have made the administrator/teacher well aware of what mastery learning is and how to implement it into his/her classroom or school. It is still a good idea, however, to check one's implementation periodically in case there has been some error or oversight. We include here several checklists that the teacher or administrator might want to use to help ensure the success of his/her program.

Why Some Programs Fail

Projects that have not been successful have tended to be flawed either in design or implementation in the following ways:

1) Failure to establish priorities among instructional objectives.

2) Failure to organize objectives into instructional units and to order/sequence the units based on rational considerations (priority to objectives).

3) Failure to properly orient the students to mastery learning programs.

4) Failure to make rational, justifiable decisions about performance standards.

5) Tendency to over-test.

6) Too much reliance on individual teachers to develop corrective alternatives and testing procedures.

7) Error analysis of formative tests not linked to specific correctives.

8) Lack of variety in corrective procedures.

9) Consistent advancement to next unit without at least 80% of group reaching 80%85% mastery.

10) No flexibility in the time frame allocated to correctives, particularly in early units.

11) Insufficient staff development, leading to teachers not understanding major assumptions or teaching strategies of the mastery learning approach.

12) No implementation checks.

13) No program developed for those students who master after the first formative test, i.e. extended learning or opportunities for tutoring

14) No plan to deal with consistent non-masters.

15) No strategies for handling initial cognitive entry differences.

16) Lack of continuity of teaching staff and administration.

17) Insufficient record keeping.

CHAPTER SIX
FREQUENTLY ASKED QUESTIONS

The following questions are those which have most frequently been asked by teachers at mastery learning training sessions. The answers are base on the knowledge which has been gained by teachers who have used a mastery learning approach, on information gathered from reading about mastery learning, and on the program's own point of view. Generally, questions fall into three categories: those that deal with practice in the classroom and school; those that revolve around theory; and those that speak to personal philosophies. The questions have been stated in terms of particular grade levels and subject areas, but the answers can be adapted to almost any class.

1. I AM A SEVENTH GRADE SCIENCE TEACHER. HOW DO I GO ABOUT TRYING TO DEVELOP AND TEACH ONE MASTERY UNIT THAT WILL BE USEFUL FOR MY 30 STUDENTS WHO HAVE TREMENDOUS DIFFERENCES IN THEIR PREPARATION FOR MY CLASS?

It should be clear that this question could be asked by almost any teacher. Students come to us with varying degrees of preparedness, no matter how "homogeneously" they are grouped.

This is probably the most difficult practical problem any classroom teacher will face as s/he embarks on a mastery learning approach. It is a question to which the literature has little to say, especially for teachers in large urban areas. There is no one answer to this question which will fit everyone's situation and personal beliefs. Our answer includes several different strategies which teachers have used, and also reflects our own point of view.

What we have advised is that teachers choose content which is important for everyone in their class to master -- content that cuts across all the various levels. Then we suggest that they set their objective at the level that is appropriate for the top 1/4 of the class. Their job is then to teach in a such a way that even the students at the lower levels can reach that goal. That means taking the whole class through all the steps required to get from low levels in that skill to the actual content objective, and/or spending extra time with those at the lower levels to help them catch up. After the formative test those who have mastered can be provided with enrichment questions.

The literature suggests that teachers take advantage of several natural vantage points: where classes are starting on an entirely new subject, or where a new beginning almost amounts to a fresh start, or where much review is likely to occur. Such vantage points are the beginning of a new school year and the beginning of a new school level (such as 5th or 7th grade in a middle or junior high school, and 9th or 10th grade in a high school). These are times when a whole-class mastery approach is especially appropriate and effective.

Another strategy used by several Philadelphia teachers is to divide the week into two parts. One part is the mastery unit time during which everyone is working on the same material. The other part of the week is given to small group or individual time for work on different levels.

Another strategy is to build the mastery units around concepts or skills which require less specific student preparedness. This allows students to start off at an equal point.

One of the really hopeful findings of many teachers has been that students with less preparedness have been able to master units which the teacher thought they never would be able to do. Some of this success comes from the fact that frequently, skills or concepts which we thought required specific kinds of previous learning actually do not. Apparently there is less sequential or prerequisite learning than was imagined. Another possible explanation of this success phenomenon is that too often we simply underestimate what students are capable of achieving when goals are clear, and when they have a second chance to demonstrate mastery.

There is another strategy that other teachers have adopted which does not fit the model of total group-based instruction, but which was necessary for their situation and their personal approach to mastery learning. These teachers begin by dividing the class into subgroups and then teach a specific different mastery unit for each group. Ultimately they hope to bring the groups together.

Another teacher decided that, before she could teach her class as one group, there was a set of prerequisite facts and skills that each child had to have. She listed this on a chart, did diagnostic tests to determine what each child needed to work on, and then spent several months doing a combination of whole class, small group, and individual work aimed at catching each child up on what s/he most needed. When everyone had most of the prerequisite skills, the teacher was able to proceed with whole class units.

2. 1 AM A 5TH GRADE TEACHER. I'D LIKE TO DO A MASTERY UNIT WITH MY SOCIAL STUDIES MATERIAL HOW CAN I DO THIS IF SOME OF MY STUDENTS CAN'T READ THE TEXT AND OTHERS CAN'T WRITE VERY WELL? (THIS SAME QUESTION IS, OF COURSE, ASKED BY MANY SECONDARY TEACHERS.)

In many ways this question is similar to the first. It speaks to the realities of our classrooms and is not addressed by the literature. Our response to this question calls for the teacher to make several decisions as to which course s/he wishes to follow.

We start from the assumption that the students in question can learn the social studies (or science, etc.) concepts and skills. The students might not be able to learn them from textbooks if their reading skills are poor, but they can learn them from other means such as tapes, films, lectures, etc. They can also demonstrate mastery of that content by means other than written tests.

Given the above assumption, the teacher must make a decision. On the one hand the teacher can say: "My job is to teach these social studies skills and concepts. That is what I want the students to learn, and I don't care how they learn it and demonstrate mastery of it. These skills and concepts are important for these young people whether or not they have mastered reading and writing. It will mean some alternative teaching and testing strategies, but it can be done."

In this case the teacher makes sure that mastery does not depend upon reading or writing skills. Mastery will be solely dependent on students' mastery of the skills and concepts in the content area.

Another teacher can take a very different position. This teacher can say: "It is important for the students not only to learn these social studies skills and concepts, but also to be able to read the textbook and express themselves adequately in writing in the form of a written test. Since I am holding them responsible for this in order to achieve mastery, I must assume responsibility for helping them read social studies textbooks and write essay answers."

In this instance the teacher informs the students very specifically and explicitly that in order to achieve mastery, they must be able to handle the text and write essay answers. This, then, means that the teacher is committing him or herself to helping the students master those reading and writing skills, both as part of the initial presentations and as learning alternatives. The same would apply for any discipline where the teacher says that spelling and punctuation, etc. counts. Similarly, a mathematics teacher would say that computational mistakes do indeed count: "In order to achieve mastery you must show not only that you understand the steps in this problem, but that you can do the computation without mistakes." By saying this, the teacher would be making a commitment to helping students improve their computational skills as well as the new mathematics concepts.

In this second strategy the teacher has two options. The teacher can determine that mastery grade will be divided into two sections: one grade will indicate mastery of the concept while the other grade will indicate mastery of the writing or computational skill. If the student does not achieve mastery in one, then at least s/he will know which area needs more work. The other option is to use just one grade for mastery for the test, but to find ways of giving specific feedback about areas of strength and weakness.

There is a third position the teacher can take which is the one most often taken by non-mastery teachers. This teacher says: "My job is to teach social studies skills and concepts. You are expected to be able to read the textbook and write essay answers; in fact, you have to be able to do these in order to pass. However, if you are deficient in these skills, then it is your job to see to the correction. I am a social studies teacher, not a language arts teacher." While this is a valid position to take, it is not one that fits into the mastery learning format. A basic principle of mastery is that you commit yourself to teaching any skill for which you are holding the student responsible.

There is one slight qualification to this general principle, and that is that you can insist that learning be cumulative. For example, if you are a social studies teacher, you may decide to make essay writing an explicit part of your mastery goals. Perhaps in

September you did a unit on exploration of the colonies, during which you included a requirement that students follow basic rules of capitalization and punctuation in writing their units. To achieve that goal you reviewed these rules and provided learning alternatives for those who needed them, and everyone eventually mastered. Now in October, you're moving to the pre-Revolutionary period, and you want students to continue correct punctuation and capitalization while also writing good paragraphs. You can simply say that correct punctuation and capitalization are expected, and that points will be taken off for mistakes. You don't have to re-teach this for each unit.

3. DOES MASTERY LEARNING MEAN THAT I HAVE TO CHANGE MY GRADING POLICY? DO I JUST GIVE A'S AND BPS AND F'S? WHAT IF MY SCHOOL HAS A POLICY THAT STUDENTS IN CERTAIN SECTIONS CANNOT GET HIGHER THAN A D?

In general, we suggest that you use whatever grading policy you and the school observe. If 75 is a C in your school, then the student with a 75 average gets a C. Likewise, even though both 85 and 95 would be master scores, 85 would be a B and 95 would be an A.

Bear in mind, though, that while you will give these grades on the report cards, in class you want to keep the focus on achieving *mastery.* Many teachers report that students who used to settle for a C or D begin consistently scoring above 80 when mastery is emphasized.

Some schools have a policy (explicit or implicit) against more than a certain portion of students in the class being given A's and B's. In a mastery classroom, if 70% of the students have earned B's and A's, then you ought to give them those grades. It might require some explanation to the administration or department head, but that should not be an obstacle to doing it. As long as you can show that your material is as difficult as that in other classes, you will be on firm ground.

However, you run into more serious problems if the school has a policy (implicit or explicit) about not giving higher than a D for certain classes that are below grade level. We do not recommend violating your school's policy. We do, however, recommend that you make clear to the students at the beginning of the year what the situation is. You could indicate that they might achieve mastery on many units but that these are at such and such a grade level and that is why they can't get higher than a D. But if you make enough progress to get the class on grade level, or if individual students demonstrate that they are capable of doing grade level work, then it is incumbent on you to give them a proper grade or to change their section.

The other side of this is that, if you have a very poorly prepared class which begins to regularly master the units you've written, you may find yourself giving A's and B's for work that, while representing much progress for your students, is still well below grade level. In such cases, we think it is important to make it clear to the students that, while they are doing excellent work for that class, they have a way to go before reaching grade level. One of the underlying working assumptions of mastery learning is that students and

parents have an accurate picture of what level has been achieved in reading and mathematics.

The grading issue will be less of a problem in elementary school, where levels are given instead of grades in many subjects.

4. HOW CAN I USE A MASTERY LEARNING APPROACH, WHICH REQUIRES TIME FOR RETEACHING AND RETESTING, WHEN I HAVE A FULL YEAR'S COURSE OF STUDY TO TEACH?

There are several different answers to this question. One overall response from the literature and from some teachers who have used mastery learning over a full year is that in the long run you do cover as much material. There is no doubt that during the first half of the year you will be behind other classes that do not reteach a unit. However, because students will have an excellent grounding in the subject due to having achieved mastery, the units will go much more quickly later in the year. Students will have learned how to learn from their errors, and the time necessary for reteaching will be greatly reduced. The literature indicates that experience in mastery learning causes the differences in students' rates of learning to decrease substantially.

Teachers in Brooklyn indicated that their mastery classes ended up covering almost all the material they had covered with traditional approaches. The big difference was that the mastery students did much better than non-mastery students on: (1) the city-wide midyears arid finals: and (2) individual course grades.

Another line of reasoning accepts the possibility that a mastery class might not cover as much material as a traditional one, but maintains that the advantage gained in having students really understand and master what they do cover is far more important than coverage. Most of us are aware of the disadvantages and problems that appear when coverage is the main criterion. We find many, many students who fail or who are passed along without understanding their subjects - and thus fall further behind every year.

One of the things to keep in mind is that the individual teacher has under his/her control just how much extra time will be given to reteaching any unit. In Brooklyn teachers often limit the reteaching and retesting time to 1.5 periods. In Philadelphia teachers have usually given a longer period of time for this phase, but they have found it worthwhile in the long run. This is under your control unless you are part of some mastery learning project that says x% must achieve mastery before moving on.

5. THIS IS NOT SO MUCH A QUESTION AS A STATEMENT THAT I WOULD LIKE YOUR REACTION TO. IN MY SCHOOL WE ARE CONCERNED THAT OUR MORE ABLE STUDENTS MAKE AS MUCH PROGRESS AS POSSIBLE. WE DON'T WANT THEM HELD BACK BECAUSE OF SLOWER STUDENTS.

If you think back to the section on mastery philosophy, you will recognize that underlying this question is an assumption that simply does not fit with mastery learning. The question refers to "more able" students. The mastery philosophy says that it is not useful to think of some students as more able than others. Rather, we talk in terms of different learning histories, or different learning levels of preparation, or different cognitive and affective entry skills. This difference in language is very important, because "ability" is outside of the teacher's control, whereas the factors on which the mastery philosophy focuses is not.

We have emphasized the point above because it is one of the most important issues related to mastery learning and education in general. Too often we allow ourselves the luxury of falling into comfortable traps or habits. In this case the habit of thinking about and referring to students as being slow or not able is a very dangerous one. It too easily allows us to write students off. When we call students "slow," we think of them as being "slow"; in class we treat them as though they were "slow"; and we get "slow" results. "Slow" or "less able" becomes a trait or characteristic that is inherent and unalterable. By forcing ourselves to begin talking about students as being "poorly prepared,'. we begin to think and speak and act as though we as teachers can do something about the problem.

Let us rephrase the question then, and respond to the concern about holding back *students who come to us better prepared.*

Both formal research on mastery learning and experience with classroom teachers indicate that the better prepared students are seldom held back by the mastery approach. Formal studies have prepared cumulative achievement test scores of the top students in mastery and nonmastery classes; those in mastery classes do as well as or better then the others. In Philadelphia a survey of 80 teachers who have implemented mastery indicated that very few felt that their top students had been held back. Most made strong statements that the combination of work on higher order thinking skills, enrichment activities, and the opportunity to gain cognitive and social reinforcement by being tutors had meant that mastery was highly beneficial to top students as well as to those less prepared.

If your class has one or two students who are far ahead of the others, you may wish to regard them as part of the 2%-3% that Bloom identifies as truly gifted, and make special provisions for them. (With such students, you would be doing this even in a nonmastery class.) However, think twice before isolating them completely; they can be a rich resource to the other students during the mastery units. Furthermore, since you will be setting high standards and emphasizing higher-order skills, they will benefit on both a cognitive and social level from some participation in the mastery unit.

If 1/4 - 1/3 of your class is significantly better prepared than the rest, you have two options. One is to set your objectives at the level appropriate for that top group, and

teach so as to bring all the students up to that level. Things will go slowly at first, as you catch up the students who are behind, and you'll need to be sure that the enrichment activities are worthwhile.

If the spread in preparation is extremely wide, there is a second option. That is to teach the better prepared students as a separate mastery group for some or all of the units. If you choose this option, you must monitor yourself throughout the year to be sure your expectations and standards regarding the rest of the class do not become too low.

As you deal with this issue, there are two guidelines to keep in mind. The first is, don't lower your standards. Mastery is meaningless if standards are watered down. Second, bear in mind that mastery seeks to reduce the differences in student achievement. At the end of the year, you want every student to have made substantial progress, but you also want to see your less well-prepared students catching up. A mastery teacher who starts the year with a class like this:

Level	# of students
1	7
2	7
3	7
4	7

would rather end up like this:

Level	# of students
1	0
2	0
3	0
4	14
5	8
6	6

than like this:

Level	# of students
1	2
2	4
3	5
4	6
5	5
6	4
7	2

This is a question that ultimately comes down to the school's or one's own philosophy about education. Mastery learning clearly rests on the assumption that the school's job is to prepare all students for a full and rich life. That means all students must master those skills and concepts deemed necessary and essential by the total school community.

6. THIS A SHORT QUESTION. IS THE PRETEST THE SAME AS THE FORMATIVE TEST?

No. formative (or practice) tests are an essential part of the mastery approach. Pretests are optional in mastery teaching.

The practice test is given after a teacher has taught the unit content. A pretest is a test sometimes given before teaching a unit to see skills and concepts the students already possess. While some mastery learning projects favor the use of pretests, we do not push it and only a very few teachers do it. It should be said that there is nothing wrong with using a pretest and it can be very helpful if a teacher thinks it worthwhile.

7. I HAVE A CLASS WHERE ABSENTEEISM IS A MAJOR PROBLEM. WILL THIS PREVENT ME FROM USING MASTERY LEARNING UNITS? WILL MASTERY LEARNING HELP WITH ABSENTEEISM?

Students who are absent a great deal are a major problem whether or not you have a mastery learning class. If they are not in school on a regular basis, it is very hard, if not impossible, to help them master anything. Mastery learning is not a panacea for the absenteeism problem.

However, many teachers have tried to use mastery learning as a way to reduce the problem. When the student finally presents him or herself in class, the teacher takes that opportunity to explain mastery learning, and points out that the student can expect to do much better if s/he comes to class. Some teachers write a letter home to the parents explaining the program and how the child's presence is a basic necessity for it. Others have used the parent-teacher conference time as an opportunity to explain this new approach.

For students who are absent less frequently, mastery learning techniques can definitely be helpful. Of particular help is the way students are expected to assist each other. Many teachers have used the reteaching time as an opportunity for those who were absent to get caught up by having a mastery student help them. The very fact that mastery learning units specify very clearly what is to be learned makes it easier for the returning student to know what needs to be made up.

Teachers often ask whether to include their absentees when deciding whether enough students have mastered so that the class can move on to a new unit. Our response is that very early in the year, if it is feasible, it may be worth your while to make every effort to get those students to return to class, and to spend time catching them up. If these students are helped early, the experience of success may improve their attendance and make them into full class participants. However, as the year moves on, most teachers have to focus on those who attend more regularly. This means that if you choose to stay on each unit until 3/4 of the students master, you will wait for 3/4 of those *with reasonable attendance.*

8. DO STUDENTS RETAIN WHAT THEY LEARN IN MASTERY UNITS? IT WOULD SEEM THAT BY FRAGMENTING LEARNING SO MUCH, THEY WOULDN'T BE ABLE TO REMEMBER VERY MUCH.

The best answer to your question is the actual experience of the classroom teacher. So far, the teachers have indicated that mastery students retain more than those taught by nonmastery approaches. When given tests that include work from many units, mastery students do better than students in other classes. In Brooklyn, for example, the students in the mastery classes did significantly better on the mid-year and final New York City test. In addition, the teachers- have found that students from mastery classes are better students in the next year's classes.

The research literature tends to corroborate these teachers' conclusions. By putting the skills and concepts into manageable, shorter units, mastery teachers seem better able to help students learn in a more thorough way.

One of the things several teachers have done is to incorporate skills and concepts from a previous unit into a current unit. This helps students refresh and relearn those concepts previously learned.

9. ISN'T MASTERY LEARNING MOST USEFUL FOR SUBJECTS LIKE MATH OR SPELLING WHERE IT IS EASY TO BE SPECIFIC ABOUT WHAT HAS TO BE LEARNED AND TO TEST FOR IT?

Mastery learning theorists and practitioners clearly (and forcefully) assert that a mastery approach is useful for any subject and for higher order thinking skills. Any project that uses mastery learning only in the service of a few subjects or in simple recall areas is doing it a disservice. What Benjamin Bloom has said is that many teachers and programs in this country tend to focus only on the first and second levels of cognitive thinking. The fact that the great majority of questions asked in most classrooms are rote questions attests to this. Thus, in some instances, mastery learning could be open to this same criticism.

However, most mastery learning programs explicitly encourage teachers to include all levels of cognitive thinking in their units -- both in the objectives and in the tests. Teachers have developed units in all subject areas and specifically in more difficult areas like composition, literature, critical thinking skills, etc. What has been exciting about this work for many teachers is that for the first time they are being forced to become much clearer about what it is they want in such areas and how they are going to evaluate it.

For work in areas that are hard to measure, we suggest the following guidelines:

- Get clear on what you want students to be able to do at the end if the year. Then work back from that in planning your units.

- Make your goals very specific, and attach a certain number of points for each.

- Don't hesitate to give points for subjective qualities if they are part of your objectives: e.g., 10 points for clarity, 10 points for interest, etc.

10. IS MASTERY LEARNING A LOT MORE WORK FOR THE TEACHER?

The response of teachers is varied on this. Some say that using a mastery learning format does not mean more work overall. It does mean spending more time initially on the preparation of each unit, but then the work flows with much less attention each day. After working with the format a while, teachers have found they can prepare a complete unit in approximately two hours.

Other teachers have said that mastery learning does mean more work for the teacher. More preparation time is needed, as well as more time for correcting papers. Sometimes, one finds that one teacher cannot adequately introduce mastery procedures without the aid of other teachers within the content of specialty. The demands of developing objectives, diagnostic tests, and corrective procedures are best handled by a team of teachers committed to the concept of mastery.

Almost all teachers say the effort, whether extra or not, is worth the trouble. They feel much better organized and prepared, and most importantly, they get better results. In addition, teachers recognize that mastery units prepared this year can be used again and that they can use units prepared by other teachers.

11. IT SEEMS TO ME THAT MANY OF THE GOOD RESULTS YOU REPORTED COULD HAVE BEEN DUE TO TEACHERS SETTING LOWER STANDARDS FOR MASTERY CLASSES.

Of course it is possible that one way to get mastery is simply to lower the standards for your tests. However, our experience has been that teachers do not do this. If anything, mastery learning had gotten them to set and stick with rigorous standards. In no case have we encountered teachers who gave easy questions or work in order to have their students achieve mastery.

Teachers have been encouraged to include strategies that help students succeed, but this is not the same lowering standards. For example, teachers have developed shorter units so that new concepts and skills come in more manageable pieces.

A recent article in *Educational Leadership* has researched this question and found that grade inflation is not a practice of mastery learning projects.

12. DO YOU RECOMMEND THAT WE TEACH EVERYTHING BY THE MASTERY LEARNING FORMAT?

This is definitely not the way to start. We have encouraged secondary teachers to start with one or two classes. Elementary teachers have been encouraged to pick one subject, such as reading or mathematics or spelling or social studies, but not to take on the whole array of subjects. (A few elementary teachers decided to use mastery for those skills which they considered most important for their grade level irrespective of what subject they came from.) As you become comfortable with the approach, you can then extend it to more classes or subjects.

One of the surprises in this project has been that many teachers have moved quickly to using mastery with many classes and subjects because it worked. Students in nonmastery classes, seeing the bulletin boards and hearing about mastery, have often asked to come under the mastery approach.

In the long haul, we imagine two developments. One, the mastery learning format will be used for every subject and topic. Bloom argues that American schools must do a better job of teaching all students to achieve mastery in the creative arts as well as in the intellectual disciplines. Two, we believe that there will be a proportion of every class and subject that you will want not to include in a mastery format. This will be material that you want students exposed to, but where measuring mastery does not seem appropriate.

13. WHAT SHOULD I BE WARNED OF IF I ADOPT A MASTERY LEARNING APPROACH?

There is a chance that if mastery learning works well for you and your students, other teachers might become resentful of your success. There will also be suspicion and mistrust if mastery works for classes whose students have been called slow or labeled as troublemakers.

If you are in a situation where grade averages are very important, such as with seniors, then you might be questioned by the administration and other teachers if most of your students get A's and B's.

APPENDICES

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I. Introduction

Current prevention research is characterized by increasing specification of risk factors in the individual, in the environment, and in the interaction between the environment and the individual's behavioral, psychological, and physiological responses, Clearly specified risk factors, in turn, will provide well-defined targets for preventive trials aimed at determining whether a change in the early risk condition can improve the risk of problem outcomes later in life. The Hopkins Prevention Research Center has developed two intervention strategies aimed at reducing risk behaviors within the classroom context. The Good Behavior Game intervention is aimed at reducing aggression and shy behavior with the long term goal of reducing antisocial behavior. The Mastery Learning intervention is aimed at increasing learning within the classroom with the long term goal of reduced psychiatric symptoms. The study populations and their environments are epidemiologically defined and deliberately varied, so that we can examine whether the impact of the trial differs under varying conditions. We use two different interventions because they are directed at specific antecedents that have been shown to increase vulnerability to later specific problem outcomes.

The Mastery Learning intervention is the focus of this paper. The general model under consideration is whether this intervention, which is aimed at improved achievement, can eventually alter the course of development which leads to later problem behavior, particularly depressive symptoms and possibly depressive disorder. Learning problems have been found to predict to psychiatric distress, particularly depressed mood and possibly depressive disorder (Kohlberg, Ricks, Snarey, 1984; Kellam, et al., 1983; Shaffer,

Stokman, O'Connor, et al., 1979). The specific causal paths by which early achievement plays a role in the development of depressive symptoms is not clear. What is clear from educational research on achievement histories and the formation of ability conceptions is that achievement patterns stabilize early within the elementary school (Bloom, 1964; Rosenholtz and Simpson, 1984). Therefore interventions focusing on achievement must start in the early elementary years. The results of the current trial will yield information in regard to the level, kind and duration of response by particular subgroups of children to the intervention. Identification of the conditions in the child and the environment which influence impact will permit developing targets for further trials.

Recent research on the impact of pre -school early intervention suggests somewhat greater optimism regarding the potential benefit of improving reading scores and behavior early on. Lazar, et al. (1982) have reported on the long- range outcomes of pre-school programs that revealed impact into adulthood. While not predicting such long-term outcomes in this study, we will at the very least be gaining information regarding when and at what targets additional interventions may be important.

In summary, measuring the impact of this Mastery Learning field trial has two major purposes. The first is to assess the utility of each intervention in improving the child's vulnerability to the problem outcomes. The second is to add to the understanding as to the function of each antecedent in the course leading to its outcome. The first purpose is eventually to guide policy decisions as to whether the intervention should be made a part of school-based mental health prevention programs. The second purpose will guide

scientific decisions as to the next stage of prevention research on psychiatric symptoms and disorders.

II. A Rationale for Mastery Learning as a Preventive Intervention

Mastery Learning is a teaching strategy which has demonstrated its effectiveness in improving achievement, adopted by many school systems since the early 1970's. The theory and research upon which Mastery Learning is based specifies that under appropriate instructional conditions virtually all students will learn most of what they are taught (Block and Burns, 1976; Dolan, 1986; Guskey, 1985). Mastery Learning individualizes learning by clearly defining what students should learn and the expected level of competence by giving them additional time to learn and by helping them when and where they have learning difficulties.

The benefits of Mastery Learning strategies towards improving school achievement have been well documented. If school personnel are sensitive to a variety of implementation issues (Guskey, 1985), the likelihood of success is increased even more so. Mastery Learning has been especially successful, for example, when introduced in the sequential, skill-based curricula of the early elementary years.

Less well documented, however, have been the affective consequences of Mastery Learning. Those studies that do include affective outcomes tend to focus on school-specific indicators such as subject matter interest and academic self concept. The

general tendency of this research is to focus on students in the fifth grade or above and on Mastery Learning interventions of relatively short duration.

Whether improving achievement histories through Mastery Learning will have an impact on later psychopathology has yet to be determined. The importance of school achievement has been questioned by leading developmental researchers (Kohlberg, Ricks and Snarey, 1984). These researchers point out that the correlation of achievement and adjustment seems in no way the result of actual achievement in and of itself. Rather, achievement is a good "proxy" variable for other more critical factors such as social class, intelligence, authority acceptance, attention, internal control and family structure. They suggest that to focus on school achievement as the key risk factor for later pathology and to design interventions focusing on achievement per se would be a mistake. A more appropriate course would be to create more positive school attitudes in the early school years, which would reduce disinterest and anxiety concerning school.

Research on the causal relationship between achievement and affective characteristics has a long history. Most agree that the relationship is cyclical yet debate the casual predominance of affect or achievement over each other (Calsyn and Kenny, 1977; Nicholls, 1979). Building from research such as Kohlberg's, many school-based programs have focused on curricula strategies that are based on self-enhancement models (Schierer and Kraut, 1979). The goal of these programs is to improve student affect (self esteem, motivation, perception of control) which in turn forms the foundation for achievement.

More recently, the conclusions of a large number of research reports have supported skill enhancement models, where the focus is on increasing achievement by systematic basic skills instruction. It has been demonstrated that these programs increase achievement and student affect, the rationale being that perception of actual competency is the key ingredient in the reduction of psychopathology. It should be noted that the affective characteristics examined tend to be school-specific variables. The research which would support a skill enhancement position with regard to broader indicators of individual adequacy related to mental health has not been fully developed. This would be research which examines not only the school-specific affective consequences of schooling but which also expands our understanding of the conditions under which achievement can lead to decreased levels of psychopathology.

What are the basic research issues concerning the mental health consequences of Mastery Learning? Is there anything about the Mastery Learning strategy for improving achievement per se that might enhance positive student affect compared to other instructional strategies?

One of the first concerns in addressing this area is to determine the developmental period on which research should be focused. There is little doubt that one critical period for investigation is during the early elementary years. During this stage of the life course, the social field of school takes primacy for most individuals. Early school achievement tends to be predictive of later maladaptation (Kohlberg et al., 1984). Furthermore, many

researchers believe the most likely period of growth in affective characteristics is in the early years of the student's interaction with school (Goldhaber, 1979). Instructional interventions designed to have a positive impact on affective development are often short-lived, and the fade-out effects so common with cognitive criteria apply equally to the affective outcomes. Long-term investigations of Mastery learning over multiple years are critical, rather than designs that may be rigorously controlled, yet focus on brief periods of development. Affective traits which are products of successful achievement-oriented intervention need time to grow and stabilize.

Early elementary school represents one of the key educational transition time in the individual's life course, that of the transition between the educational environment of the home to the educational environment of the classroom. If the transition is not successfully negotiated, the possibility of academic and emotional difficulties is increased. Other key transitions, such as between elementary and high schools and when the older adult returns to school, are critical periods but are not typically of the magnitude of early elementary school.

The final concern is particularly salient with regard to understanding achievement via Mastery Learning vs. other instructional strategies as a predictor of mental health status. Few would argue that achievement, regardless of the teaching-learning strategy utilized to produce it, is the key ingredient of positive affect. It is hypothesized that Mastery Learning produces positive achievement due to the development of some critical instructional processing skills. Furthermore, these mediating student skills are critical not

only for addressing academic problems, but also for dealing with problems and stress outside the school environment.

The initial impetus for this line of inquiry emerged from the research of Covington and Omelich (1979) and Nicholls (1979), who noted that the achievement-affect relationship was strongly influenced by the degree to which the student attributed the cause for positive achievement to ability and effort. Students needed to possess and be aware of certain processing skills that lead to increased achievement. A number of these instructional processing skills which are beneficial to competency inside and outside the classroom are the products of successful implementation of Mastery Learning. Over time, many of the external characteristics of Mastery Learning are believed to be internalized by the student, the result being an individual with a high level of self regulation and management, what used to be often characterized as "learning to learn" skills. Recent discussions by Corno and Mandinach (1983), Thomas (1979) and Block (1984) point to some of the most salient student process characteristics that result from Mastery Learning strategies. This transfer of instructional responsibilities (e.g., when to go for help, when to move to next task, when to assess, when to record, when to reinforce) from the teacher to the student is often indexed by the proxy variable of time-on-task or academic involvement.

The critical point with regard to understanding the development of positive mental health is that many of these classroom instructional skills are closely related to the competence involved in successfully coping with significant social tasks outside the school

environment. For example, the work of Pearlin and Schooler (1978) suggest the individuals best able to deal with interpersonal stressors and avoid symptomatology are individuals who have available a range of cognitive mechanisms. The work of Mischel (1973) on self regulation is also supportive of this position.

Perhaps one way to summarize this position is to suggest that one important consequence of successful Mastery learning is students' obtaining a greater sense of self efficacy concerning their in-school, as well as their out-of- school behavior. Self efficacy, as defined by Bandura (1977), points to the student's self perception that he has the basic skills to succeed in life. The greater his sense of self efficacy, the less vulnerable and distressed the individual feels in light of his perceived ability to cope with stress.

Currently, most of the above theories are at the level of speculation and need to be examined from a variety of research perspectives. This research would be consistent with the call by Doyle (1977) to focus on student mediating processes, those student behaviors between the specific teacher behavior and student achievement. The recent research on time-on-task and attentional strategies is one small step in this direction. However, the level of analysis of student instructional processing behavior must go far beyond this perspective. The dimensions of student competence which enable students to adjust to classroom context and recognize and adjust to cues have not been well articulated. Research in this area, perhaps the most critical to understanding the relationship between classroom competence and the development of positive mental health, is in its infancy.

The following criteria were applied in the development of the current Mastery Learning trial:

- Given the early stability of achievement histories, it is critical to intervene early in the elementary school years. The goal is to alter the early trajectory of achievement.
- The intervention trials should be nested within varied, well-defined community areas.
- The intervention trials should target risk behaviors, not at-risk students. Therefore classroom-based interventions directed at all students within a class should be developed.
- The intervention should be developed collaboratively with the host agency (Public Schools) and be generalizable beyond the core research program.
- The intervention should be nested within a epidemiologic framework for assessing risk behaviors within the target population. Key variables for the short-term impact of Mastery Learning would include achievement, concentration, and depressive symptoms.
- The evaluation design should be longitudinal in order to follow the long term course of risk behaviors leading to later psychopathology.
- The first short-term impact model for the Mastery Learning trial should be to document impact on achievement, concentration, and depressive symptoms. Impact on depression symptoms should follow a causal path through improved achievement. However, the lag the impact on depression needs thorough analysis.

111. Method

Design and Sample

The Mastery Learning preventive intervention is being carried out in the eastern half of Baltimore City, where The Johns Hopkins University Prevention research Center has established a collaboration with the Baltimore City Public Schools.

The urban areas involved and their Baltimore residents are similar to a wide variety of urban areas in cities like Baltimore. Some of these urban areas have many characteristics of community decay and poverty that have a relationship to the residents' high risk of problem behavior. Some are more middle class urban areas and have many characteristics of community organization and access to resources that would appear to be associated with lower levels of risk.

From within the overall area of eastern Baltimore City, five urban areas have been selected. Each of the five urban areas is served by at least three public elementary schools, each having two or more first-grade classroom sections. Before starting the PRC studies, the schools and the areas they serve were examined in relation to a profile of characteristics. The three or four most closely matched schools within each area were identified, for a total of 19 schools. The matching characteristics included achievement levels, socioeconomic status of the students, and their ethnicity. The three most similar schools were identified so that within each of the five urban areas one school might be

assigned to the Good Behavior intervention, one school to the Mastery Learning intervention, and one school might serve as a "Standard- Setting" school with no special intervention activities. In four of the five urban areas, it was possible to add an additional school to the design in light of parent, administration, and staff interest in the program and to provide for potential future loss of a school's participation. Within the triad of most similar schools, the assignments of individual schools to the Good Behavior intervention, the Mastery Learning intervention, and the Standard- Setting (no special intervention) condition are made at random.

The Mastery Learning intervention is a classroom-level intervention. That is, it involves working with classrooms or groups of children. In the primary preventive trials, the classrooms within the intervention schools were assigned to the interventions at random. In addition, prior to beginning the intervention work, the school principals were asked to assign the entering first-grade children to classroom membership in a balanced fashion. For the preventive trials balanced distributions were sought for the following variables: gender, pre-school and kindergarten (K-level) experience, K-level conduct grades, K-level achievement test scores.

The research design for a preventive trial of this type must provide for some control over leakage or spillover effects that might happen if all or part of the intervention strategies were adopted in the comparison classrooms. These problems are addressed in the research design by having both internal comparison classrooms within the intervention schools and external comparison classrooms in the Standard Setting (no

special intervention) schools. This also controls for school level effects so critical in this type of research.

The total sample for the first phase of the intervention research consists of the one cohort of area children who entered the first grades of these 19 Baltimore public schools during the 1986-87 academic year.

The analyses that follow will only focus on results of the Cohort 1 students within the Mastery Learning condition, the within school contrast, and the between school contrast who remained in a stable design condition over two years. Results for standardized achievement in reading, teachers' noting of concentration, and student self report of depressive symptoms will be examined for the fall and spring of first grade, and the spring of second grade.

This ongoing population-based prevention trial is based upon a strong collaborative relationship between the Baltimore City Public Schools and The Johns Hopkins Prevention Research Center, a necessary partnership for this type of population and community-based research (Jason, 1982). We actively sought and obtained the support of the local community organizations and the parents of the children. Through an intensive process of identifying mutual interests, it was possible to develop and carry out multiple methods of assessment and random assignment of children to the interventions and to control classrooms over the first two school years.

The Mastery Learning Intervention

Mastery Learning individualizes learning by clearly defining what students should learn and the expected level of competence by giving them additional time to learn and by helping them when and where they have learning difficulties. The intervention in the current project consists of an extensive and systematically applied enrichment of the Mastery Learning approach in the reading curriculum, with intervention teachers receiving 30 hours of training over a two year period, as well as much-augmented Mastery Learning instructional strategies and curriculum materials, and the flexibility to adjust the curriculum time line with respect to student progress.

Key elements in the Mastery Learning intervention for the PRC research are: clear statements of instructional goals and objectives; communication of high expectations for success; small, sequenced instructional units; use of formative and summative testing and use of corrective methods, with maintenance of teach- test-correct-test cycles; clear linkage between objectives, teaching, and testing; presentation of mastery standards for each instructional unit; immediate feedback to students, and clear and updated records of student progress, in a form understandable to students and usable for evaluation research.

Critical aspects of training program include a group-based approach to mastery, a more flexible corrective process, and material support. The development of a more group-paced approach to mastery means that students do not proceed to the next

learning unit until the majority (80°/o achieving 80-85% objectives) of students have fulfilled the learning of objectives of the previous unit. Therefore, more than one formative test may be necessary to assure such a standard has been achieved.

The key to the effectiveness of Mastery Learning lies in systematic provision and use of correctives. Corrective instruction, by its very nature, must be targeted toward particular learners and particular learning problems or difficulties. A primary goal of training was to develop a flexible corrective process tailored to specific weaknesses of students. This process will be flexible both in terms of time, grouping strategy, and variety of correctives. A systematic linking of objectives, test items, error prescriptions, and correctives will be developed and reinforced through an instructional management model.

Assessments to Evaluate Impact

The assessment program of the PRC is aimed at measuring students in first and second grade via multiple methods of each core construct (aggressive behavior, shy behavior, concentration, learning, classmate relationships, and depression and anxiety). Teacher ratings, school records, peer nominations, and behavior observations were used to measure Social Adaptational Status in first and second grades in both intervention and control classrooms. Self-reports of feelings and peer nominations of affect were used to measure Psychological Well- Being.

The current analysis will focus on school achievement, concentration as rated by the teacher, and depressive symptoms as rated by the student. All three variables were rated during the fall and spring of the first grade and the spring of second grade. Within the Mastery Learning condition students received intervention over two years. For the internal school contrast and external school contrast no intervention was received and they were assessed at comparable time periods.

Assessments utilized in the current analyses include:

1) Teacher Rating of Concentration Problems - The concentration scale of the TOCA-R (Teacher Rating of Classroom Adaptation) was used. This instrument is a structured interview in which the teacher rates each child in the class on a set of 30 items. The concentration scale includes items such as whether the student is paying attention, distractible, stays on task, or whose mind wanders easily. Psychometric properties of the rating are reported in Werthamer-Larsson, (1987). The scale reported is the long term form of the teacher rating, with higher scores indicating more concentration problems.

2) Self-Report of Depression - The depression rating scale used was a modified version of the Children's Depression Inventory (Kovacs and Beck, 1977). The original scale was modified and shortened for ease of administration and comprehension. The scale includes items such as: the scale reported is the square root transform of the self report with higher scores indicating more depressive symptoms. Psychometric analyses for the revised scale point to strong internal consistency (Edelsohn, 1988).

3) School Achievement - School achievement will be assessed by the total reading score (standard scores) from the California Achievement Tests administered during the fall and spring of the first grade and the spring of second grade.

IV. Short Term Results of the Mastery Learning Trial

The core hypothesis of these analyses is that the Mastery Learning intervention will raise achievement scores. Furthermore, by raising achievement scores, the Mastery Learning intervention will reduce depressive symptoms. It is hypothesized that this effect on depression will grow stronger over time as the importance of the failure to learn becomes greater with successive age and grade level. However the precise timing and staging of this impact on depression is unclear.

The analyses have been partitioned into four types. The first analyses examine whether the intervention effects achievement after one year of intervention and after two years of intervention. This is considered the key short term impact of interest. If this result is not confirmed, the intervention strategy must be questioned and perhaps altered or abandoned. The next set of analyses move from reading achievement and examined whether the intervention has a short term impact on self report of depressive symptoms or teacher rating of concentration. These dependent variables are of somewhat more limited interest. Teachers ratings of concentration, although an important mediating variable to increased achievement and reduction in depression, are contaminated by the

teacher being the agent of the intervention. A direct effect of the intervention on depression may be possible in light of the instructional and cognitive processing strategies developed, but one would expect this result to emerge over multiple years. The third type of analyses returns to the impact on achievement. However, here the interest in on whether the achievement impact is modified as a result of baseline characteristics such as initial achievement levels of the student or the initial rates of depressive symptoms. Finally, if we can document an achievement impact of the intervention, can we also document that a change in achievement leads to a change in the self reports of depressive symptoms.

The basic statistical approach utilized was that of general linear models. For nearly normally distributed outcomes (such as reading achievement scores or transformed concentration and self reports of depression) standard ANOVA and ANCOVA techniques were used. For example, to examine the direct hypothesis that Mastery Learning improves reading achievement, beginning first grade reading will be used as a covariate and then compare Mastery Learning and the two contrast conditions end of year achievement scores. Gender will always be included in all models investigated. Subgroups will be examined by adding additional variables into the basic model such as baseline rates of depression.

Basic descriptive statistics are displayed in Table 1 and the Pearson correlations among the core variables are displayed in Table 2. A few points regarding these results should be made prior to further analyses. There exists an imbalance across the design

conditions with regards to baseline reading achievement. Therefore it will be critical to examine adjusted reading scores at the end of first and second grades. There appears to be some sex differences with regard to concentration and depression variables. Concentration problems seem to be slightly more prevalent among males by the end of first and the end of second grade. Depressive symptoms seem to be more prevalent among females by the spring of second grade.

The correlations displayed on Table 2 also point to some potential relationships of interest. Both reading achievement and concentration ratings tend to remain fairly sable across the three points of time. Depression is fairly stable from fall to spring of the first grade (r=.43***) but drops in the prediction from first to second grade (r=.24 for fall of first grade to spring of second; r=.25 for spring of first grade to spring of second). As would be expected teachers' rating of concentration and reading achievement are strongly correlated across all the three time points. Finally, both reading achievement and concentration are only moderately correlated with depressive symptoms. These descriptive results will now be explicated by general linear model procedures, which form the major component of the analytic strategy.

Impact on Achievement. The first analysis examined whether Mastery Learning had an impact on standardized reading achievement. Three design conditions were included in the model---Mastery Learning, a Internal Standard, and an External Standard. The ANCOVA analyses, once adjusting for fall achievement scores, demonstrated a significant design effect. The best fitting models for the assessment of intervention impact are

displayed on Table 3. Once controlling for baseline, the intervention design had a significant impact on both spring of first grade reading achievement (F=9.27, p=.0001) and spring of second grade reading achievement (F=8.52, p=.0003). In both models gender was not a significant source of achievement variance. These analyses were completed using standard scores that permit statistical analyses and that can measure growth in reading over multiple years. Multiple comparison procedures found that the major significant difference among the three groups is that the Mastery Learning group is significantly different from the two standard setting conditions. Figure 1 translates the adjusted standard scores into reading grade equivalent scores. They are the actual reading competence of the groups as indexed by years and months of reading growth. The scores on Figure 1 are adjusted for baseline reading achievement. At the end of one year of intervention the Mastery Learning students were reading at a grade equivalent(GE) equal to one year and nine months(GE=1.9) of reading competence compared to GE=1.7 for both the internal and external standard setting condition. Therefore the Mastery Learning students were approximately two months ahead after one year of intervention. After two years of intervention the group differences in terms of adjusted grade equivalents became even larger, with the Mastery Learning students with a GE = 3.2, the internal standard with a GE=2.9, and the external standard dropping to a GE=2.6.

In examining an intervention impact on achievement, it is often useful to investigate over what part of the baseline distribution of achievement did the intervention impact occur. Note that the best fitting model for spring of second grade achievement was a model that included both baseline achievement and the quadratic of that variable (baseline

achievement x baseline achievement). In plotting the predicted values estimated by this model, the intervention effect appears to vary across baseline achievement, with the greatest impact at higher levels of baseline achievement and little impact over the lower ends of the achievement distribution (approximately 20% of baseline sample). These results indicate that these poorest achieving students are not benefiting from the intervention as are the majority of students. This results have important implications for prevention planning of such academic enhancement strategies.

Impact on Depression and Concentration. Table 3. also presents the results of intervention status on depressive symptoms and on ratings of concentration. With regards to depression, there exists a slight design effect over one year which becomes non-significant by the end of-the second grade. However even the first grade effect cannot be clearly explicated by multiple comparison procedures as to the ordering of intervention groups. Recall that the impact of Mastery Learning was hypothesized to take place through achievement gain. By the end of the second grade this impact on depression as indexed by membership in the Mastery Learning condition did not occur. Further subgroup analyses are necessary to explore progress towards meeting long-term reduction of depressive symptoms. One other finding of note with regards to depression. During the second grade a clear gender effect is noted ($F = 20.99$, $p = .0001$), with females having higher rates of self reported depressive symptoms.

The analyses of teacher rated concentration demonstrates a slight intervention effect during the first grade ($F=3.04, p=.049$) with the Mastery Learning group having fewer

attention problems. However, during the second grade the intervention design effect becomes larger (F=6.65,p=.0015), but it is the internal standard group with the lowest rate of concentration problems. A significant gender effect also emerges during the second grade (F=12.35,p=.0005), with males rated as having more concentration problems. Recall that the teacher is the intervention agent, so this result must be interpreted with caution.

Although not displayed in the Tables, teacher grades were also analyzed. Because the design calls for an across school and classroom aggregation of results, teacher grades are not considered as valid an indicator of impact as standardized test scores. Teachers in the Mastery Learning condition did give fewer unsatisfactory grades to their students (Mastery learning=17%, Internal Standard=23%,External Standard=27%). If this result persists over time it could lead to fewer depressive symptoms within the Mastery Learning sample. The public evaluation of the classroom in the form of teacher grades is often more important to the child than the results of standardized reading tests, the scores of which the child may never see.

Achievement Impact with Regard to Baseline Depression. One potential mechanism for an intervention effect on later depression is that subgroups of depression at baseline respond differentially to the interventions. One model that proved to be productive in this regard is displayed in Table 4. The model includes baseline achievement and its quadratic term, depression (divided into thirds), intervention design, and design x depression, with the dependent variable being spring reading achievement at the end of

first grade. What is of most interest is the design by baseline depression interaction. There appears to be differences in patterns of achievement gain in light of intervention group and baseline depression. These differential gains are shown on Table 5 by intervention group and by baseline depression. At the low levels of depression there is no distinction in achievement gain. However the Mastery Learning conditions leads to significant gain in achievement for the mid and high depression groups. This was not true for the other design conditions. Mastery Learning seems to not permit students with mid & high levels of depression to fall behind in achievement. Over time this impact may help to alter the course of depression for these groups, i.e., through increased self esteem and sense of efficacy due to academic competence. A greater sense of competence for the more depressive samples may alter the high initial levels noted at baseline.

Change in Depression as a Function of Fall Depression and Reading Achievement Gain. As has been stated, a change in depression due to achievement gain in the mastery learning condition has not been demonstrated by the end of second grade. Across all design conditions, an analysis of change in depression as a function of fall depression and reading achievement gain may help increase understanding of how achievement gain within the Mastery Learning condition may lead to decreased depression.

Table 6 displays the general linear model which includes baseline depression (3 groups of thirds), achievement change (3 groups of thirds), and an interaction term with the dependent variable of change in depression from baseline to spring of first grade.

Achievement change is significantly related to change in depression ($F=4.93$, $p=.0075$). Examination of mean change scores for depressive groups point to the most substantial change in depression occurring at the most severe baseline depression, with moderate and high achievement change contributing to a lowering of the depression score. This differential impact of achievement on depression at the severe end suggests that achievement contributes above and beyond what might be expected due to regression to the mean.

This result, which shows a relationship between a change in achievement to a change in depression, added to the previous analysis which shows Mastery Learning having an impact on achievement across baseline depression conditions, point to the potential power of the Mastery Learning intervention to effect depressive symptoms over the early elementary school years.

V. Discussion

In order to examine the efficacy of the current Mastery Learning preventive intervention on depressive symptoms and disorder longitudinal follow-up studies will be necessary. The analyses of short term impact reported here form an important foundation for these future follow-up studies. Among the important elements of this foundation is the impact of the Mastery Learning intervention on standardized reading achievement over the two grade levels. Furthermore, the early relationship between achievement and depression, apparent from the early part of first grade has also been confirmed. Finally, the ability of

the Mastery Learning intervention to positively effect achievement across all levels of baseline depression suggests a learning strategy that may eventually result not only in improved achievement but also in reduced rates of depression in children. It is hypothesized that the major mechanism for this path will be through increased levels of perceived academic competence and through a growing set of instructional processing skills that the learner can rely on in both academic and nonacademic settings.

The study also demonstrated that in this application of the Mastery Learning strategy not all students benefited equally. In fact, quite the converse of other mastery learning studies, the real comparative gains in achievement occurred for the top eighty percent of the baseline achievement distribution. Little distinction was found for the lowest achieving students compared to their internal and external standard condition students. Clearly more needs to be done for these students above and beyond the current intervention strategies. However this intervention did successfully alter the early achievement trajectory for the majority of the students involved in the intervention classrooms. This suggests that future studies should examine these early achievement patterns for their end result on depression. One possible analysis worth exploring is the existence of specific threshold effects of achievement on depression. Perhaps only achievement to a current threshold results in change in depression. This question will likely be answered only with the addition of other mediating variables such as classroom rates of achievement and the value and expectations for achievement placed on the student by significant others, such as parents, teachers, and peers.

References

Bandura, A. "Self-Efficacy: Towards a Unifying Theory of Behavior Change.: The Elementary School Journal, 85, 65-75, 1984.

Block, J. "Making School Learning Activities More Playlike: Flow and Mastery Learning." The Elementary School Journal, 85, 1984.

Block, J. and Burns, R. "Mastery Learning." In L. Shulman (Ed.), Review of Research in Education, Vol. IV. Itasca, Illinois: F.E. Peacock Publishers, 1976

Bloom, B.S. Stability and Change in Human Characteristics. N.Y. Wiley, 1964.

Calsyn, R. J. and Kenney, D.A. "Self Concept of Ability and Perceived Evaluation of Others: Cause or Effect of Academic Achievement." Journal of Educational Psychology, 69, 136-145, 1977.

Corno, L. and Mandinach, E.B. "Student Cognitive Engagement in Classroom Learning and Motivation. Educational Psychologist, 18, 88-108, 1983.

Covington, M.V. and Omelich, C.L. "Effort: The Double-Edged Sword in School Achievement. Journal of Educational Psychology, 71, 169-182, 1979.

Dolan, L. "Mastery Learning as a Preventive Strategy." Outcomes, 5 (2), 20-27, 1986.

Doyle, W. "Paradigms for Research on Teacher Effectiveness." In L. Shulman (Ed.), Review of Research in Education, Vol. V. Itasca, Illinois: F.E. Peacock, 1977.

Goldhaber, D. "Does the Changing View of Early Experience Imply a Changing View of Early Development?" In L. Katz (Ed.), Current Topics in Early Childhood Education. Norwood, New Jersey: Abbey, 1979.

Guskey, T. Implementing Mastery Learning. Belmont, California: Wadsworth, 1985.

Jason, L.A. "Community-Based Approaches in Preventing Adolescent Problems." School Psychology Review, 11 (4), 417-424, 1982.

Kellam, S.G., Simon, M.B., and Ensminger, M.E. "Antecedents in First Grade of Teenage Drug Use and Psychological Well-Being: A Ten Year Community-Wide Prospective Study." In D. Ricks & B. Dohrenwend (Eds.), Origins of Psychopathology: Research and Public Policy. New York, N.Y.: Cambridge Press.

Kohlberg, L., Ricks, D. and Snarey, J. "Childhood Development as a Predictor of Adaptation in Adulthood." Genetic Psychology Monographs, 110, 91-172, 1984.

Kovacs, M., & Beck, A.T. (1977). An empirical clinical approach toward a definition of depression. In J.G. Schulterbrandt and A. Raskins (Eds.), Depression in Childhood: Diagnosis. Treatment. and Conceptual Models. New York: Raven Press.

Lazar, I., Darlington, R., Murray, H., Royce, J. & Snipper, A. (1982). The Research in Child Development, 47 (23, Serial No. 195).

Mischel, W. "Towards a Cognitive Social Learning Reconceptualization of Personality." Psychological Review, 80, 252-283, 1973.

Nicholls, J. "Quality and Equality in Intellectual Development." American psychologist, 34, 1071-1084, 1979.

Perlin, L.l. and Schooler, C. "The Structure of Coping." Journal of Health and Social Behavior, 19, 2-21, 1978.

Rosenholtz, S.J., & Simpson, C. The Formation of Ability Conceptions: Developmental Trend or Social Construction. Review of Educational Research, 1984, 54, 1, 31-63.

Scheirer, M. and Kraut, R. "Increasing Educational Achievement Via Self Concept Change." Review of Educational Research, 49. 131-150, 1979.

Shaffer, D., Stokman, C., O'Connor, P.A., Shafer, S., Barmack, J.E., Hess, S., & Spaulten, D. (1979). Early Soft Neurological Signs and Later Psychopathological Development. Paper presented at the annual meeting of the Society of Life History Research in Psychopathology and Society for the Study of Social Biology, New York.

Thomas, J.W. "Agency and Achievement: Self Management and Self Regard." Review of Educational Research, 50, 213-240, 1980.

Werthamer-Larsson, L. (1987). Psychometric properties of the TOCA-R. Unpublished manuscript, Johns Hopkins University, Prevention Research Center.