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EFFECTS OF KNOWLEDGE OF ACCOUNTABILITY IN MASTERY  
LEARNING PROGRAMS ON ACADEMIC ACHIEVEMENT,  
GOAL SETTING CHARACTERISTICS, AND  
LOCUS-OF-CONTROL ORIENTATION

by

Donn C. Ritchie

A dissertation submitted in partial fulfillment  
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Education  
(Instructional Technology)

UTAH STATE UNIV  
Logan, Utah

1992

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Donn C. Ritchie

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## ABSTRACT

Effects of Knowledge of Accountability in Mastery Learning Programs  
on Academic Achievement, Goal Setting Characteristics,  
and Locus-of-Control Orientation

by

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During the past quarter century, over 1000 articles have documented changes in student behaviors related to participation in mastery learning programs. Although the results have been generally positive, a debate continues as to the cause for increased student performance: Are results due to changes in how students attend to the information, or simply due to increased study time as a result of remediation?

In this study, a videodisc-based program in fractions was used with fifth-grade students. The videodisc-based instruction was chosen to help minimize differences in instructional materials, instructional time, and instructional delivery. A pretest-posttest, control-group design was used to compare academic achievement, locus of control, and goal setting scores of two groups (N=154). Both groups received instruction in fractions via the teacher-directed, videodisc-based *Mastering Fractions* program. Treatment 1 students (N=80) were knowledgeable that they were participating in a mastery-learning program and would be held accountable for their

progress and remediation. Treatment 2 students (N=74) were not aware that their teacher was using mastery learning principles to determine progression and remediation. A control group (N=32) received their normal grade five mathematics program.

Comparisons between Treatment 1 and Treatment 2 student scores, after adjustments for pretest results using analysis of covariance, revealed standardized mean difference effect sizes of +0.03 for achievement, +0.32 for locus-of-control, and +0.46 for goal setting mean scores favoring Treatment 1. A discrepancy in implementation of the videodisc program in two classes may have skewed results. When data from these two classes were omitted, the analyses showed adjusted standardized mean difference effect sizes of +0.63 for achievement, +0.75 for locus-of-control, and +0.55 for goal setting mean scores favoring Treatment 1.

A two-way analysis of covariance with treatment groups and achievement levels was also conducted. Subsequent standardized mean difference effect sizes using adjusted mean scores were greatest for students from the lowest achievement level (+0.64 for internal locus-of-control and +0.55 for goal setting mean scores). When data from the two discrepant classes were omitted, the adjusted standardized mean difference effect sizes were found to be +1.24 for internal locus-of-control and +1.06 for goal setting mean scores favoring students from the lowest achievement level.

Implications of these results for mastery learning programs in public schools are discussed. (136 pages)

## CHAPTER I INTRODUCTION

### Background

The quality of a child's education is influenced by a variety of internal and external variables. External variables include the number of students per classroom, the knowledge and ability level of the teacher, the curriculum mandated by the school board, the teaching methods used in the classroom, and the support which a child receives at home. Most external variables are manipulable, and educational reform movements often focus on altering one or more in hopes of improving the educational system. Often, this manipulation of external conditions is implemented to influence how a learner attends to, encodes, retains, and recalls information. In other words, these programs strive to do more than simply manipulate external variables. They also attempt to influence how learners process information internally.

A variety of teaching models, based on theoretical, philosophical, and psychological orientations, have been used and refined in our desire to increase learning (Joyce & Weil, 1986). A common strategy has been to insure that instruction is applicable to the student. One of the earliest documented reports of this strategy was in 1912-1913 when Frederic Burk, president of San Francisco State Normal School, devised an individualized instructional plan to be used with students from kindergarten through eighth grade (Reiser, 1987). Because each child was able to progress through the material at his or her own rate, this appears to be one of the



first institutionalized plans in which students were held closely accountable for their progress through the educational materials.

Holding students accountable to master and demonstrate competence in academic material is now a common practice of mastery learning programs. Although variations of the theme have occurred, all include the establishment of pre-set attainment levels which students or groups of students strive to reach. Progression and remediation are dictated by how well students attain these levels. Programs that incorporate mastery learning concepts surface periodically in various configurations as practitioners attempt to find the best combination of variables applicable to various environments. Over the years, these programs have provided educators with a fertile area of pontification and research. In a recent span of 25 years, over 1,000 articles were written on mastery learning (Guskey & Pigott, 1988).

In the vast majority of recent empirical studies, authors have concluded that students placed in mastery learning programs demonstrate increases on both cognitive and affective academic measures (Guskey & Gates, 1985; Guskey & Pigott, 1988; Kulik, Kulik, & Bangert-Downs, 1990). Evidence cited to support these claims includes higher scores on instruments which measure attitudes toward subject matter and self-concept (Block & Burns, 1976), higher levels of motivation of students to succeed in their coursework (Weiner, 1979), less attrition of students from college courses (Caponigri, 1981; Clark, Guskey, & Benninga, 1983), higher student rating of classes using mastery learning concepts (Kulik, Kulik, & Cohen, 1979), higher scores on measurements of students' time on task (Guskey, 1987; Guskey & Gates, 1985), and higher levels of subject matter comprehension (Fitzpatrick, 1985; Guskey & Pigott, 1988; Hymel, 1983).

Despite these results, an ongoing controversy exists as to their explanation. Many researchers state or imply that a change in the individual's learning process occurs, due to either an increase in active learning time (Bloom, 1984; Fitzpatrick, 1985), a stronger academic self-concept (Bloom, 1984), an improvement in the student's feelings about the importance of the subject (Blackburn & Nelson, 1985), or a change in student attributions for learning outcomes (Duby, 1981; Guskey, Benninga, & Clark, 1984). Critics, however, contend that mastery learning programs simply provide students with additional instruction time through remediation, and that increased comprehension is simply a reflection of additional instruction, not an inherent improvement in the learning process (Arlin, 1984; Slavin, 1987). In addition, these critics cite that because the rate of learning for an individual is fairly stable, extra time used for remediation results in either time taken away from other disciplines or in reduced coverage of the material under study.

Contributing to the divergence of opinions has been the format used by many of the researchers studying mastery learning programs (Slavin, 1987; 1990). Based on my review of studies, the experimental and control groups are often established without controlling important confounding variables, e.g., differences in instructional material, instructional time, and instructional delivery method. If these variables are not controlled, it greatly reduces the ability to identify, with any certainty, the extent to which mastery learning programs alter the learning process. A more revealing approach would be to control these confounding variables while isolating and analyzing factors inherent within mastery learning programs.

One such factor found within mastery learning programs, which is not a component of conventional teaching, is the requirement that students

reach a predetermined level of mastery on one unit of instruction before being allowed to progress to the next. When mastery learning programs are properly implemented, this knowledge of accountability is made explicit to students. This knowledge may influence students in at least two ways. First, it may increase the student's perception of control over the learning environment. Perception of control, as measured by the locus-of-control construct, has been correlated to academic achievement in a variety of learning situations (Coady, Fellers, & Kneavel, 1981; Keith, Pottebaum, & Eberhart, 1985; Owie, 1983; Shorr & Young, 1984; Steipek & Weisz, 1981; Tomlinson, 1987), and may be related to achievement in mastery learning programs.

Second, the need to reach a prespecified achievement level may provide students with an academic goal to strive towards. Goal theory states that when goals are specific, proximal, and within the competence of students, motivation and achievement are increased (Bandura, 1989; Locke & Latham, 1990; Locke, Shaw, Saari, & Latham, 1981). Either of these components may alter the students' perception of the educational environment, thereby influencing the extent to which they acquire information in mastery learning programs.

#### Statement of the Problem

An important outcome of school-based education is improving student's ability to gain knowledge. Several authors have suggested that the use of mastery learning programs results in positive changes in this ability due to internal changes in the student. There is, however, a contingent of researchers who state that these changes are not due to changes in the

individual, but to the external variables of instructional content, instructional time, or instructional delivery methods. Because research studies have not been found which control these external variables, it is not possible at this time to determine if achievement increases are caused by one of these external, confounding variables, or are due to internal changes in individuals such as their goal setting characteristics or locus-of-control orientation.

#### Purpose

The purposes of this study are to (a) isolate the component of accountability within a mastery learning program by minimizing differences in the instructional content, instructional time, and instructional delivery; (b) determine if students' knowledge of accountability contributes to academic, locus-of-control, and goal setting changes; and (c) identify if academic changes correlate to changes in locus-of-control and goal setting measures. To meet these purposes, a videodisc-based program in fractions was implemented in nine classrooms. Students in three classrooms had knowledge of participating in a mastery learning program and of their accountability (informed students); students in three classrooms were not aware that they are participating in a mastery learning situation (not-informed students); and students in three classrooms were used as a control group.

## Research Hypotheses

As a part of the investigation, the following hypotheses were tested.

1. Students knowledgeable of the accountability factor in a mastery learning program (informed students) will have significantly<sup>1</sup> greater adjusted<sup>2</sup> posttest mean scores on the subject-domain achievement tests than will students who are not knowledgeable of the accountability factor (not-informed students).

2. Students in the informed group will achieve significantly higher internal locus-of-control scores than students in the not-informed group.

3. There will be a significant difference among achievement levels within the informed and not-informed groups towards internality on the locus-of-control measure, favoring students in the medium achievement level over students in either the high achievement and low achievement levels.

4. Students in the informed group will achieve significantly higher goal setting level scores than students in the not-informed group.

5. There will be a significant difference among achievement levels within the informed and not-informed groups towards higher levels on the goal setting measure, favoring students in the medium achievement level over students in either the high achievement and low achievement levels.

---

<sup>1</sup> significance refers to both statistical and educational significance.

<sup>2</sup> posttest scores will be adjusted in a covariance analysis using the pretest as a covariate.

6. The adjusted posttest mean scores of the experimental groups on the locus-of-control measure and goal setting measure will be significantly greater than the control group.

7. There will be a significant correlation between achievement scores and locus-of-control scores, and between achievement scores and goal setting scores for the informed groups.

## CHAPTER II

### REVIEW OF THE LITERATURE

#### Mastery Learning, Achievement, and Level of Performance

In 1991, President George Bush declared that one of the most pressing goals of our public educational system was to "make existing schools better" (U.S. Department of Education, 1991, p. 52). Methods for achieving this goal, however, are continually debated. A number of authors have proposed that mastery learning programs be considered as an essential component of any strategy attempting to increase knowledge acquisition by students (e.g., Bloom, 1986; Guskey, 1986; Hymel, 1983). Their beliefs are based on two basic assumptions: first, mastery learning programs are specifically structured to provide multiple opportunities for students to master a subject domain; and second, because material is mastered, future knowledge acquisition in related topics will be accelerated because prerequisite knowledge has been obtained (e.g., Bloom, 1968). Recent meta-analyses appear to support these contentions (Guskey & Gates, 1985; Guskey & Pigott, 1988; Kulik et al., 1990). Others, however, argue that achievement results for mastery learning programs are simply due to additional time spent learning the material (Arlin, 1984; Slavin, 1987). These critics conclude that mastery learning programs are not an efficient method to increase knowledge.

One of the unique ideas imbedded within mastery learning programs is the requirement that students achieve preestablished levels of performance before being allowed to progress to ensuing lessons. This requirement may influence student achievement by either of two means:

first, when students are cognizant that academic progression is directly tied to formative test scores, their perception of control over the learning environment may increase; and second, the attainment level for progression may act as a goal for students to strive towards. Both higher levels of goal setting (Locke & Latham, 1990) and an internal locus-of-control orientation (Strickland, 1989) have been positively correlated to academic achievement. To identify possible relationships between these concepts, I include in this review discussions of the following bodies of research and theory:

1. types and characteristics of mastery learning programs;
2. relationship between locus-of-control construct and academic achievement;
3. relationship between the level of goal setting and academic achievement; and
4. factors which influence motivation in learning.

In the final section of the review of literature, I address the research pertaining to possible alteration of goal setting levels and locus-of-control orientation through implementation of mastery learning programs, and how this manipulation may affect motivation and academic achievement.

### Mastery learning programs

There are two major types of mastery learning programs used in the United States: Keller's Personalized System of Instruction (PSI) and Bloom's Learning for Mastery (LFM) (Kulik et al., 1990). In Keller's plan, students work through the instructional material at their own pace. As a student masters one instructional unit, he or she advances to the next.



In this system, each student works through the academic material independent of classmates. Teachers employing the PSI plan often spend class time more as a motivator and supplier of supplemental information than as a disseminator of subject material (Keller, 1968).

The LFM system is based on John Carroll's (1963) and Benjamin Bloom's (1968) work. In the LFM plan, the traditional classroom structure is maintained as students move together through the instructional units. The teacher is often the main disseminator of knowledge, although other presentation formats may be used. The structure of the classroom and role of the teacher as deliverer of information allows the LFM method to be more applicable to traditional classroom settings. Instead of each student working at his or her own pace on individualized material, all students work on the same material at the same time and are directed by the teacher.

Mastery learning programs deviate from traditional programs in both their development and implementation. After the goals, objectives, and instructional content are identified, the instructional material is divided into small units. Tests are developed for each unit and a level of mastery is established to determine when the student or students may proceed from one unit to the next. In addition, a set of parallel instructional units and tests is developed for remediation. During instruction, the knowledge level of students is assessed frequently with formative tests. When students or classes do not achieve at pre-set levels, they are directed to a remediation loop which provides additional support. At the completion of the remediation loop, mastery is again assessed. Depending on the structure of the individual program, this sequence of remediation and assessment may continue.

In four recent meta-analyses, researchers concluded that student scores on criterion-referenced posttests are higher for mastery learning classes than scores for similar nonmastery classes (Guskey & Gates, 1985; Guskey & Pigott, 1988; Kulik et al., 1990; Slavin, 1987). Proponents of mastery learning contend that these improvements are due to the requirement that students demonstrate mastery at each level of instruction. This provides the students with a solid understanding of the concepts before moving on to more advanced material. This is unlike traditional programs of instruction where students, deficient at one level, are moved to the next unit regardless of their competency. Understandably, these students experience difficulty considering their lack of knowledge of prerequisite material. As this scenario is repeated in the traditional classroom, it perpetuates itself to the point where the academically rich get richer, and the academically poor get poorer.

In addition to cognitive advancements, Weiner (1979) suggests there is an improvement in the affective domain of the students. Children who have not experienced positive reinforcement in the traditional classroom due to low ability suddenly find themselves in a system in which they succeed. This success often motivates them to more conscientious studying and learning. Another indication of an improved affective domain comes from a study by Whiting and Render (1987). They cite the steady increase of students voluntarily enrolling in mastery learning courses as an overt indication of their satisfaction with the programs. In addition to improved student attitudes, researchers have identified an improvement in teacher attitudes. Instead of suppressing feelings of failure and frustration due to student inadequacy and low achievement, teachers express feelings of finally making a difference to the academic growth of their students

(Caponigri, 1981; Guskey, 1984) and begin to alter their expectations for student achievement (Guskey, 1982).

Another advantage of mastery learning is that the structure of the programs lends itself to better instructional quality (Dunkleberger & Knight, 1981). This improvement originates in the requirement that objectives are identified, instruction is established in small, testable units, student feedback on attainment of objectives is frequent, student accountability on reaching a level of mastery is maintained, and remediation is offered when students fail to reach mastery. Although these components of instruction are not limited to mastery teaching, the structure of the programs insures their inclusion.

Critics of mastery learning programs, especially the LFM method, question the benefits. A common argument centers on the problem of what to do with more capable students. Arlin (1984) has referred to this as the "Robin Hood effect." In group-based, mastery learning programs, faster students are required to slow down or stop until the group has reached mastery on the current material. When this occurs, the academically rich are deprived for the benefit of the academically poor. Arlin questioned the practical and ethical considerations of detaining faster students while slower students catch up, and suggested that the large amount of material covered in most traditional classes is sacrificed when group-based, mastery learning class are implemented.

In studying the amount of time required for slower students to master the material of faster students, Arlin (1984) calculated ratios ranging from 3:1 to 10:1, with a ratio of 6:1 as common. He stated that this time differential may produce psychological effects for students at both ends of the time-to-master continuum. Faster students, being constantly

held back, find that they have an abundance of excess time as they wait for their classmates to complete lessons. Students may find this waiting time appropriate for causing trouble (Barr & Dreeben, 1977) or for daydreaming or coasting through their lesson (Arlin, 1984). Slower students, recognizing that their classmates are continually waiting for them, may develop a negative self-image and form images of intellectual inferiority (Cox & Dunn, 1979). Students at both ends of the time-to-master continuum may not thrive in a group-based mastery learning program as well as those who tend to cluster more toward the middle.

This reduction of completed material has been challenged by Fitzpatrick (1985). In her study, teachers reported equal amounts of material covered during a semester when engaged in either mastery or nonmastery programs. The time for remediation was made up by better time management and improved instructional strategies within mastery learning classrooms.

Critics of group-based, mastery learning programs also cite a lack of improvement in the mean scores of students on standardized test as an indication that these programs do not enhance knowledge acquisition (Slavin, 1987). Proponents of mastery learning counter that standardized tests tend to measure stable, long-term, and general knowledge, not knowledge recently obtained (Anderson & Burns, 1987). Although students in some longitudinal LFM studies show gains in standardized scores over students in traditional classes, there is a consistent finding that results are much stronger in criterion-referenced tests (Kulik et al., 1990).

## Locus of Control

Studies conducted over the past quarter century have repeatedly demonstrated a relationship between a student's perception of control and academic achievement. This relationship could be advantageous to the field of education, for as Stipek and Weisz (1981) acknowledged: "If students' personality or motivation are more amenable to change than their ability, then achievement might be enhanced indirectly through educational practices that positively affect personality and motivational development" (p. 101).

Rotter (1966), one of the first to examine the relationship between perception of control and academic achievement, described a locus-of-control construct as how people perceive rewards and reinforcements from the environment as contingent upon their actions. He described the construct as a continuum that extends from an internal orientation (in which the individual attributes his own hard work, ability, or persistence to his successes and failures), to an external orientation (in which the individual identifies factors other than himself, such as luck, fate, chance, task difficulty, or powerful others as responsible for his successes and failures). According to Rotter's social learning theory (1966), academic success for students with an internal locus-of-control orientation increases the likelihood of behaviors such as attention or persistence during future tasks. Conversely, students with an external locus-of-control orientation may not perceive a relationship between outcome and behavior, and academic success will not increase the likelihood of such behaviors in the future.

Rotter (1975) and other social learning theorists (Lefcourt, 1976) described an individual's perception of control in a given situation as dependent upon situational variables and a general expectancy that develops over time from actions in similar situations. The more novel or ambiguous the situation, the more the general expectancy contributes to the individual's perception of control. As an individual gains experience in an activity or situation, the less the generalized expectancy influences this perception. In measuring generalized expectancy of rewards with locus-of-control scores, Strickland (1989) states that researchers have found a number of strong correlations between scores on measures of personality, achievement characteristics, attitudes, and health. One of the strongest of the correlations has been with students who score toward the internal side of locus-of-control measures and high on academic achievement measures (Coady, Fellers, & Kneavel, 1981; Keith, Pottebaum, & Eberhart, 1985; Owie, 1983; Shorr & Young, 1984; Stipek & Weisz, 1981; Tomlinson, 1987).

It has been hypothesized that students with an internal locus-of-control orientation (internals) utilize different cognitive processes when learning new material (Lefcourt, 1976). These students often exercise cognitive processes that are more abstract, divergent, and generalized in nature than those who score more towards the external locus-of-control orientation (externals). Tomlinson (1987) suggested that internals are often more perceptive, inquisitive, curious, and better processors of information than are externals, and have also been found to be more active and alert. In addition, Gagné and Parshall (1975) and Gordon, Jones, and Short (1977) determined that children with an internal locus-of-control orientation exhibit more persistence towards the completion of tasks.

Students with an external orientation tend to exercise cognitive processes that are more concrete, convergent, and compartmentalized than internals (Lefcourt, 1976). Tomlinson (1987) suggested that they utilize fewer learning strategies, and because they more readily accept dependency on more competent others, have less need for information and therefore ask fewer questions in a classroom situation. Seeman (1963) suggested that these students sense a powerlessness in their environment that tends to depress classroom behaviors such as attentiveness and knowledge acquisition. Because these students may not believe that life can be fulfilling and rewarding through personal actions, they often do not exert themselves or persist at activities which may fulfill more distant goals. Persistence towards academic achievement lessens for these students because it makes little sense to strive after goals they perceive as being controlled by inconsistent or capricious external forces.

#### Modifying locus of control

Because student scores toward internality on locus-of-control measures have been correlated to higher scores on academic achievement (see reviews of Bar-Tal & Bar-Zohar, 1977; Steipek & Weisz, 1981), researchers have attempted to discover how individuals develop an internal orientation. Reimanis (1971) found that children who grow up with attentive, responsive, and sharing individuals in either the home or larger social institution have a greater chance in developing an internal orientation. A less responsive and opportunistic environment can create a "climate of fatalism and helplessness" which is often reflected in external scores on locus-of-control measures (Tomlinson, 1987, p. 7-8).

Due to both the amount of time a child spends in the academic arena and the correlation which exists between an internal locus-of-control orientation and academic achievement, it behooves schools to take an active role in promoting the development of a child's internal orientation. Although a child's orientation is built up over time, researchers have concluded that it can be modified through a variety of activities from the time they are in the first grade (Shore, Milgram, & Malasky, 1971) to college age (Ayabe & Nitahara-Pang, 1981; Eisenman & Russell, 1972; Jaremko, 1979; Johnson, 1975). The optimal time to work with a modification program, however, is yet to be established. Evidence provided by Bailer (1961) and Penek (1969) indicates that as children's levels of verbally mature abstractions increase, so does their ability to comprehend the relationship between their actions and the consequence of their actions. Therefore, programs to modify locus-of-control orientations may be most beneficial in the primary grades as a child's ability to form these abstractions develops (Benati, 1986).

Activities used to modify children's locus-of-control orientation (see Table 1) include operant conditioning (Eitzen, 1974; Gutkin, 1978; Jaremko & Rose, 1979; Joe, 1971; Krovertz, 1974; Wicker & Tyler, 1975), helping others (Martin & Shepel, 1974), camping situations (Nowicki & Barnes, 1973), the nationwide "Follow Through" program (Shore, Milgram, & Malasky, 1971), covert sensitization (Eisenman, 1972; Jaremko & Rose, 1979; Stanton 1982), mnemonic training (Ayabe & Nitahara-Pang, 1981), teacher training (DeCharms, 1972), goal setting (Bradley & Gaa, 1977; Gaa, 1979), student self-scheduling (Wang & Stiles, 1976), and mastery learning (Benati, 1986; Dertinger, 1984; Johnson & Croft, 1975).



Although the 25 studies listed in Table 1 had a mean effect size of 0.64, the results of many have reduced generalizability due to either the lack of control groups (Johnson & Croft, 1975; Nowicki & Barnes, 1973), short durations (Ayabe & Nitahara-Pang, 1981; Eisenman, 1972; Gutkin, 1978; Jaremko & Rose, 1979; Martin & Shepel 1974; Nowicki & Barnes, 1973), lack of a pretest (Ayabe & Nitahara-Pang, 1981), or by groups representing only low socioeconomic status or individuals with disabilities (Eitzen, 1974; Gutkin, 1978; Wicker & Tyler, 1975; Jaremko & Rose, 1979; Nowicki & Barnes, 1973; Shore, Milgram, & Malasky, 1971; Wang & Stiles, 1976). Conclusions drawn from these studies on locus-of-control modification are at best tentative due to the numerous threats to validity.

One noticeable factor in Table 1 is the diversity in ages of students who have been studied and have had their locus-of-control orientation altered. Shore's study of first grade students (1971) revealed an effect size of 0.57, the same effect size as Eisenman's study with college students (1972). Also seen in Table 1 are the variations in length for locus-of-control studies, ranging from one week to one year.

A possible trend viewed in Table 1 is the decline in locus-of-control studies during the 1980s. Although Strickland (1989) views the topic as valuable, evolving, and worthy of research, the decline of studies in recent years may indicate that the topic is no longer viewed as critical by educational researchers.

Table 1

Summary: Locus-of-Control Studies

Author	Year	Grade	Duration	Exper. n	Control n	L.O.C Measure	Independent Variable	Effect Size
Ayabe	1981	College	1 wk.	10	10	I-E	Mnemonic	0.99
Ayabe	1981	College	1 wk.	10	10	N-S	Mnemonic	0.68
Benati	1986	3	7 wk.	23	23	IAR	Mastery Learning	0.40
Bradley	1977	10	5 wk.	12	12	IAR	Goal Setting	1.01
Bradley	1977	10	5 wk.	12	12	IA	Goal Setting	0.78
DeCharms	1972	6-7	2 yr.	57	50	Stories	Motivational Training	0.96
DeCharms	1972	6	1 yr.	27	50	Stories	Motivational Training	0.65
DeCharms	1972	7	1 yr.	41	50	Stories	Motivational Training	0.55
Dertinger	1984	6	7 wk.	13	12	IAR	Mastery Learning	0.29
Eisenman	1972	College	*	50	50	I-E	Verbal conditioning; int.	0.57
Eisenman	1972	College	*	50	50	I-E	Verbal conditioning; ext.	0.53
Eitzen	1974	7-9	1 yr.	21	82	N-S	Token	0.70
Gaa	1979	10	5 wk.	12	12	IRA	Goal Setting	1.07
Gaa	1979	10	5 wk.	12	12	IA	Goal Setting	0.79

(table continues)

Author	Year	Grade	Duration	Exper. n	Control n	L.O.C Measure	Independent Variable	Effect Size
Gutkin	1978	4, 5	3 wk.	43	42	CLOC	Contingent Reward	0.84
Jaremko	1979	College	1 wk.	8	8	I-E	Overt Reinforcement	0.48
Jaremko	1979	College	1 wk.	8	8	I-E	Covert Assertion	0.39
Johnson	1975	College	14 wks.	138	0	I-E	P.S.I. Mastery Learning	0.25
Martin	1974	Adults	2 days	21	0	James	Helping Relationships	0.96
Nowicki	1973	7,8,9	1 wk.	261	0	N-S	Camping	0.37
Nowicki	1973	7,8,9	2 wk.	27	0	N-S	Camping	0.89
Shore	1971	1	9 mo.	53	24	LOCI	Enrichment Program	0.57
Stanton	1982	12	3 wk.	17	17	I-E	Suggestions (RIE)	0.29
Wang	1976	2	15 wk.	21	64	IAR	Self Scheduling	0.66
Wicker	1975	9-12	12 wk.	13	14	IAR	Social Reinforcement	0.44

- \* Data not presented in the article
- CLOC Children's Locus-of-Control Scale
- IA Intellectual/academic situations
- IAR Crandall's Intell. Achiev. Responsibility
- Stories Plimpton behavioral scores on children's stories
- I-E Rotter's Internal-External Locus-of-Control Scale
- N-S Norwicki-Strickland locus-of-control
- LOCI Locus of Control interview
- James James Scale of locus-of-control orientation

## Goal Setting Theory

In an attempt to explain why people are motivated to interact with their environment, Bandura (1990) identified two broad principles: to satisfy biological needs, and to satisfy cognitive needs. Satisfying cognitive needs is distinctly human, and occurs when people purposely act through forethought and action to attain a desired goal (Bandura, 1989).

The setting and striving for goals have recently become a popular research topic of cognitive psychologists. Locke and Latham (1990) identified over 200 studies on goal setting research conducted during the 1970s and 1980s. One reason for this surge in popularity is that goals are viewed by many as having a major influence on the regulation of human action. For this to occur, the goal does not have to continually be at the forefront of our consciousness (Klinger, 1987). Goals often fade in and out of our awareness. Once firmly grounded and accepted, however, they reside in the background of our consciousness, subtly influencing our choices and actions.

Goals are generally viewed as having two attributes: content and intensity (Locke & Latham, 1990). The goal's content refers to some aspect of the external world which is the object or result being sought. A goal's content can vary along a number of attributes. It can be either specific (e.g., improve 5%) or ambiguous (e.g., do the best you can). The content can be planned to be reached in the near future (e.g., by the end of the week) or distant future (e.g., before retirement). The achievement of the content can be viewed as either being easy (e.g., one hour of work) or hard (e.g., 15 years). The second attribute, goal intensity, refers to how strong the goal is in comparison to other goals (i.e., its location in the goal

hierarchy). Of the two global attributes, goal content has been the major area of research during the past 20 years. Within this attribute, the goal's difficulty and specificity have been the major focus.

A meta-analysis conducted by Locke and Latham (1990) identified 175 studies which examined the relationship between an individual's performance and the goal's difficulty. Of this group, 140 studies (91%) showed a positive correlation. Other recent meta-analyses support these results (Chidester & Grigsby, 1984; Mento, Steel, & Karren, 1987; Tubbs, 1986; Wood, Mento, & Locke, 1987), with mean effect sizes ranging from 0.52 to 0.82. Locke and Latham (1990) hypothesized that this relationship occurs because "hard goals make self-satisfaction contingent on a higher level of performance than easy goals" (p. 29). They asserted that this relationship between performance and hardness is positive and linear.

A relationship has also been identified between an individual's performance and the specificity of the goal. In a meta-analysis of 201 studies, 91% (183 studies) were identified as having positive correlations between difficult, specific goals and more ambiguous goals such as "do your best" (Locke & Latham, 1990). These results have been corroborated by five meta-analyses conducted during the 1980s which reported mean effect sizes ranging from 0.42 to 0.80 (Chidester & Grigsby, 1984; Hunter & Schmidt, 1983; Mento et al., 1987; Tubbs, 1986; Wood, Mento, & Locke, 1987). Locke and Latham (1990) speculate that when people are instructed to do their best, they allow themselves leeway in determining what the phrase "their best" means, and therefore are able to receive satisfaction by a variety of performances. When a specific goal is set, there is a definite level at which performance must be accomplished before satisfaction is gained. This level often spurs learners on to greater

accomplishments than would otherwise be achieved. For children, specific goals have been shown to produce a marked increase in task performance and self-evaluations (Schunk, 1983a; Schunk, 1983b). This increased effort may be explained by what Piaget referred to as the desire of students to resolve the disequilibrium of new tasks to their existing cognitive structures (Flavell, 1963).

Traditional instructional programs have done little to establish specific goals for students. Mastery learning programs, on the other hand, stipulate the specific level of mastery required for the student to progress through instructional units. According to goal setting research, this specificity may be an important component of mastery learning programs.

Although goals in mastery learning programs are established by an external source, they may be as valid as goals established individually or participatorily. Meta-analyses by Mento et al. (1987) and Tubbs (1986) found a negligible effect in regards to who set the goals, as long as they were accepted. More important is how specific, difficult, and realistic the goal is. Latham, Steele, and Saari (1982) found that assigned goals, when set higher than those established participatively, produce greater performances. In addition, externally set goals appear extremely important for children because many set unrealistic goals in terms of time, amount of effort, and skills required for completion (Bandura & Schunk, 1981; Rosswork, 1977; Schunk, 1983a; Schunk, 1983b; Schunk & Gaa, 1981).

Not all goals established by external sources, however, are appropriate. Drawbacks exist if externally set goals are either too high or too low for the individual. While high goals may be beneficial for students who already have strong cognitive abilities, students with a history of low ability might find the goals established in mastery learning programs as

unobtainable, thereby reducing their motivation (Bandura, 1989; Hohn, 1986). On the other hand, students who initially set high personal challenges may lower their standard if the mastery learning goals are too low or nonmotivating. Specific, easy goals have actually been found to produce lower performances than no goal (Locke, Chah, Harrison, & Lustgarten, 1989). Therefore, mastery learning goals set for an entire class may be most beneficial to students who cluster towards the norm in subject domain knowledge. These same goals may do little more than frustrate students who fall towards the extremes in subject knowledge.

By specifying the degree of attainment required to progress from one instructional unit to the next, mastery learning programs also reduce the level of ambiguity found in most classrooms. Doyle (1983) stressed the importance of the concept of ambiguity by stating that all academic work can be thought of in terms of varying degrees of ambiguity and risk. His usage of the word ambiguity is not to refer to the effectiveness of explanations by the teacher, but to the degree to which a precise answer or method to achieve an answer is established in advance. Risk is defined as to the likelihood that the student will generate the desired answer. Classroom tasks have either a high or low ambiguity and a high or low risk value.

Based on Doyle's definition of ambiguity, mastery learning programs should help reduce classroom ambiguity by specifying the performance level required for students to proceed from one instructional segment to the next. In traditional classrooms, advancement is left up to the teacher, who seldom specifies criteria to determine when the class will progress through the instructional concepts. Students quickly find that if they nod their heads at the right time and do not ask too many questions, the teacher will proceed without checking for complete understanding. In

mastery learning classrooms, however, students are not only held accountable to know the correct answer, but progression and remediation are directly tied to their level of achievement. Students are quick to pick up cues that announce accountability (Carter & Doyle, 1982; King, 1980; Winne & Marx, 1982), and seldom take learning tasks seriously for which they will not be held accountable (Doyle, 1983). This accountability is quite clearly spelled out in mastery learning programs where ambiguity is reduced by prespecifying the level of attainment required to progress.

### Motivation Theory

There is little consensus on a precise definition of motivation agreeable to researchers and theoreticians. In 1981, Kleinginna and Kleinginna documented 98 separate definitions. One of the more encompassing definitions was offered by Zapata and Cohn when they defined motivation, both biological and cognitive, as "a state of need or desire that initiates behaviors which are directed toward satisfying those needs or desires" (1986, p. 10). One reason for the variety of definitions stems from a major schism in the perception of what causes humans to act within their environment. According to Weinberger and McClelland (1990), the two general views of human motivation revolve around the traditional, behavioristic model, and the newer, cognitive model.

In the traditional model, researchers view humans as reacting to the environment in order to establish conditions in which "natural incentives" are available (McClelland, 1985). It is hypothesized that there are a limited number of these natural incentives, and when triggered, the individual receives a pleasurable effect or psychological high from the experience by



the body's release of neurohormones. Over time, individuals learn how to recognize conditions that lead to receiving this pleasurable effect. They therefore control this occurrence by adjusting their behavior. This ability to establish the requisite conditions and anticipate its effect serves as a goal for the individual. The goal state acts as the motive for an individual's behavior.

Those who subscribe to the more cognitive viewpoint of motivation tend to view the individual as interacting with the environment to achieve more desirable conditions of the self. Instead of reacting in response to biological needs, they hypothesize that individuals are aware of possible selves, and that it is the striving to achieve a better self that motivates human action.

Supporters of this viewpoint focus on the individual molding his or her self-schema. Markus (1977, 1983) proposed that each individual is aware of "possible selves" that he or she would like to become or avoid. Each of these selves carries with it a set of expectations and images of what attainment of that self would be like. These positive and negative expectations serve as incentives for individual actions. A similar viewpoint is proposed by Cantor who sees the self as interacting in a series of "life tasks" (Cantor, Markus, Niedenthal, & Nurius, 1986; Cantor, Niedenthal, & Langston, 1987). These life tasks are important issues which the individual sees as relevant at specific points in one's life. By striving for and achieving a life task, the individual is able to reach one of the mentally developed possible selves, and thereby attain the associated expectations.

Another issue within motivation theory examines how an individual responds to intrinsic and extrinsic motivational forces. These two states have been defined by Higgins and Trope (1990) as "engaging in an activity

as an end in itself (intrinsic motivation) and engaging in an activity as a means to an end (extrinsic motivation)" (p. 232).

This distinction is an important one, for researchers have found strong correlations between a student's source of motivation in the classroom and achievement scores (Deci & Ryan, 1985). These researchers determined that intrinsic motivation, as measured by student self-reporting and time on task, correlated to improved learning and persistence to the learning task. Extrinsic motivation, however, correlated negatively to these variables. They hypothesized that this difference occurs because extrinsic motivational techniques focus the child away from learning activities and toward receiving rewards.

Although students seem to prosper when intrinsically motivated, it is not feasible to exclude extrinsic motivation in classrooms where learning and behavioral skills are required to help students become competent members of society. When students are required to attend to activities they would not normally choose (such as memorizing multiplication tables), extrinsic motivational methods, such as grades, stickers, or threats, have been used to keep students on task. Over time, however, these methods tend to decrease any intrinsic interest the students may have brought with them, especially if they perceive the rewards as a method of control or coercion (Ryan, Connell, & Deci, 1985). In addition, the more closely the activity is linked to the reward, the less likely it will be done without supplying the reward.

Due to this limitation, researchers have attempted to identify methods to help reduce the amount of extrinsic motivation required by students to undertake nonmotivating tasks by increasing the student's level of intrinsic motivation. This process, known as internalization, has been

described by Deci and Ryan (1985) as "the process through which an individual acquires an attitude, belief, or behavioral regulation and progressively transforms it into a personal value, goal or organization" (p. 130). To foster the development of intrinsic motivation in the classroom, and to internalize extrinsic motivation, three conditions should be present (Ryan et al., 1985). First, students should perceive that they have control of the academic events. Second, they should feel competent in achieving the undertaken events. And third, the events should provide relevant informational feedback as to the student's autonomy.

Although not purposefully designed to meet these three criteria, mastery learning programs achieve all three. First, results on formative tests are used to determine if ensuing material will be used to remediate the students or introduce them to new concepts. Because students are cognizant that their results directly influence their progression through subject material, they may be provided with a feeling of control over the learning environment. Second, the structure of advancement through mastery learning programs should provide students with a sense of competence. Not only are students required to reach mastery on prerequisite material, but new material is presented in small incremental steps which are designed to be easily assimilated. Both factors should increase the competence level of students. Third, mastery learning programs are structured to provide students with abundant formative feedback on their mastery on the material. Because these results dictate future remediation and progression, students help decide the direction of their learning, and therefore may develop a sense of autonomy in regards to the learning progress.

## Studies Involving Mastery Learning and Locus-of-Control

In an analysis of students' perceived personal control in academic settings, Stipek & Weisz (1981) concluded that increasing students' perceived control in a learning environment tends to increase their motivation. In turn, a heightened motivational state increases children's academic achievement. From this relationship they propose that enhancing a student's perceived control in academic settings may be a better method to increase achievement results (through motivation) than trying to directly change the children's ability.

Methods to increase perceived personal control in academic venues have previously been cited (see Table 1). Of these methods, the mastery learning approach is the only one specifically structured to directly relate a student's test scores to academic progression. This direct contingency between a student's score and the ensuing direction of the academic progression into either remediation or new material may provide the setting in which students develop an enhanced perception of control over their learning environment. Although this relationship between mastery learning programs and ensuing alteration of perceived control is potentially important in regards to altering academic achievement, only five studies have been identified which examined this effect. Table 2 presents elements of these reports, including a description of the effectiveness of these programs.

One reason to verify the existence of this relationship is to provide new insight into the effectiveness of mastery learning programs. Documentation provided earlier in this review suggested that the success of mastery learning programs is due to additional time provided for students

to learn the material and not due to inherent changes in the way in which children attend to the academic setting (Arlin, 1984; Slavin, 1987). However, if changes are shown to also occur in students' perceived personal control in the learning environment, it may indicate that academic changes are occurring, not only due to additional time, but to changes within the individual. Unfortunately, previous studies have done little to resolve this conflict. The major problem uncovered during the review of literature was the inability of previous researchers to structure studies which effectively isolated mastery learning characteristics without allowing pronounced extraneous variables to interfere. The most common altercations occurred when a variety of instructors were used to teach students through a lecture format. Because of the lack of replicability of this procedure, it is highly improbable that students within the experimental and control groups received the same information. Discrepancies initiated by this format may have occurred because of changes in the coverage of the subject matter (i.e., differences in breadth, depth, organization, or elaboration) or in the delivery of information (i.e., differences in teacher enthusiasm, enunciation, pacing of the instruction, or guidance). With these variables potentially interacting with changes produced by the mastery learning technique, conclusions developed through an analysis of the results are at best tenuous.

The inability to isolate mastery learning characteristics as the independent variable was most evident in research studies by Benati (1986), Duby (1981), and Guskey et al. (1984). In each of these studies, students in the experimental and control groups were separated, were taught by different instructors, and received instruction primarily through the lecture format. The most noticeable lack of control with these variables was in the

Table 2

Studies Investigating the Potential Effect of Mastery Learning on Locus of Control

Authors	Year	Research Design	Instrument Used	Curricular Area	Unit of Analysis	Effect Size	N Size	Grade Level	Length of Treatment	Mastery level	Instruct format	Instruction delivery
Benati	1986	Pre/post comparison	IAR	Reading	Student	NA	46	3rd	7 weeks	Unknown	Group lecture	Different Instructors
Dertinger	1984	Solomon four block	IAR	Science	Student	0.62	58	6th	7 weeks	100%	Group lecture	Same Instructor
Duby	1981	Pre/post comparison	AAR	4 Different Content Areas	Student	0.60	189	College	18 week Semester	80%	Group lecture	Different Instructors
Guskey et al.	1984	Pre/post comparison	AAR	General Education	Student	0.35	34 Exp. 88 Cont.	College, mostly Juniors	Semester	90%	Group lecture	Different Instructors
Johnson & Croft	1975	Pre/post comparison	I-E scale	Personality	Student	0.24	179	College	Semester	Unknown	Individual	Work Packets

NA Pretest scores not given

AAR Adult Achievement Responsibility Scale

IAR Crandalls' Intellectual Achievement Responsibility Questionnaire

I-E Rotter's Internal-External Locus of Control Scale

1981 study by Doby, where a total of 8 instructors taught 13 different classes. Four instructors taught seven mastery learning classes and four instructors taught six traditional classes. The 13 classes represented 4 subject domains. Although the researcher paired-up mastery and control groups from the same domain to analyze results, there is no indication that instructors coordinated their teaching, taught the same subject material, or had similar objectives to direct their teaching. The conclusion that students in the mastery learning programs significantly altered their perceived control toward internality (with a mean standard effect size of 0.60) is suspect due to the numerous confounding variables.

In the Benati study (1986), the research was conducted with one experimental and one control group. Each group was taught by a different instructor. Although both instructors used the Houghton Mifflin basal reader as their source material, the majority of instruction was conducted through a lecture mode. Because teachers were using the same textbook with identical competency test, this setup appears more sound than that used by Doby. But because of the small number of subjects, and the fact that lectures by different teachers were the primary means of delivering instruction, the results may not represent the change produced by mastery learning alone.

Guskey et al. (1984) appear to have done the best to isolate potentially interfering variables. Although seven different instructors were employed to teach two experimental and five control groups, all instructors were provided with a set of terminal objectives to direct their teaching. In addition, the sequence of topics, course content, and activities included in the course were specified. However, because lectures and discussions were again used as the main mode of instructional delivery, there is a high

probability that the information delivered to the groups was not equivalent. In addition, the instructors who taught the mastery learning classroom volunteered for that assignment. This may also have biased the results.

The Johnson and Croft (1975) research did not have the problem of controlling differences in instruction between the control and experimental groups. They accomplished this by failing to include a control group. Therefore, changes in the locus-of-control construct may have been due simply to maturation of the students or the influence of the topic under study. In addition, only 137 of 179 students completed the course, indicating an attrition level of 23%. Because earlier studies (Caponigri, 1981; Clark et al., 1983) indicated that levels of attrition by students in mastery-based classrooms are lower than nonmastery classrooms, this large attrition level raises questions as to the quality of the instructional units.

The Dertinger study (1984) was the only research study conducted where students from both groups received fairly consistent material. Although lectures were used as the main dissemination mode in four classes, each class was composed of an equal number of students assigned to both the control and experimental groups. Although this reduced the problem of students not receiving equal instruction, other problems were evident. Students in the experimental group, after taking a quiz and not reaching mastery, were sent to the back of the room to continue studying the material. Control students in the same classroom were not required to go to the back of the room on failing to reach mastery. Because of the discriminatory actions by the teacher between the experimental and control groups, results generated may have been clouded.

In 1976, Rotter proposed that an individual's perception of control is dependent upon both situational variables and a general expectancy. When



situations are novel or ambiguous, the individual's general expectancy contributes most strongly to the perception of control. As experience is gained, situational variables begin to overshadow the generalized expectancy. In the five studies reviewed, all reported a change in the students' orientation towards internality. But how meaningful was the change? Alterations in the students' perception of control due to participating in a mastery learning program may have been isolated within the context of the situation, or may have been related to a change in the more global generalized expectancy of the students. Because none of the studies collected data beyond the initial posttest, the answer to this question could not be determined.

#### Studies Involving Mastery Learning and Goal Setting

Documentation was provided earlier in this review that identified a strong correlation between difficult, specific goals and increased academic achievement. When an individual adopts a goal believed to be within his/her capability, and feedback on his performance is provided, the individual often makes a comparison between performance and the goal. This comparison creates an incentive for the individual to persist at the task in hopes of obtaining the satisfaction of reaching the valued goal. Even when goals are imposed from an external source, individuals often construct personal goals which provide self-satisfaction and help prolong motivation (Bandura, 1989). In the work environment, motivating individuals through goal setting has "demonstrated more scientific validity to date than any other theory or approach" (Pinder, 1984, p.169).

Goal theory stipulates that both elements, the criteria to develop the personal challenge and the feedback required to evaluate the effectiveness of the individual's actions, be present for cognitive motivation to sustain an activity. Although both of these components are an integral part of mastery learning programs, I have not located any studies that examine the impact of goal setting within this type of program.

### Summary

The implementation of mastery learning programs differs from traditional instruction in that it requires the achievement of a predefined level of mastery on one instructional unit before advancement to the next unit is permitted. This characteristic, along with the division of instruction into small units, frequent assessment, and remediation on nonmastered units, provides a structure which allows students in mastery learning programs to score higher than students in nonmastery learning programs on a variety of instruments designed to measure cognitive and affective gains. Researchers propose a variety of reasons for this phenomenon. Proponents of mastery learning state that these improved test scores are due to internal changes within the individual, such as increased motivation, increased active learning time, and improved self-concept. Critics, however, state that these improved scores are simply a reflection of the additional teaching time provided to students in mastery learning programs.

To help shed light on the question of mastery learning effectiveness, I examined three areas. I first examined the relationship between students' participation in mastery learning programs and alterations in their locus-

of-control orientation. Because progression through course material in mastery learning programs is based directly on student results, participation in these programs may provide students with a feeling of enhanced personal control over their academic environment. This may be important because scores which reflect an internal locus-of-control orientation have been correlated positively to high academic achievement. Although research has demonstrated that altered locus-of-control orientation is possible through various academic and social situations, studies examining changes due to mastery learning programs are inconclusive due to their inability to effectively isolate mastery learning variables without permitting extraneous variables to compromise the results. The most notable extraneous variable identified in the located studies was the inconsistency of instructional variables within the experimental and control groups.

Secondly, I examined the relationship between an individual's goals and achievement. It was found that specific goals that were difficult to achieve correlated positively to higher levels of achievement. This is potentially important to mastery learning research because a critical attribute of these programs is the establishment of levels of performance which are used to determine the routing of students through the academic material. This level of achievement may act as a goal for students to strive towards. If this occurs, the goal may increase student motivation and be reflected in heightened academic achievement. Unfortunately, no studies have been identified which examine this relationship.

Finally, I examined relationships between mastery learning programs and student motivation. In particular, I examined the setting of external levels of achievement for student progression through instructional

material in light of information on extrinsic and intrinsic motivation. It appears that externally set levels for student progression by the teacher would not be a deterrent to building intrinsic motivation as long as three variables were satisfied: first, students should perceive personal control of the instructional situation; second, they should receive feedback as to their control, and third, they should feel competent to achieve at the preestablished goal level. It is proposed that mastery learning programs satisfy these three requirements.

## CHAPTER III METHODS

### Research Design

Hypotheses 1 through 5 and Hypothesis 7 were tested using a pretest-posttest, control-group design with random assignment of classes to treatment groups (Cook & Campbell, 1979). Testing hypothesis 6 (see Table 5) involved a quasi-experimental, pretest-posttest, nonequivalent-control-group design because classes were not randomly assigned to the control group. The results from studies using quasi-experimental designs have limitations in the interpretation of statistical significance (Shaver, 1992). These limitations are discussed in the data analysis section.

The study was conducted during the winter of 1991 and 1992 and consisted of two treatment groups and one control group at each of three sites. All students were measured on their knowledge of fractions, locus-of-control orientation, and goal setting characteristics prior to the implementation of the treatment. Students in Treatment 1 and Treatment 2 then received instruction on concepts and manipulation of fractions via an instructional videodisc. Students in the control group were provided with their regular grade-appropriate mathematical instruction, which included whole numbers, decimals, and fractions.

### Research Sites

Site 1 and Site 2 consisted of two classes of fifth-grade students (randomly assigned to the two treatment groups), and one class composed of both fifth- and sixth-grade students (used as the control group). Site 3

consisted of three classes of fifth-grade students which were assigned to the two treatment groups and one control group.

My intention had been to randomly assign all classes to either the treatment or control groups (Campbell & Stanley, 1963). Of the nine classes participating in the main experiment, six were randomly assigned to Treatment 1 and Treatment 2. Two of the remaining three classes, because of their approaching off-campus time in the year-round scheduling, were designated as control groups. This configuration allowed the experimental groups at both of these sites to better parallel their implementation of the instructional program.

Two classes included students from both fifth and sixth grade. Because the sixth-grade students had received instruction in fractions the previous year, only students currently enrolled as fifth graders were included in the sample. These combined classes were located at Sites 1 and 3, and served as control groups.

All sites used random assignment to place students into classrooms. At Site 1, however, eight students with limited English proficiency had been assigned into the classroom that served as Treatment 2. Although this violates an assumption of randomization in experimental research, it was not considered a large threat due to the small number of students assigned to this class.

### Subjects

All subjects were upper-elementary, public school students from urban areas who had previously received minimal instruction in fractions. In a comparison between the study population and the national population,

a notable difference was identified in the percentage of Hispanic students. Whereas the national percentage of Hispanic students is about 10.5% (Lowry, 1989), the overall total of Hispanic students in the study was 52% at Site 1, 13% at Site 2, and 25% at Site 3.

Grade equivalent differences between the population under study and the national norm were compared using test scores of the Comprehensive Test of Basic Skills, Fourth Edition (CTBS/4)-Level 14. Whereas the national normative score for fifth-grade students on the CTBS/4 is 5.9, the study sample's CTBS/4 scores were 6.25. Viewed together, these scores indicate that, although ethnic origin comparisons demonstrate differences between the study population and national population, grade-equivalent scores demonstrate an academic parallel between the two populations.

The State of California requires that all public school students be instructed in accordance with the California State Educational Framework. The Framework mandates that instruction in fractions occur during the fifth grade. Therefore, informed consent was not required for students participating in the *Mastering Fractions* videodisc instruction (Systems Impact, 1986a). Permission was required, however, for students to complete the locus-of-control and goal setting measures. Of the 232 students available in Sites 1, 2, and 3, 225 (97%) returned the parental permission letter (see Appendix A). During the course of the study, 33 cases were lost by improper posttest administration to a control group by one of the assistants. At all sites, the tests administered at pretest and posttest were spread over a two-day period. The number of respondents who took both the pretest and posttest of the different instruments is shown in Table 3. In the test-retest experiment of the goal setting instrument, a sample of 84 students was used. Three cases were omitted due to illness.

Table 3

Sample Sizes of Students Taking Both the Pretest and Posttest

Group	Achievement	Locus-of-control	Goal setting
Treatment 1	77	80	80
Treatment 2	73	74	73
Control	19	32	31

Pretest Equivalence of Treatment and Control Groups at Pretest

Prior to treatment, four comparisons were made to identify initial equivalence of the groups (see Table 4). The analyses indicated that gender differences, subject-domain achievement scores, and goal setting characteristics were comparable. The analysis of variance on locus-of-control orientation, however, identified a statistically significant difference. Scheffé's test of multiple comparisons identified this difference to exist between Treatment 1 and Treatment 2. The final analysis used pretest scores as the covariate to statistically adjust for these differences.

Table 4

Pretest Differences Between Groups

Pretest measure or condition	Level of Significance
Distribution by sex	$p > .25$
Subject-domain achievement tests	$p > .25$
Locus-of-control orientation	$p < .05$
Goal setting characteristics	$p > .25$



## Instruments

### Goal Setting Measure

In chapter II of this report, research studies and results were described in which goals and goal components were altered to identify ensuing changes in achievement levels. However, I could not locate any studies in which goal setting was studied as a dependent variable. The only goal setting questionnaire I could identify had been developed to identify goals of adults in work environments (Locke & Latham, 1990). Because of these limitations, I found it necessary to generate a new goal setting instrument. The purpose of the developed instrument was to identify goal setting characteristics of fifth-grade students and how these characteristics may be altered when students are aware that they are participating in a mastery learning program. As a basis for the instrument, I incorporated relevant aspects of the Locke and Latham goal setting questionnaire (1990) and personal communications with Edwin Locke (1991).

To help establish the validity and reliability of the goal setting instrument, two groups of teachers and students were solicited in the spring of 1991 to participate in formative evaluations on an early version of the instrument. After administering and discussing the test with the students, the teachers provided suggestions regarding the face validity and phrasing of the questions. Their input was used to develop a second version of the instrument. The second version was used during the fall of 1991 with students in a test-retest situation. The time between the test and retest was 13 days. It was determined that this time period would be long enough for the students to forget previous answers to questions, but not so long that maturation would alter their responses. The instrument was revised to

produce a third version, which was then used during the primary study (Appendix B).

Responses on items 2, 6, 7, 9, 10, 12, 16, 17, 23, 25, 27, 28, 29, 30, and 32 are scored 1 to 5 from left to right. Responses on items 33 to 42 are scored 1 to 10 from left to right, then divided by 0.5. All other responses are scored 5 to 1. Scores range from 37 to 185, with a high score indicating a high level of goal setting in the academic area of mathematics. From the sample of 184 students who took the final version during the pretest, a reliability value of .85 for internal consistency was identified by using Cronbach's alpha (Norusis, 1990). Version 2, which included 40 of the 42 questions on the final version, had a reliability level of .83 on the test-retest correlation after 13 days. A test-retest correlation, conducted on the final version of the goal setting instrument for the control group, was calculated at .65 over a mean time span of 12 weeks.

#### Locus-of-Control Measure

The *Academic Achievement Accountability Scale* (Clifford & Cleary, 1972) was chosen for the locus-of-control measure for two reasons (Appendix C). First, the reliability of this test has been determined to be .63-.85 for internal consistency and .83 for test-retest. This is higher than the majority of locus-of-control measures identified by Steipek and Weisz (1981) in a review of locus-of-control measures. Second, the test has been specifically designed to measure locus-of-control orientations for students in grades 2-6. Because researchers have found that locus-of-control measures are specific to age groups and subject domains for which they have been designed, it was felt important to use one designed for school-aged children. Responses on items 2, 5, 9, 13, 15, and 16 are scored 1 to 5

from left to right. All other responses are scored 5 to 1. Scores range from 18 to 90, with a high score indicating acceptance of responsibility for academic outcome (i.e., an internal locus-of-control). Students with posttest scores higher than pretest scores are considered to be moving towards a more internal locus-of-control orientation, and those who score lower on the posttest are considered to be moving towards a more external locus-of-control orientation.

### Achievement Tests

All sites in the main study used the criterion-referenced fractions test developed by Systems Impact Corporation to measure student academic levels. This test was chosen over a standardized test due to the desire to measure specific knowledge gained, and not more permanent and stable knowledge which is assessed in standardized tests (Anderson & Burns, 1987).

This test comprises 60 items which cover concepts and skills of fractions. Because the test is structured as a criterion-referenced test, pretest results identified low scores and low variability. Previous test-retest over 90 days revealed a correlation of .67 for the test, and a correlation of .56, with percentage correct scores, on the Comprehensive Test of Basic Skills (Lowry, 1989). Lowry suggests that this low correlation is due to the floor effect of the criterion-referenced test.

### Instructional Program

During the time that the experimental groups were using the *Mastering Fractions* videodisc program, control group teachers continued with their daily instruction in all subject areas normally covered in fifth

grade. Mathematics instruction centered on whole-number, decimal, and fraction concepts and skills. Activities were based on normal classroom teaching, and included worksheets, lectures, discussions, manipulables, quizzes, games, and tests.

The experimental groups received their mathematics instruction via a six-sided instructional videodisc program. To implement the program properly, the developers established a set of required equipment, materials, and classroom organization. The hardware requirements included a videodisc player with remote control capable of playing Level I interactive videodiscs, a television monitor with a screen large enough to be read by all students from their seats, and an audio system loud and clear enough to be heard by all students. Consumable worksheets, paper, and pencil were required for all students. In addition, a teacher workbook was provided which had tips for classroom organization, test and quiz masters, answer keys, and copy masters for student classwork and homework.

The *Mastering Fractions* program consists of 35 lessons which instruct students on recognizing, adding, subtracting, multiplying, dividing, writing, and reducing fractions. Lessons are designed to be completed in approximately 30-40 minutes. The lessons include instruction, testing, and remediation based on weaknesses determined by student responses.

Student understanding is checked through oral responses, quizzes, and mastery tests. Oral responses are requested throughout most lessons to check understanding on the simpler concepts. Teachers are instructed to listen to the choral response of the students to determine whether the program should be continued or halted. When students have consistent trouble with these skills or concepts, the teacher is requested to stop the program, repeat the demonstration, and check again for student

understanding. These choral responses are used to check knowledge on small steps of information. Eventually, this knowledge develops into larger strategies for problem solving with fractions.

Unlike most academic programs, which use quizzes to formulate student grades, the quizzes in the *Mastering Fractions* program are used to determine the sequence of ensuing material. These quizzes are used as the opening sequence in most lessons to identify whether information from previous lessons has been retained. In addition, most lessons contain two or more additional quizzes to check understanding of new material.

Mastery tests, containing approximately 40 questions, are given after five lessons. Both quizzes and tests are followed by suggestions as to the next instructional material based on specific strengths and weaknesses of students. It is suggested that teachers determine the level of understanding by circulating among the students and checking scores, or by checking their show of hands. When 80% of the students demonstrate mastery on the questions used in a particular quiz or test, the class progresses to the next unit. When less than 80% master the material, a remediation branch is suggested by the program to reinforce the concept or skills not mastered. The remediation material is often followed by another quiz. A test is used at the completion of the program to identify comprehension of the instructional material.

Previous research with the *Mastering Fractions* program indicated that results depend on how well teachers implement the program according to the established guidelines (Hasselbring, Sherwood, & Bransford, 1988; Lowry, 1989). Hasselbring and associates noted that various levels of implementation can occur because of classroom conditions, how well

teachers are trained to use the program, and the willingness and ability of the teacher to learn and use the recommended procedures.

To help the teachers implement the program as intended, guidelines for the proper use of the program and equipment were provided in the *Instructor's Manual to Mastering Fractions* (Systems Impact, 1986b). In addition, I offered suggestions to the teachers gained from observations and experience in working with this and other programs from System Impact Corporation. These guidelines and suggestions pertained to the organization of the classroom, presentation of the lesson, evaluation of students, and use of the equipment. This material was covered during an in-service training with the teachers before the program was implemented. In addition, site visits were conducted during the program implementation to identify how well the teachers were implementing the program. At the conclusion of each site visit, I offered suggestions as to how implementation could be improved.

#### Procedures

Measures were conducted by the researcher with help from assistants. Test administrators were provided with written information on testing protocol as well as verbal instruction from the researcher. Students in Treatment 1 (informed students) were told that they would be participating in a mastery learning program. As such, it was stressed that their answers to quizzes and tests would be used to determine their routing through the instructional material. At the end of each formative quiz and lesson test, they viewed a screen on the monitor which stated the criteria used to determine if the next instructional sequence would be a progression

or remediation sequence. A rendition of the monitor with a branching video screen from Lesson 4 is shown in Figure 1. Teachers were asked to reinforce students periodically with the idea that progression through the material was determined by their success on the quizzes and tests.

If 1st time through and:	
less than 1/5 of the students missed problem 2 . . . . .	Step
more than 1/5 of the students missed problem 2 . . . . .	Ch 5
If 2nd time through . . . . .	
	Ch 12
If remedy for Lesson	
5. Test . . . . .	Ch 13

Figure 1. Branching screen from Lesson 4 detailing the criteria for remediation or progression and the location for ensuing instruction.

Students in Treatment 2 (not-informed students) received the same instruction in fractions as students in Treatment 1 with one exception: students in Treatment 2 did not see the branching screens nor were they informed that they were participating in a mastery learning program. Treatment 2 students were told that the teacher was making a non-criterion-based decision on their progression or remediation. This was accomplished by giving Treatment 2 teachers a detailed printout of all branching points, the criteria that determined the routing of the students,

the frame addresses for the ensuing instructional sequence, and having the teachers stop the videodisc program before the branching screen appeared on the screen. In addition, teachers who used the Pioneer LDV-2200 videodisc player were provided with bar code printouts which could be used to access the next sequence (see Figure 2).





Lesson 4		Chapter-Frame
CSP		(05-05404)
Criteria:	Remote	Bar Code
If first time through and:		
Work OK on problem 2	Ch 6 Search	
Remediate problem 2	Ch 5 Search	
If second time through:		
If remedy for Lesson 5 Test:	Ch 12 Search	
	Ch 13 Search	

Figure 2. Branching guide identifying location of program, criteria to use for remediation or progression decisions, search procedure to use with remote control, and search code to use with bar-code reader.

Although the instructional program contained 35 lessons, teachers stated from the onset that they would not be able to complete the program because of the time requirement. It was decided that the teachers would complete lessons 1-20 before giving the posttest. By omitting the final 12 lessons, the concepts of dividing by fractions and working with mixed numbers were not included. Because the California State Framework does not include these concepts in the fifth grade, it was felt that completing the program at this lesson would satisfy the state requirement as well as the teachers' concern about the time requirement to implement the program.



When students had completed the assigned instructional material, posttests were conducted using the same procedures as during the pretest.

## Data Analysis

### Statistical Analysis

In establishing this study, existing classes of students were randomly assigned to one of two treatment groups. Random assignment was not used with the control groups. Hypothesis 6 is the only hypothesis comparing treatment groups to control groups, and is considered quasi-experimental. Two limitations of quasi-experimental studies will be addressed before an analysis of the data is shown.

First, all statistical significance results reported within quasi-experimental studies should be interpreted with caution. Most of the tests used here, such as analysis of variance and covariance, are based on the idea that the population was randomly sampled and assigned. Because random assignment was not used with the control group, there is no way to insure that the identified significance levels and probabilities are valid.

Second, without random assignment, generalizability is limited. This occurs because there is no insurance that the sample is representative of the population from which it is drawn as specified by the null hypothesis (Shaver, 1992). Without random assignment, generalization cannot go beyond the sample in the study.

Table 5 contains a summary of the analyses by hypothesis. All analyses were conducted using *SPSS for the Macintosh* (Norusis, 1990).

Table 5

Summary of Hypotheses, Measures, and Analyses

Hypothesis	Measures	Analysis
1. Informed-group students will have significantly greater adjusted posttest mean scores on the subject-domain achievement tests than will students in the not-informed group.	Criterion-referenced mathematics test.	Analysis of covariance; gain score differences. Standardized mean score effect sizes.
2. Informed-group students will achieve significantly higher internal locus-of-control scores than students in the not-informed group	<i>Academic Achievement Accountability Scale.</i>	Analysis of covariance; gain score differences. Standardized mean score effect sizes.
3. Within the informed group, there will be significant differences in locus-of-control mean scores among low, medium, and high achievers.	Criterion-referenced mathematics test. <i>Academic Achievement Accountability Scale.</i>	Two-way analysis of covariance; gain score differences. Standardized mean score effect sizes.
4. Informed-group students will achieve significantly higher goal setting levels than students in the not-informed group.	Author-produced goal setting measure.	Analysis of covariance; gain score differences. Standardized mean score effect sizes.

(table continues)

5. Within the informed group, there will be significant differences in goal setting mean scores among low, medium, and high achievers.	Author-produced goal setting measure.	Two-way analysis of covariance; gain score differences.  Standardized mean score effect sizes.
6. The adjusted posttest mean scores of both the locus-of-control measure and goal setting measure will be significantly greater for treatment groups than the control group.	<i>Academic Achievement Accountability Scale.</i> Author-produced goal setting measure.	Analysis of covariance; gain score differences.  Standardized mean score effect sizes.
7. A positive correlation will exist between achievement scores and locus-of-control scores, and between achievement scores and goal setting scores for the informed group.	<i>Academic Achievement Accountability Scale.</i> Criterion-referenced mathematics test. Author-produced goal setting measure.	Pearson product moment correlation between achievement change scores and locus-of-control change scores, and between achievement change scores and goal setting change scores.

### Statistical and Educational Significance

The main emphasis of the study is to identify whether students' academic achievement, locus-of-control orientations, or goal setting characteristics are altered because of knowledge of participating in a mastery learning program. Therefore, the "student" has been chosen as the unit of analysis.

Statistical significance estimates are calculated and reported for each analysis to assist the reader in interpreting the results. Probability levels of .05 or greater are considered statistically significant. As noted by Shaver (1992), however, statistical significance is often misconstrued as relaying information about the worth of the study. Its purpose, however, is to simply state the probability of the occurrence in the long run under the null hypothesis, and is strongly dependent on sample size. As Shaver pointed out, "to know only whether a result is statistically significant tells one virtually nothing about the magnitude or importance of the result" (1992, p. 16). Correspondingly, educational significance is considered more important than statistical significance and is included in each analysis. Educational significance was estimated by calculating the standardized mean difference effect size for each analysis. The standardized mean difference effect size between groups is calculated by dividing mean differences of the posttest for both adjusted and unadjusted scores by the standard deviations of the scores from the untreated groups (the pooled standard deviation of all pretests and the control group posttest). Standardized mean differences allow comparisons between widely disparate studies.

A priori levels for educational significance could not be established because of the lack of existing literature on using mastery learning programs to modify goal setting and locus-of-control orientations. Tallmadge (1977) suggested that an effect size of 0.25 can be considered educationally significant.

## CHAPTER IV

### RESULTS AND DISCUSSION

#### Introduction

In this chapter I discuss the results of the study as they relate to the seven hypotheses presented in Table 5, chapter III. As noted in chapter I, the basic premise being explored is that when students know they are participating in a mastery learning program, they will exhibit changes in their level of academic achievement, internal locus-of-control orientation, and goal setting level which will be greater than students not knowledgeable of participating in a mastery learning program. This section of the report is organized by the hypotheses as listed in Table 5.

As shown in Table 6, Sites 1, 2, and 3 implemented the *Mastering Fractions* program at different times during the school year. This time differential was due to the limited availability of the videodisc players and the instructional program as well as the teachers' and school administrators' decisions on when the program would best fit their established curriculum. Although the sites implemented the programs at different times, attempts were made to insure that both treatment groups at each site used the material concurrently.

Table 6

Testing and Treatment Dates

Location	Class Number	Group	Pretest	Posttest	Instructional Time
Site 1	1	Treatment 1	1/15/92	3/19/92	45 days
	4	Treatment 2	1/8/92	2/26/92	36 days
	7	Control	1/6/92	3/5/92	43 days
Site 2	2	Treatment 1	1/17/92	4/23/92	68 days
	5	Treatment 2	1/21/92	6/12/92	104 days
	8	Control	1/17/92	5/5/92	77 days
Site 3	3	Treatment 1	2/26/92	5/20/92	61 days
	6	Treatment 2	2/26/92	4/24/92	43 days
	9	Control	2/26/92	Not given	N.A.

Differences in the amount of time required to implement the *Mastering Fractions* program occurred at each site and were caused by one or more of three variables. First, although the *Mastering Fractions* program is designed to be teacher led, the progression, remediation, and completion are based on student success. Teachers were asked to use a student mastery level of 80% to determine advancement of the class. Because student responses among groups were not identical, the time required to complete the program differed at each site.

Second, conflicts at each school precluded keeping the groups together. The most noticeable conflict occurred in the year-round school system implemented at Sites 1 and 3. This administrative structure mandates that classes alternate in taking a leave of absence for up to 6 weeks. Although the dates for the experiment were chosen to minimize the

conflict, the configuration caused a postponement for the program at both sites. An additional postponement occurred at Site 2 when the videodisc player was stolen. Only Treatment 2 had completed the program at the time of the theft. More than two weeks passed before an additional videodisc player could be borrowed from another school to resume the program.

The third reason for differences in instructional time was teacher reluctance to incorporate the program on a daily basis. At Sites 2 and 3, teachers were "volunteered" to participate in the program by their building principal. From personal discussions with the teachers at these sites, it was evident that many felt that they had been coerced into participating in the program, that the program required too much instructional time for their schedule, and that they had "done their best" to fit it in.

Prior to conducting the analysis, a concern was identified as to the amount of time the groups were taking to implement the instructional program. The *Mastering Fractions* videodisc is designed so that teachers can complete one lesson each day, approximately 30-45 minutes of instruction. Because this study was structured to include the first 20 lessons, without interruptions the instruction should have been completed in 20 days. As is shown in Table 6, however, the time interval for the groups was much greater. Previous research conducted by Hasselbring et al. (1988) and Lowry (1989) identified statistically significant correlations between the level of implementation and changes in achievement. If the time delay in the completion of the program was due to poor implementation, results may reflect not only the influence of the independent variable, but also a lack of proper implementation.

Again, as shown in Table 6, treatment classes at both Sites 2 and 3 exhibited large differentials in the time required to complete the instructional material. At Site 2, the Treatment 2 class (Class 5) required 53% more time to complete the instructional product than the Treatment 1 class. Part of the delay was caused by the theft of the videodisc player. During this time, the teacher continued to instruct her students in the concepts and manipulation of fractions. This extra instruction between the pretest and posttest may be partially responsible for the gains exhibited by this class. This class had gains of more than 43% above any other Treatment 2 class.

The class at Site 3, Treatment 1 (Class 3) took 43% longer to complete the instructional material than the Treatment 2 class at the same site. From discussions with this teacher at the completion of the study, it was apparent that she had participated in the program only because it had been required by her school principal. Previous studies have not only shown large gains in the criterion-referenced test at the completion of the program (Hasselbring et al., 1988; Lowry, 1989), but that the level of implementation effects gain score differences. Because Class 3 had gain score differences at least 20% lower than all other classes, and because the teacher admitted her reluctance to participate in the study, a concern was raised as to whether this class should be included in the analyses.

Furthermore, the major purpose of this study was to use an instructional program that would help insure consistency of instructional variables across classes and that had consistently resulted in high achievement, and then to examine locus-of-control and goal setting under different conditions in the presence of controlled instruction and high achievement. Because achievement resulting from use of *Mastering*



*Fractions* is closely related to implementation level, classes that show large deviations from prescribed implementation should be used with caution. For this reason, results will be shown which both include and exclude Classes 3 and 5.

All but one of the following analyses compare Treatment 1 and Treatment 2 scores. Control group scores are used in an analysis of covariance only in Hypothesis 6. They are included in the descriptive statistic tables in the other hypotheses for both comparison purposes and because the control group standard deviations are used for calculating effect sizes.

#### Hypothesis 1

Hypothesis 1: Informed-group students will have significantly greater adjusted posttest mean scores on the subject-domain achievement tests than will students in the not-informed group.

To conduct this analysis, mean scores, standard deviations, gain score differences, and adjusted mean scores were calculated for both groups on scores from the mathematics pretest and posttest. Descriptive statistics are shown in Table 7. The means and standard deviations for each of the classes have been calculated to point out changes in achievement in relation to time required to complete the instruction.

Table 7

Treatments, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on Achievement Tests

Groups	Pretest		Posttest		Gain	Adjusted Mean	n-size
	Mean	SD	Mean	SD	Mean		
Treatment 1 (informed)	19.64	11.77	52.96	14.28	+33.31	52.97	77
Site 1: Class 1	23.58	11.41	58.08	12.96	+34.50		26
Site 2: Class 2	16.38	14.34	60.04	11.96	+43.67		24
Site 3: Class 3	18.78	8.42	52.96	14.28	+22.96		27
Treatment 2 (not-informed)	19.71	11.83	52.66	9.82	+32.95	52.64	73
Site 1: Class 4	29.42	11.60	58.07	8.86	+28.64		28
Site 2: Class 5	11.11	6.25	51.41	8.08	+40.29		27
Site 3: Class 6	17.5	6.42	46.11	9.38	+28.61		18
Control	21.10	14.46	28.52	11.71	+7.42		19
Overall	20.38	12.67	50.63	14.01	+30.25		169

Table 8 shows descriptive statistics for each treatment with and without Classes 3 and 5 included.

Table 8  
Treatments, Unadjusted Mean Scores, Standard Deviations, Adjusted  
Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores  
on Achievement Tests With and Without Classes 3 and 5

Groups	Pretest		Posttest		Gain Mean	Adjusted Mean	n-size
	Mean	SD	Mean	SD			
All Classes							
Treatment 1	19.64	11.77	52.96	14.28	+33.31	52.97	77
Treatment 2	19.71	11.83	52.66	9.82	+32.95	52.64	73
Control	21.10	14.46	28.52	11.71	+7.42		19
Total	20.38	12.67	50.63	14.01	+30.25		169
Class 3 and 5							
Omitted							
Treatment 1	20.12	13.29	59.02	12.40	+38.90	60.33	50
Treatment 2	24.76	11.44	53.39	10.73	+28.63	51.97	46
Control	21.10	14.46	28.52	11.71	+7.42		19
Total	22.14	12.86	51.73	15.73	+29.59		115

Before program implementation began, pretest scores were obtained. Although Scheffé's test of multiple comparisons did not identify statistically significant differences on scores from the achievement tests, an analysis of covariance was conducted to help equate initial differences which may have existed. In the analysis of covariance, achievement pretest scores were used as the covariate. Results of this analysis are shown in Table 9 with all sites included, and in Table 10 when Classes 3 and 5 are excluded.

Table 9

ANCOVA Table of Academic Achievement Change by Treatment Group  
with Pretest Scores as Covariate: All Classes

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of 1-tail F
Covariate: Pretest scores	6298.40	1	6298.40	57.35	.000
Treatments	4.30	1	4.30	0.04	.442
Explained	6302.69	2	3151.34	28.70	.000
Within groups	16144.09	147	109.82		
Total	22446.77	149	150.65		

The information from Table 9 indicates that the observed differences are not considered statistically significant because the chance of achieving these results under the null hypothesis with the sample size shown is greater than .05. The standardized mean difference effect sizes of 0.02 for raw mean scores and 0.03 for covariance adjusted mean scores are negligible.

When Classes 3 and 5 are excluded from the analysis of covariance (see Table 10), the observed differences are considered to be statistically significant at the .001 level.

Table 10

ANCOVA Table of Academic Achievement Change by Treatment Group  
with Pretest Scores as Covariate; Classes 3 and 5 Omitted

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of 1-tail F
Covariate: Pretest scores	4181.29	1	4181.29	50.66	.000
Treatments	1617.13	1	1617.13	19.59	.000
Explained	5798.42	2	2899.21	35.12	.000
Within groups	7676.57	93	82.54		
Total	13474.99	95	141.84		

The inclusion or deletion of Class 3 and Class 5 greatly alters the analysis and ensuing conclusions for Hypothesis 1 (see Table 8). When the classes are deleted, the standardized mean difference effect size increases from 0.02 to 0.43 for raw mean scores and from 0.03 to 0.63 for covariance adjusted mean scores. This relatively large effect size generated by students who know they are accountable for class progression in mastery learning classes parallels the ideas of Locke and Latham (1990) who concluded that specific goals lead to increased performance over no goals or general goals. These effect sizes also parallel previous research by Lowry (1989) and Hasselbring et al. (1988).

#### Hypothesis 2

Hypothesis 2: Informed-group students will achieve significantly higher internal locus-of-control scores than students in the not-informed group.

Descriptive statistics were calculated for both treatment groups on locus-of-control scores from the *Academic Achievement Accountability Scale* (Clifford, 1976) and are shown in Table 11.

Table 11

Treatments, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on Locus-of-Control Tests With and Without Classes 3 and 5

Groups	Pretest		Posttest		Gain Mean	Adjusted Mean	n-size
	Mean	SD	Mean	SD			
All Classes							
Treatment 1	74.92	7.66	74.39	9.76	-0.54	72.95	80
Treatment 2	70.12	9.96	68.52	12.93	-1.59	70.07	74
Control	71.31	8.36	70.25	9.40	-1.06		32
Total	72.29	9.07	71.34	11.35	-1.05		186
Class 3 and 5							
Omitted							
Treatment 1	74.13	7.50	75.68	9.65	+1.55	74.74	47
Treatment 2	68.78	6.78	67.68	10.89	-1.10	68.75	41
Control	71.31	8.37	70.25	9.40	-1.06		32
Total	71.55	7.79	71.50	10.55	-0.05		120

The standardized mean difference effect size for raw mean scores was calculated at 0.64 with all classes included. An analysis of covariance was conducted using locus-of-control pretest scores as the covariate. Results are shown in Table 12 for all classes and Table 13 when Classes 3 and 5 are omitted.

Table 12

ANCOVA Table of Locus-of-Control Change by Treatment Group with  
Pretest Scores as Covariate: All Groups

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of one-tail F
Covariate: Pretest scores	5598.35	1	5598.35	55.79	.000
Treatments	296.53	1	296.53	2.96	.044
Explained	5894.88	2	2947.44	29.37	.00
Within groups	15152.83	151	100.35		
Total	21047.71	153	137.57		

The information from Table 12 indicates that there is a statistically significant difference between the adjusted posttest mean scores when all classes are included. The standardized mean difference effect size was calculated at 0.32 for adjusted mean scores.

Previous researchers, as discussed in chapter II, indicated that students alter their locus-of-control scores towards a higher internal orientation after participating in a mastery learning program (a higher score on the locus-of-control posttest). When all classes are considered, students from both treatment groups had lower posttest mean scores than pretest mean scores. Therefore, earlier findings were not confirmed in this aspect of the analysis. However, students knowledgeable of participating in the mastery learning program did exhibit less of a change towards an external orientation than students in the not-informed group. Because all groups shifted toward the external end of the locus-of-control measure, confounding variables may have been altering student perceptions

of control. It is speculated that this alteration may have been due to students experiencing less perceived academic control as the school year progressed and final grades approached. The effect size of 0.32 for adjusted scores for a less external score by the informed students is slightly lower than the median effect size of 0.40 by students in mastery learning programs shown in Table 2.

When the two classes with the implementation problems are excluded, the analyses of covariance (see Table 13) yields a one-tailed statistical significance at the .01 level, the standardized mean difference effect size for the raw scores is 1.00, and the standardized mean difference effect size for the adjusted scores is 0.75. The exclusion of these two groups increases both the level of statistical significance and effect sizes for both the raw and adjusted scores. Also noticeable when the two aberrant classes are excluded is the movement of the Treatment 1 students towards an internal locus-of-control orientation (see Table 11), which parallels findings in previous research.



Table 13

ANCOVA Table of Locus-of-Control Change by Treatment Group with  
Pretest Scores as Covariate; Classes 3 and 5 Omitted

Source of variation	Sum of squares	Degree of freedom	Mean square	<i>F</i> -ratio	Significance of one-tail <i>F</i>
Covariate: Pretest scores	1342.14	1	1342.14	13.57	.000
Treatments	686.92	1	686.92	6.95	.005
Explained	2029.06	2	1013.53	10.26	.000
Within groups	8406.76	85	98.90		
Total	10435.82	87	119.95		

### Hypothesis 3

Hypothesis 3: Within the informed group, there will be significant differences in locus-of-control mean scores among low, medium, and high achievers.

To conduct this analysis, students in the treatment classes were divided into low, medium, and high achievement levels within each class based on their criterion-referenced pretest scores. Students were divided into groups within each class by assigning approximately one third of the students to each achievement level. Descriptive statistics are shown in Table 14 for all groups, and Table 15 when Classes 3 and 5 are omitted.

Table 14

Achievement Levels, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on the Locus-of-Control Measure: All Classes

Groups	Pretest		Posttest		Gain Means	Adjusted Means	n-size
	Mean	SD	Mean	SD			
Treatment 1							
Low	72.33	8.64	76.29	8.48	+3.96	76.51	24
Medium	74.83	7.21	70.92	12.80	-3.92	69.77	24
High	77.04	6.77	75.09	7.32	-1.96	72.74	23
Overall	74.70	7.73	74.08	9.99	-0.62		71
Treatment 2							
Low	69.81	8.39	69.13	11.29	-0.69	70.71	16
Medium	71.50	9.54	70.29	9.44	-1.21	70.96	24
High	70.86	7.74	69.09	12.79	-1.77	70.11	22
Overall	70.84	8.53	69.56	11.02	-1.27		62

Table 15

Achievement Levels, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on the Locus-of-Control Measure; Classes 3 and 5 Omitted

Groups	Pretest		Posttest		Gain Mean	Adjusted Means	n-size
	Mean	SD	Mean	SD			
Treatment 1							
Low	72.06	7.92	79.79	5.00	+7.13	78.91	16
Medium	73.87	7.39	71.00	15.01	-2.87	69.99	15
High	76.44	6.97	76.56	3.87	+0.13	74.52	16
Overall	74.13	7.50	75.68	9.66	+1.55		47
Treatment 2							
Low	67.09	7.99	67.09	10.89	0.00	68.82	11
Medium	69.53	5.93	69.60	7.98	0.07	70.35	15
High	69.27	6.89	66.20	13.73	-3.07	67.05	15
Overall	68.78	6.78	67.68	10.89	-1.10		41

A two-way analysis of covariance was conducted using the two treatments and three achievement levels as factors, the posttest locus-of-control scores as the dependent variable, and the pretest locus-of-control as the covariate. The analysis, when all classes are considered, is shown in Table 16.

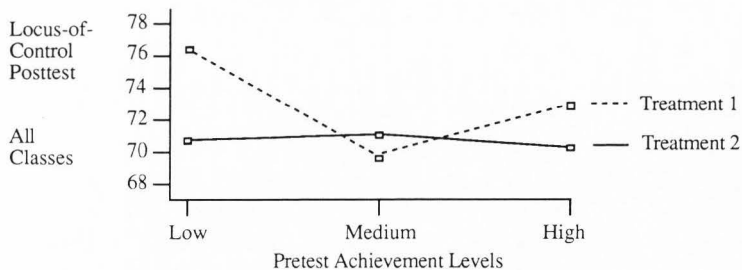
Table 16

Two-Way ANCOVA Table of Locus-of-Control and Achievement Level by  
Treatments: All Classes

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of 1-tail F
Covariate:	2791.28	1	2791.28	30.49	.000
LOC Pretest					
Main effects	484.16	3	161.39	1.76	.158
Treatments	145.22	1	145.22	1.59	.210
Achievement	285.80	2	142.90	1.56	.214
Interaction	263.90	2	131.95	1.11	.241
Explained	3539.34	6	589.89	6.44	.000
Residual	11535.59	126	91.55		
Total	15074.93	132	114.20		

Neither of the main effect differences nor the interaction was statistically significant.

However, as shown in Table 15 and in Figure 3, there is a relatively large difference between the two treatments with low achieving students.



**Figure 3.** Treatment 1 and Treatment 2 locus-of-control adjusted posttest scores by achievement level at pretest for all classes.

Although a wide separation between treatment groups in the low achievement level exists, a Scheffé's analysis did not reveal statistical significance between these groups. Visual analysis of the graph, however, and a standardized mean difference effect size between the two low achievement groups of 0.64 suggest that the mastery learning program had the greatest effect on the locus-of-control orientation for lower achievement students.

A two-way analysis of covariance was also conducted on the treatment classes with Class 3 and Class 5 omitted and is described in Table 17.

Table 17

Two-Way ANCOVA Table of Locus-of-Control and Achievement Level by  
Treatments: Classes 3 and 5 Omitted

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of 1-tail F
Covariate:	1342.14	1	1342.14	14.10	.000
LOC Pretest					
Main effects	957.75	3	319.25	3.35	.023
Treatments	564.21	1	564.21	5.93	.017
Achievement	270.82	2	135.41	1.43	.247
Interaction	422.85	2	211.43	2.22	.115
Explained	2722.74	6	453.79	4.77	.000
Residual	7713.08	81	95.22		
Total	10435.82	87	119.95		

There was a statistically significant difference between treatment mean scores but not a statistically significance difference between achievement levels nor was there a statistically significant interaction. As shown in Table 15 and in Figure 4, however, there is a relatively large difference between the two treatments with low achieving students.

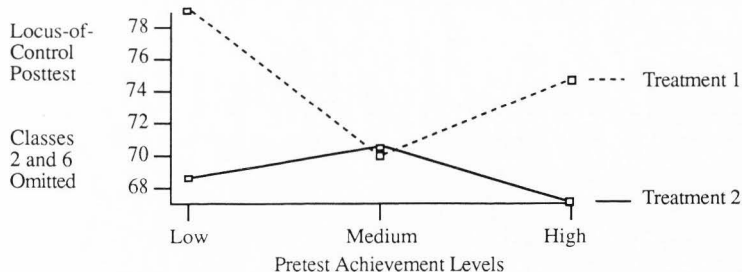


Figure 4. Treatment 1 and Treatment 2 locus-of-control adjusted posttest scores by achievement level at pretest for all classes except 3 and 5.

Again, the Scheffé's analysis did not reveal statistical significance between the low achievement groups. The standardized mean difference effect size between the two low achievement groups of 1.24, however, suggests again that the mastery learning program had the greatest effect on the locus-of-control orientation for lower achievement students. Comparisons to previous research are not possible because no other studies were found in which mastery learning students are separated along achievement levels.

#### Hypothesis 4

Hypothesis 4: Informed-group students will achieve significantly higher goal setting scores than students in the not-informed group.

Descriptive statistics are shown in Table 18 for both groups on scores from the author-produced goal setting instrument with and without Classes 3 and 5.

Table 18

Treatments, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on Goal Setting Measure With and Without Classes 3 and 5

Groups	Pretest		Posttest		Gain Mean	Adjusted Mean	n-size
	Mean	SD	Mean	SD			
All Groups							
Treatment 1	153.66	17.63	157.19	16.58	+3.53	156.68	80
Treatment 2	152.08	21.30	146.81	25.50	-5.26	147.38	73
Control	156.74	18.18	154.02	23.91	-2.72		31
Total	153.47	19.41	152.76	22.36	-1.06		184
Class 3 and 5							
Omitted							
Treatment 1	151.62	17.50	156.46	16.54	+4.84	156.23	47
Treatment 2	150.75	16.97	145.51	19.66	-5.24	145.79	40
Control	156.74	18.18	154.02	23.91	-2.72		31
Total	152.67	17.53	152.11	20.16	-0.56		118

Results of the analysis of covariance for all classes are shown in Table 19. Goal setting pretest scores were used as the covariate. With all classes included, the standardized mean difference effect size was calculated at 0.52 for raw mean scores.



Table 19

ANCOVA Table of Goal Setting Change by Treatment Group with Pretest Scores as Covariate; All Groups

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of one-tail <i>F</i>
Covariate: Pretest scores	27279.43	1	27279.43	97.32	.000
Treatments	3293.79	1	3293.79	11.75	.001
Explained	30573.22	2	15286.61	54.54	.00
Within groups	42044.32	150	280.30		
Total	72617.54	152	477.75		

The information from Table 19 indicates a statistically significant difference between the adjusted posttest mean scores at the .001 level. Using the adjusted mean scores from the analysis of covariance (see Table 18), the effect size was recalculated and found to be 0.46. These results may indicate that participating in a mastery learning program helps students internalize goals which have been presented from an external source and thereby alter their personal level of goal setting. Table 20 shows the analysis of covariance when Classes 3 and 5 are omitted.

When the two classes with the implementation problems are excluded, the analysis yields a one-tailed statistical significance at the .001 level and a standardized mean difference effect size of 0.55 for adjusted mean scores.

Table 20

ANCOVA Table of Goal Setting Change by Treatment Group with Pretest Scores as Covariate: Classes 3 and 5 Omitted

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of one-tail F
Covariate: Pretest scores	4217.75	1	4217.75	18.64	.000
Treatments	2353.02	1	2353.02	10.40	.001
Explained	6570.77	2	3285.39	14.52	.000
Within groups	19008.50	84	226.29		
Total	25579.28	86	297.43		

Whether or not Classes 3 and 5 are omitted, statistical significance is identified at the .001 level. However, when Classes 3 and 5 are omitted, the standardized mean difference effect size increases from 0.46 to 0.55 for adjusted scores.

#### Hypothesis 5

Hypothesis 5: Within the informed group, there will be a significant difference among goal setting scores towards internality for subgroups defined as high, medium, and low achievement favoring the medium achievement level.

To conduct this analysis, students in the treatment classes were divided into low, medium, and high achievement levels within each class based on their criterion-referenced pretest scores. Students were divided into groups within each class by assigning approximately one third of the

students to each achievement level. Descriptive statistics are shown in Table 21 for all classes and Table 22 when Classes 3 and 5 are omitted.

Table 21

Achievement Levels, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on the Goal Setting Measures: All Classes

Groups	Pretest		Posttest		Gain Means	Adjusted Means	n-size
	Mean	SD	Mean	SD			
Treatment 1							
Low	144.42	20.18	155.40	14.72	+10.98	160.37	24
Medium	153.65	14.52	150.33	15.14	-3.31	150.08	24
High	160.41	14.56	162.98	16.10	+2.57	158.90	23
Overall	152.72	17.69	156.14	15.97	+3.42		71
Treatment 2							
Low	147.34	12.57	140.40	21.49	-6.94	143.72	16
Medium	152.09	23.13	151.20	25.17	-0.89	151.83	23
High	161.32	16.16	155.70	16.07	-5.61	151.11	22
Overall	154.17	18.97	149.99	21.80	-4.18		61

Table 22

Achievement Levels, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on the Goal Setting Measures; Classes 3 and 5 Omitted

Groups	Pretest		Posttest		Gain	Adjusted	n-size
	Mean	SD	Mean	SD	Means	Mean	
Treatment 1							
Low	145.09	19.92	157.81	15.51	+12.72	160.94	16
Medium	149.53	13.64	148.80	14.78	-0.73	149.45	15
High	160.09	15.57	162.28	17.25	+2.19	157.03	16
Overall	151.62	17.50	156.46	16.54	+4.84		47
Treatment 2							
Low	141.32	9.35	135.73	22.01	-5.24	140.96	11
Medium	146.04	19.74	143.82	19.69	-2.21	146.42	14
High	162.07	12.19	154.27	14.49	-7.80	147.91	15
Overall	150.75	16.97	145.51	19.66	-5.24		40

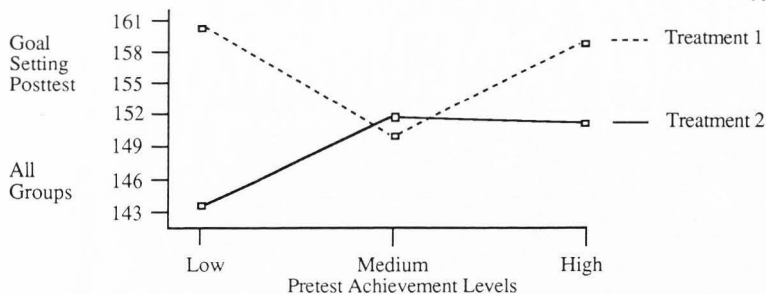
A two-way analysis of covariance was conducted using the two treatments and three achievement levels as factors, posttest goal setting scores as the dependent variable, and the pretest goal setting scores as the covariate. The analysis, when all classes are considered, is shown in Table 23.

Table 23

Two-Way ANCOVA Table of Goal Setting Scores by Achievement Level  
for Treatment 1 Students; All Classes

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of one-tail <i>F</i>
Covariate:	13907.73	1	13907.73	58.12	.000
Goal Setting					
Main effects	1996.31	3	665.44	2.78	.044
Treatments	1575.63	1	1575.63	6.59	.011
Achievement	399.64	2	199.82	0.84	.436
Interaction	1793.33	2	896.66	3.75	.026
Explained	17697.37	6	2949.56	12.33	.000
Residual	29977.06	125	239.23		
Total	47608.43	131	363.42		

A statistically significant difference at the .01 level between treatment mean scores existed, but not for achievement level differences nor for the interaction of the treatment and achievement levels. As shown in Table 22 and Figure 5, however, there is a relatively large difference between the two treatments with low achieving students.



**Figure 5.** Treatment 1 and Treatment 2 adjusted goal setting posttest scores by achievement level at pretest for all classes.

Because of the wide separation between treatment groups in the low achievement level, a Scheffé's analysis was conducted to identify if these groups were statistically different. Scheffé's test is considered more rigorous than other procedures, and a level of .10 is recommended and considered significant (Scheffé, 1959, as cited in Ferguson, 1971). Statistical significance was found in this analysis at the .05 level. The standardized mean difference effect size between the two low achievement groups was calculated at 0.83. An analysis was also conducted when Class 3 and Class 5 were omitted. The two-way analysis of covariance is shown in Table 24.

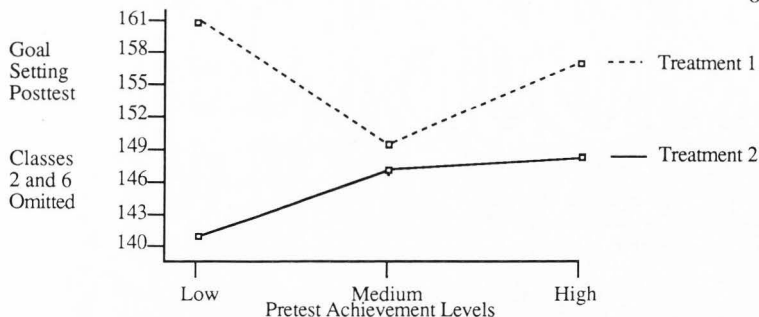
Table 24

Two-Way ANCOVA Table of Goal Setting Scores and Achievement Level  
by Treatments; All Classes; Classes 3 and 5 Omitted

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of one-tail F
Covariate:	8879.24	1	8879.24	40.25	.000
Goal Setting					
Main effects	2709.09	3	903.03	4.09	.009
Treatments	2297.72	1	2297.72	10.42	.002
Achievement	356.08	2	178.04	0.81	.450
Interaction	1004.11	2	502.06	2.28	.109
Explained	12592.45	6	2098.74	9.51	.000
Residual	17648.31	80	220.60		
Total	30240.76	86	351.64		

As with the analysis with all classes included, statistical significance was shown for the treatment mean scores at the .05 level, but not for the achievement level differences or the interaction between treatments and achievement levels. When plotted in Figure 6, however, a difference between the two treatments and the low achieving students is obvious.

Again, a wide separation between the treatment groups for scores from students in the low achievement level is observable, and a Scheffé's analysis was conducted. Statistical significance was found at the .05 level. The standardized mean difference effect size for adjusted scores was calculated at 1.06.



**Figure 6.** Treatment 1 and Treatment 2 adjusted goal setting posttest scores by achievement level at pretest for all classes except 3 and 5.

This information indicates that mastery learning programs increase lower academic students' goal setting levels more than the students in the medium and high achievement levels. Comparisons to previous research are not possible because no other studies have been identified which examine the relationship between goal setting levels and mastery learning programs.

#### Hypothesis 6

Hypothesis 6: The adjusted posttest mean scores of both the locus-of-control measure and goal setting measure will be significantly greater for the informed group (Treatment 1) than the control group.

Descriptive statistics were calculated for both the Treatment 1 group and control group from scores on the *Academic Achievement Accountability Scale* (Clifford, 1976), and are shown in Table 25. The standardized mean difference effect size was 0.49 for raw mean scores and 0.28 for adjusted mean scores when all classes were included in the



analysis. When Class 3 is omitted from the analysis, the standardized mean difference effect size is 0.65 for raw mean scores and 0.49 for adjusted scores.

Table 25

Treatments, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on Locus-of-Control Tests With and Without Class 3

Groups	Pretest		Posttest		Gain Mean	Adjusted Mean	n-size
	Mean	SD	Mean	SD			
All Classes							
Treatment 1	74.92	7.66	74.39	9.76	-0.54	73.88	80
Control	71.31	8.36	70.25	9.40	-1.06	71.54	32
Total	73.72	8.18	73.21	9.79	-0.69		112
Class 3							
Omitted							
Treatment 1	74.13	7.50	75.68	9.65	+1.55	75.14	47
Control	71.31	8.37	70.25	9.40	-1.06	71.04	32
Total	72.99	7.93	73.48	9.87	+0.49		79

In the analysis of covariance, locus-of-control pretest scores were used as the covariate. Table 26 shows the results of this analysis with all classes.

Table 26

ANCOVA Table of Locus-of-Control Change for the Informed Group and Control Group with Locus-of-Control Pretest Scores as Covariate; All Classes

Source of variation	Sum of squares	Degree of freedom	Mean square	<i>F</i> -ratio	Significance of one-tail <i>F</i>
Covariate:	1969.27	1	1969.27	25.08	.000
LOC pretest					
Treatment	119.25	1	119.25	1.52	.111
Explained	2088.51	2	1044.26	13.30	.000
Within groups	8559.77	109	78.53		
Total	10648.28	111	95.93		

The information from Table 26 indicates a lack of statistical significance at the .05 level. Table 27 shows the results of the analysis of covariance when Class 3 is omitted.

The results displayed in Table 27 indicate that when Class 3 is omitted from the analysis, there are statistically significant mean score differences at the .05 level.

The omission of Class 3 makes a relatively large change when the Treatment 1 classes are compared to the control group on locus-of-control scores. Deleting Class 3 raises the standardized mean difference effect size for the adjusted scores from 0.28 to 0.49 and shows the effect becoming statistically significant at the .05 level.

Table 27

ANCOVA Table of Locus-of-Control Change for the Informed Group and Control Group with Locus-of-Control Pretest Scores as Covariate; Class 3 Omitted

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of one-tail <i>F</i>
Covariate: LOC pretest	1306.47	1	1306.47	16.62	.000
Treatment	310.90	1	310.90	3.96	.025
Explained	1617.38	2	808.69	10.29	.000
Within groups	5974.34	76	78.61		
Total	7591.72	78	97.33		

The second aspect of this hypothesis was to determine if the knowledgeable group scored significantly higher than the control group on the goal setting instrument. Descriptive statistics were calculated and are shown in Table 28. The standardized mean difference effect size calculated at 0.16 for raw mean scores and 0.27 for adjusted mean scores when all classes were included in the analysis. When Class 3 is omitted from the analysis, the standardized mean difference effect size is 0.12 for raw mean scores and 0.31 for adjusted scores.

Table 28

Treatments, Unadjusted Mean Scores, Standard Deviations, Adjusted Posttest Mean Scores, and Population Sizes for Pretest and Posttest Scores on Goal Setting Measure With and Without Class 3

Groups	Pretest		Posttest		Gain Mean	Adjusted Mean	n-size
	Mean	SD	Mean	SD			
All Classes							
Treatment 1	153.66	17.63	157.19	16.58	+3.53	157.78	80
Control	156.74	18.18	154.02	23.91	-2.72	152.48	31
Total	154.04	18.39	156.30	18.84	+1.78		111
Class 3							
Omitted							
Treatment 1	151.62	17.50	156.46	16.54	+4.84	157.92	47
Control	156.74	18.18	154.02	23.91	-2.72	151.80	31
Total	153.65	17.84	155.49	19.69	+1.83		78

In the analysis of covariance, goal setting pretest scores were used as the covariate. Results of the analysis of covariance are shown in Table 29 when all Treatment 1 classes were included and in Table 30 when Class 3 is omitted.

Table 29

ANCOVA Table of Goal Setting Change for the Informed Group and Control Group with Goal Setting Pretest Scores as Covariate: All Classes

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of one-tail F
Covariate: Goal pretest	15930.90	1	15930.90	76.46	.000
Treatment	622.60	1	622.60	2.99	.044
Explained	16553.50	2	8276.75	39.72	.00
Within groups	22502.64	108	208.36		
Total	39056.14	110	355.06		

Table 30

ANCOVA Table of Goal Setting Change for the Informed Group and Control Group with Goal Setting Pretest Scores as Covariate: Class 3 Omitted

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	Significance of 1-tailed F
Goal pretest	11822.85	1	11822.85	51.16	.000
Treatment	686.58	1	686.58	2.97	.045
Explained	12509.43	2	6254.71	27.01	.000
Within groups	17332.06	75	231.09		
Total	29841.49	77	387.55		

Table 29 shows statistical significance for the treatments at the .05 level when all groups are included. Table 30 indicates the same statistical

significance when Class 3 is omitted from the analysis. Although the omission of Class 3 does not increase the level of statistical significance, it does raise the adjusted standardized mean difference effect size from 0.27 to 0.31.

### Hypothesis 7

A positive correlation will exist between achievement gain scores and locus-of-control gain scores, and between achievement gain scores and goal setting gain scores for the informed group.

Table 31 shows the correlations between gain scores on these three variables by treatment group.

Table 31  
Correlations Between Achievement, Locus-of-Control, and Goal Setting for Treatment 1 and Control Groups With and Without Class 3

Group	Achievement and Locus-of-control	<i>p</i>	Achievement and Goal Setting	<i>p</i>	n-size
Treatment 1; all classes	.34	>.05	.10	<.05	71
Treatment 1; without Class 3	.32	>.05	.24	<.05	47
Control	-.41	>.05	-.25	<.05	19

The Pearson Correlation Coefficient for the criterion-referenced achievement test and the locus-of-control test for Treatment 1 with and without Class 3 included indicates a low, positive relationship which is statistically significant. This result is consistent with past findings as

indicated in Table 1. The correlation coefficient squared yields the coefficient of determination ( $r^2$ ). The value of  $r^2$  is .12 for Treatment 1 with all classes included, and represents the proportion of the variance which the locus-of-control test and achievement test have in common. The value of  $r^2$  is .10 for Treatment 1 when Class 3 is omitted.

The Pearson Correlation Coefficient for the criterion-referenced achievement test and the locus-of-control test for the control group indicates a statistically significant low, negative relationship. The coefficient of  $-.41$  yields a  $r^2$  of .17.

The correlation between goal setting and academic achievement is in the direction as hypothesized, but did not reach levels of statistical significance.

## CHAPTER V CONCLUSIONS

### Introduction

Holding oneself accountable for one's actions is usually regarded as a sign of developing maturity. Although this belief is often alluded to and taught in our educational system, few educational strategies actually employ this principle. Mastery learning programs are an exception to this rule. By mandating that progression and remediation be directly dependent on achievement levels, mastery learning programs help to bring the concept of accountability into focus. Whether this aspect of mastery learning programs is partially responsible for the success of these programs is currently unanswered, as no studies have been identified which analyze this variable.

By using new technologies, such as videodiscs, combined with highly structured programs, more finely tuned empirical studies can be designed which help isolate the variables under study while minimizing extraneous and confounding variables. Because the *Mastering Fractions* videodisc program is solidly based on the mastery learning format, and because it represents a well-defined, replicable treatment, it was seen as uniquely suited to a study that isolated students' knowledge of participating in mastery learning programs as the independent variable while keeping instructional methods, instructional delivery, and instructional content constant across treatment groups.

The purpose of this study was to determine whether students' knowledge of participating in mastery learning programs affects their



academic achievement, locus-of-control orientation, or goal setting level. Hypotheses for the study were derived from previous research on these three variables. In the following sections of this report, I interpret the findings and draw conclusions as to the impact that accountability has in mastery learning programs, and the overall benefits of mastery learning programs in public education.

### Findings

The hypotheses for the study address how knowledge of participating in mastery learning programs influences academic achievement, locus-of-control orientation, and goal setting levels, and how this knowledge and initial achievement levels of students effect changes in locus-of-control orientation and goal setting levels.

#### Differences in Academic Achievement

Results of the program-specific, criterion-referenced test administered in this study indicate that students instructed by the *Mastering Fractions* program do learn fractions skills and concepts. The standardized mean difference effect size between the two treatment groups and the control group was +1.73. This number is lower than, but parallel with, previous research findings by Hasselbring et al. (1988) and Lowry (1989).

Achievement comparisons made between students who were aware that they were participating in a mastery learning program and students who were unaware that their results directed subsequent instruction revealed a standardized mean difference effect size of 0.03. There is a strong possibility, however, that these results may be skewed. Previous research by both Lowry (1989) and Hasselbring et al. (1988) noted that the

degree to which teachers implement the *Mastering Fractions* program in the classroom, as directed by the program authors, directly influences achievement results. Lowry identified a 20% difference in scores between classes that he identified as having a high implementation level against those he identified as having a low implementation level. How well teachers implemented the program in this study was not directly assessed. Circumstantial evidence, however, points to a discrepancy in implementation levels due to the amount of time required for classes to complete the designated program.

Although implementation guidelines were delivered in both the instructor's manual and during in-service training, teachers made obvious modifications to the program. As mentioned in chapter IV of this study, one Treatment 1 class and one Treatment 2 class took more than 40% longer to complete the instructional material than their treatment counterparts at the same site. Although part of this time differential could be explained by extenuating circumstances within each classroom, the delays obviously affected the proposed implementation of the program. When these classes are omitted from the analysis, the standardized mean difference effect size on achievement by treatment increases from 0.03 to 0.63 for adjusted scores.

The larger effect sizes shown when these classes are dropped from the analysis are consistent with previous meta-analyses (Guskey & Gates, 1985; Guskey & Pigott, 1988; Kulik et al., 1990) and lend support to the idea that knowledge of participating in mastery learning programs contributes to academic achievement. The results from this study not only support this idea, but show that improvement may be partially due to informing students they are accountable for the progression of the class and

then enforcing the established criteria. However, lack of supporting evidence when all groups are included weakens the strength of this conclusion.

If the results of the reduced sample are accepted, this study would support the idea that when upper-elementary students are told what academic expectations exist, and are then held accountable to achieve those expectations, their behavior is altered so that expectations are more closely met. Although accountability is a component of advancement between grade levels and within the practice of educational activities such as assertive discipline, no instructional strategy includes accountability on as frequent or demanding a level as mastery learning programs.

#### Differences in Locus-of-Control

Students who perceive that they have more control over their academic environment tend to do better on achievement tests than those who feel that external forces control their environment (Strickland, 1989). Therefore, if perception of control can be influenced, it may provide an indirect route to improving academic performance. Previous research conducted to identify whether mastery learning programs alter locus-of-control perception generally showed favorable results. In this study, the standardized mean difference effect size of scores adjusted for pretest scores was 0.32 between students in Treatment 1 and Treatment 2. When Classes 3 and 5 are omitted from the study, the standardized mean difference effect size of scores adjusted for the pretest rose to 0.75, and is similar to previous locus-of-control modification studies shown in Table 1, where the mean score of the 25 studies equaled 0.67, and the six studies in Table 2, where the median effect size was 0.40. When students

knowledgeable of the mastery learning criteria (Treatment 1) were compared to students in the control group, the standardized mean difference effect size for adjusted scores was computed at 0.28 when all groups were included, and 0.49 when Class 3 was omitted.

When all classes are included, each group had posttest scores lower than pretest scores on the locus-of-control instrument, indicating a move towards an external locus-of-control orientation. This movement away from an internal locus-of-control orientation is opposite the results from previous studies, and may have been influenced by the unique instructional medium used to deliver the lessons.

In traditional instruction, students, while not in control of the academic environment, do have an influence on the instructional strategy, pacing of the teacher, determination of question types, frequency of quizzes, and other class activities and instructional techniques. In other words, their interactions with the teacher, to a large extent, help direct the flow of instruction. In this study, with instruction being delivered to the treatment groups by a videodisc, students may have either consciously or subconsciously perceived a reduction in their level of control.

When all treatment and control groups are compared, students instructed by the videodisc without knowledge of participating in a mastery learning program had the greatest shift to an external locus-of-control orientation as shown by their lower scores on the locus-of-control test (see Table 8). Students in the control group had the second greatest shift towards externality, and students knowledgeable of participating in a mastery learning program had the least shift, i.e., they completed the program with scores representing the most internal orientation.

Interactive technologies have long been viewed as a way to adapt instruction to the individual by providing control over many of the variables often associated with instruction. The results of this study when all classes are included, however, show a shift away from the individual's perceived internal control when an interactive videodisc was used to deliver instruction to an entire class at one time. Although the *Mastering Fractions* program was designed to be interactive to the needs of the class, individual subjects appear to have perceived a loss of control over their individual academic environment.

When Class 3 and 5 were omitted from the analysis, Treatment 1 students had scores interpreted as a move toward an internal locus-of-control orientation. This change, exhibited by higher posttest scores on the locus-of-control measure shown in Table 8, indicates that the remaining two classes knowledgeable of accountability in mastery learning programs (Classes 1 and 2) changed their locus-of-control orientation as expected. Class 3 was initially omitted from the analysis due to the reluctance of the teacher to participate in the study, doing so only because it had been mandated by her principal. It is speculated that her reluctance and opposition to the program may have been perceived by her students, as evidenced by their posttest scores being low enough to change the entire mean gain scores of Treatment 1 from a net gain to a net loss (changing their movement from an internal orientation toward an external orientation).

When locus-of-control gain scores were correlated to academic gain scores for the Treatment 1 group, statistical significance was identified at the .05 level with correlational coefficients of .34 for all classes and .32 when Class 3 was omitted. This indicates that although most students

experienced a decrease in their perceived control, there was a tendency for students who moved toward an internal locus-of-control orientation to have the highest scores on the achievement test.

### Differences in Goal Setting

Although an abundance of research exists which analyzes changes in performance when individuals are given goals that are demanding, specific, and attainable (Locke & Latham, 1990), no previous research was found which examines the relationship between goal setting and mastery learning programs.

Results of this study indicate that students do exhibit changes in their goal setting characteristics after participating in a mastery learning program. Students informed about their participation in a mastery learning program had a gain score increase of 3.53 on the author-produced goal setting measure, while students in the not-informed group had a decrease of 5.26. The pretest adjusted, standardized mean difference effect size of 0.46 between the informed and not-informed groups indicates a moderate effect. When the aberrant classes are dropped from the analysis, the pretest adjusted, standardized mean difference effect size increased to 0.55.

Because goals which are difficult, attainable, and specific have a strong correlation to increased performance (Bandura, 1989), a correlation between achievement gain scores and goal setting gain scores was anticipated. However, the Pearson correlation coefficients of .10 for all classes in Treatment 1 and .24 when Class 3 was omitted did not reach statistical significance. This evidence, along with the relatively large effect size for goal setting changes calculated from Table 18, indicates that

although students who participate in mastery learning programs alter their goal setting characteristics, those who changed the greatest on the goal setting measure did not necessarily score highest on their achievement tests. The lack of a statistically significant correlation between gain score differences in the achievement and goal measures (see Table 31) may be attributed to the high posttest scores on the goal measure by the low academic students (see Figures 7 and 8).

#### Achievement Levels and Locus-of-Control Orientation

This study attempted to identify if students' initial achievement levels had any bearing on locus-of-control changes after participating in the mastery learning program. Although the initial hypothesis stated that students in the middle achievement level would show the greatest change toward an internal locus-of-control orientation, they instead had posttest scores which revealed a more external orientation. Surprisingly, students in the lower achievement level showed the greatest change toward a more internal orientation when all classes were analyzed and when Classes 3 and 5 were omitted from the analyses. When a two-way analysis of covariance and subsequent standardized mean difference effect sizes for adjusted scores were conducted between the two treatment groups and three achievement levels, effect sizes were found to be 0.64 when all classes are included and 1.24 when Classes 3 and 5 are omitted.

The *Mastering Fractions* videodisc program is an instructional product specifically designed to give instruction in small units and to frequently check for understanding. In a typical lesson, over 20 choral responses are required in which the students' knowledge is checked. This

frequent interaction between students and knowledge in their long-term memory helps establish strong retrieval cues. This interaction may be why ensuing quiz scores were high and few remediations were required.

The change between locus-of-control pretest and posttest scores for the low, medium, and high achievement groups was dramatic. Whereas the medium and high academic groups of students knowledgeable of accountability showed a combined change of 2.94 towards an external orientation at posttest, the lower academic students had an increase of 3.96 towards an internal orientation. The high success structure of the *Mastering Fractions* program may be partially responsible for the large standardized mean difference effect size of students from the lower achievement group. Low academic students are not used to success in most school situations, especially in difficult subjects such as fractions. By providing these students with an opportunity to master a difficult subject, the students appear to have felt an increased perception of control over their academic environment.

It is possible that the shift towards an internal locus-of-control orientation is strongest for students who perceive the academic material as demanding, yet attainable. If questions are too easy, students may not perceive that their effort directly influences the direction of the class. However, for students who have to struggle to reach criterion levels, the knowledge that class progression can only occur if their achievement reaches prescribed levels may instill a level of perceived control over the academic environment. Without other studies which examined the same hypothesis, conclusions are tentative.



### Achievement Levels and Goal Setting

Previous research has documented that goals that are difficult, well defined, and attainable produce better performance than goals that are general. If the goal is considered too easy, performance has been found to actually decrease (Locke, Chah, Harrison, & Lustgarten, 1989). In this study, quizzes that determined progression or remediation were administered frequently, yet achievement levels low enough to require remediation occurred infrequently. The high mastery rate may indicate that many students did not perceive the criterion levels required for progression as being difficult. Those who did perceive the level as being difficult would be students at the lower end of the academic achievement spectrum.

Although the initial hypothesis stated that students in the middle achievement level would show the greatest increase in goal setting, this was not supported by the analysis of scores. Students knowledgeable of accountability in mastery learning programs from the lowest pretest achievement level had a greater change in goal setting levels than either the medium or high achievement groups. The two-way analysis of covariance and Scheffé's Test identified statistically significant gains at the .05 level by knowledgeable lower achievement students over lower achievement students not knowledgeable of accountability within their instructional program. Effect sizes were calculated at 0.83 when all classes were considered and 1.06 when Classes 3 and 5 were omitted. For the knowledgeable students, the goals may have appeared both specific and difficult. These factors, when combined with the frequent feedback offered by the program, appear to have provided these students with the necessary ingredients to cause an increase in their goal setting process.

Because previous research has shown that higher goal levels contribute to greater performance (Mento et al., 1987), mastery learning programs may achieve part of their success by providing a mechanism that helps to increase students' goal setting levels.

When the *Mastering Fractions* program is presented as prescribed, classes should seldom require remediation. The results of lower achievement students gaining the most on the goal setting measure may be specific to instructional programs that have an easily obtainable criterion level for advancement. Had the instructional program been structured to make it harder for students to reach mastery, a shifting in the results may have occurred. If lower achievement students begin to raise their goal level, but are not rewarded with success, their goal levels may revert to lower levels (Bandura, 1989). The medium ability group, working with goals that are then more applicable to their ability, may then show the greatest increase in the goal setting measure.

#### Generalizability of Findings

This study was conducted in two school districts within San Diego County, California. Even though it was not possible to randomly select subjects, treatment classes were randomly assigned. To help identify whether generalizability is plausible, comparisons to national census data and previous studies were made.

#### Consistency with National Norms

Demographic data on gender and academic achievement levels of the sample were comparable to the national norm. A noticeable difference existed in the ethnicity of the sample, where 30% were Hispanic as

compared to 10% Hispanic nationally. However, it is assumed that, because achievement levels of the sample were comparable to those of the nationwide population, the differences in ethnicity should not overly restrict comparisons. Whether or not this sample of students reacts the same way to mastery learning programs as the national population was not determined, nor was information on this question located in the review of literature.

### Consistency with Past Findings

Achievement gains for the criterion-referenced test, although not as strong as those found in previous studies, were similar to results of Lowry (1989) and Hasselbring et al. (1988). The reduction in achievement gains would have been due, at least in part, to the reduction of completed lessons from 35 in the Lowry study to 20 in this study.

On the locus-of-control instrument, mixed results were provided by students who knew they were participating in the mastery learning program. When all classes were included, all group means shifted toward an external orientation, although knowledgeable students shifted less towards an external orientation than either the control group or the not-informed group. When the aberrant classes were omitted, Treatment 1 (the informed group) had posttest scores interpreted as moving toward an internal orientation. This result is parallel to previous research shown in Table 2. As explained earlier, the shift towards an external orientation when all classes are included may have been due to either the instruction being delivered from a videodisc instead of a human, or the influence of a teacher who had been reluctant to implement the program in her classroom.

No previous studies have been identified in which changes in goal setting have been attributed to an instructional program. However, because this study employed a mastery learning program in which the criteria for advancement for the lower achievement group were difficult, specific, and attainable, increases in scores on the goal setting measure are as expected.

Posttest measures of the control group showed minimal changes in academic achievement, locus-of-control orientation, and goal setting characteristics over pretest measures. Achievement changes that were documented are consistent with growth in the subject domain for the untreated group. The slight decrease in perception of control and goal setting by the control group seems normal as the school year approached its conclusion.

By comparing the results of this research to previous findings, the consistencies provide some evidence that the study sample is similar to earlier samples and that the instruments appear to be reliable across time.

### Summary

Students who participated in the *Mastering Fractions* instructional program achieved substantial gains in the criterion-referenced test over students in the control group. Because the test was criterion-based to the product, this was as expected.

More important comparisons were conducted between students knowledgeable of participating in a mastery learning program and students not informed that their teacher's decision to either progress or remediate the class was dictated by students' quiz scores. Results based on same site groups requiring similar amounts of time to implement the program

identified a strong relationship between students who know that they would be held accountable for their progression through the instructional material and higher comprehension of the subject matter. In addition, these students received more internal scores on the locus-of-control measure and higher scores on the goal setting measure.

Previous conclusions by critics of mastery learning programs, who often take the position that these programs increase achievement solely by increasing instructional time due to remediation, are challenged by these results. Changes in achievement are also associated with students' knowledge that they are participating in a mastery learning program, and that their results on comprehension checks determine ensuing progression and remediation. Students knowledgeable of this accountability factor also show a more internal locus-of-control orientation and higher goal setting scores on posttest measures.

In analyzing the effects of mastery learning programs on groups of varying abilities, it is apparent that these programs do not affect all students equally. Critics have often pointed out that mastery learning programs hinder faster students by slowing them down until students with less ability catch up, and therefore are only applicable to homogeneous groups (Slavin, 1987). In this study, students with the lowest pretest achievement scores showed the greatest changes towards internality in locus-of-control orientation, as well as the greatest changes in goal setting measures. Although this analysis does not support or reject the critics' comments about higher ability students, it does support their conclusion that group-based mastery learning programs do not affect all students equally.

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## APPENDIXES

Appendix A

Parent Permission Letter



DEPARTMENT OF EDUCATIONAL TECHNOLOGY  
COLLEGE OF EDUCATION  
SAN DIEGO STATE UNIVERSITY  
SAN DIEGO CA 92182-0311

(619) 594-6718

Dear Parent or Guardian:

Your child will be learning fractions by working through a videodisc-based program during the 1991-1992 school year. The program has provided substantial learning gains in fractions for many students in a number of settings. This year we would like to study the attitudes of children engaged in the program.

To study attitudes, we're planning to administer two sets of questionnaires. The first contains questions regarding academic locus-of-control, that is, how your child sees her/himself in regards to the amount of control they have in their learning environment. The second deals with goals they set in school. We anticipate that both of these tests will be administered three times during the school year, with each administration requiring about twenty minutes.

We feel that the study will provide valuable information for future curriculum planning by further testing the value of the fractions program. All personal responses will remain strictly confidential, and only group average responses will be cited in written reports. No risk seems apparent from this project. Similar research has been carried out with no reported negative outcomes.

We are requesting written permission for your child to fill out the questionnaires. Both you and your child have the right to ask questions and receive responses regarding the questionnaires. You may also withdraw your child from the questionnaire research at any time without any negative consequences.

Please call Donn Ritchie at 594-5076 if you have questions regarding the research. We are looking forward to working with your child and his or her teacher during the coming year.

Sincerely,

Mr. Frank Murphy  
Principal  
Bancroft Elementary School

Donn Ritchie  
Assistant Professor  
San Diego State University

By signing and returning this letter, you will be giving permission for your child to complete the attitude questionnaires.

I/we understand the procedures of the study and give permission for my child to participate. I/we realize that he or she may withdraw, or that I/we may withdraw my child from the questionnaire research at any time.

Your child's name: (First) \_\_\_\_\_ (Last) \_\_\_\_\_

\_\_\_\_\_  
Signature of parent or guardian  
Please return this letter to your child's teacher.

\_\_\_\_\_  
Date

Appendix B

Goal Setting Instrument

Name (Print) \_\_\_\_\_ Grade \_\_\_\_\_ Boy \_\_\_ Girl \_\_\_ Age \_\_\_\_\_ Teacher \_\_\_\_\_ Date \_\_\_\_\_

Goals are things that you work for and try to achieve. Sometimes you set them by yourself. Sometimes other people set them for you. Think about the goals you have in school. Here are some questions that ask you about those goals when you work in mathematics. There are no right answers. Just tell how you feel by circling only one response for each question. Your answers will not be used to determine your grade.

Example: Having lots of friends in school is very important. . . . . YES! yes ? no NO!  
 Circle around the word **YES!** if you think having lots of friends is extremely important; **yes** if you think having lots of friends is pretty important; **?** if you are not sure; **no** if you think having lots of friends is not important; and **NO!** if you think having lots of friends is extremely unimportant. Now answer these questions.

- |     |   |      |     |   |    |     |
|-----|---|------|-----|---|----|-----|
| 1.  | My teacher is very pleased when I reach my goals in mathematics -----                       | YES! | yes | ? | no | NO! |
| 2.  | I don't try very hard to finish my math work -----  | YES! | yes | ? | no | NO! |
| 3.  | I love being challenged by hard problems -----  | YES! | yes | ? | no | NO! |
| 4.  | I know exactly what I want to achieve in mathematics -----                                  | YES! | yes | ? | no | NO! |
| 5.  | I would rather solve one hard math question than three easy ones -----                      | YES! | yes | ? | no | NO! |
| 6.  | As long as I try to do my best, it doesn't matter if I finish my math work -----            | YES! | yes | ? | no | NO! |
| 7.  | I often fail to reach my goals in mathematics -----   | YES! | yes | ? | no | NO! |
| 8.  | Other students really encourage me to reach my goals in mathematics-----                    | YES! | yes | ? | no | NO! |
| 9.  | I hardly ever know if I'm achieving my goals in mathematics -----                           | YES! | yes | ? | no | NO! |
| 10. | The pressure to achieve my goals in math class sometimes makes me think about cheating----- | YES! | yes | ? | no | NO! |
| 11. | I get lots of credit and recognition when I reach my goals in mathematics -----             | YES! | yes | ? | no | NO! |
| 12. | I'm not sure what my goals are in mathematics-----  | YES! | yes | ? | no | NO! |
| 13. | Reaching my goals in mathematics is very important -----                                    | YES! | yes | ? | no | NO! |
| 14. | Working for goals makes mathematics fun-----  | YES! | yes | ? | no | NO! |
| 15. | I really enjoy working on hard problems if I think I can answer them-----                   | YES! | yes | ? | no | NO! |
| 16. | Goals in mathematics are used to punish me more than help me -----                          | YES! | yes | ? | no | NO! |
| 17. | I find that working for goals in mathematics is very stressful -----                        | YES! | yes | ? | no | NO! |
| 18. | My teacher encourages me to reach my goals in mathematics -----                             | YES! | yes | ? | no | NO! |
| 19. | Each day in math class I can judge how well I'm reaching my goals-----                      | YES! | yes | ? | no | NO! |
| 20. | I always try to complete all math work even when I don't have to -----                      | YES! | yes | ? | no | NO! |
| 21. | I always try to reach my goals in math class before other students reach their goals-----   | YES! | yes | ? | no | NO! |
| 22. | I always know if I am reaching my goals in mathematics -----                                | YES! | yes | ? | no | NO! |

23. I often get confused as to which goals in school are most important----- YES! yes ? no NO!
24. I know I can reach my goals in mathematics if I keep working on them----- YES! yes ? no NO!
25. My math work is too easy----- YES! yes ? no NO!
26. I have an excellent plan for reaching my goals in mathematics----- YES! yes ? no NO!
27. I can't stand working on hard problems ----- YES! yes ? no NO!
28. I have too many goals in mathematics to reach them all ----- YES! yes ? no NO!
29. It really doesn't matter if I achieve my goals in mathematics----- YES! yes ? no NO!
30. No one cares if I reach my goals in mathematics----- YES! yes ? no NO!
31. Math work is O.K. when I know exactly what needs to be done ----- YES! yes ? no NO!
32. My goals in math class are much too difficult to accomplish----- YES! yes ? no NO!

The next section places questions in groups. Read the first group, then answer all the questions. Use the same procedure with each group.

When I think about my final grades in mathematics:

33. What grade do you **hope** to get?----- D D+ C- C C+ B- B B+ A- A
34. What grade will you **actually try for**?----- D D+ C- C C+ B- B B+ A- A
35. What is your lowest **acceptable** grade?----- D D+ C- C C+ B- B B+ A- A

When I think about my final grades in other subjects:

36. What average grade do you **hope** to get?----- D D+ C- C C+ B- B B+ A- A
37. What average grade will you **actually try for**?----- D D+ C- C C+ B- B B+ A- A
38. What is your lowest average **acceptable** grade?----- D D+ C- C C+ B- B B+ A- A

When I take a mathematics test in school that has 10 questions:

39. How many questions do I **usually** get right?----- 1 2 3 4 5 6 7 8 9 10
40. How many questions do I **try** to get right?----- 1 2 3 4 5 6 7 8 9 10

When I take tests in other subjects that have 10 questions:

41. How many questions do I **usually** get right?----- 1 2 3 4 5 6 7 8 9 10
42. How many questions do I **try** to get right?----- 1 2 3 4 5 6 7 8 9 10



## Appendix C

*Academic Achievement Accountability Scale*

**The University of Iowa**

Iowa City, Iowa 52242

College of Education  
Division of Psychological and Quantitative FoundationsCounseling Psychology, Educational Psychology  
Instructional Design and Technology  
Measurement and Statistics  
School Psychology

October 4, 1991

Donn Ritchie  
Assistant Professor Of Education  
Department of Educational Technology  
College of Education  
San Diego State University  
San Diego, CA 92182-0311

Dear Dr. Ritchie:

You have permission to use the AAA scale; a copy and scoring instructions have been enclosed. I wish you the best with your research.

Sincerely,

Margaret M. Clifford  
Professor

/skm

Enclosure

NAME

(FIRST)

(LAST)

GRADE

BOY GIRL 

AGE

SCHOOL

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## VITA

Donn Carlton Ritchie  
 Assistant Professor  
 Department of Educational Technology  
 San Diego State University

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 Birth: April 12, 1950

## Education

Institution	Years Attended	Degree	Major Field
University of Akron	1969-1973	B.S.	Education
University of Wyoming	1975-1980	M.S.	Park Admin.
Utah State University	1987-1992	Ph.D.	Instr. Tec.

## Teaching positions

Institution	Rank	Date	Major Subject
Ross County Schools, OH	Teacher	1973-1974	Science
School District #25, WY	Teacher	1978-1989	Science
San Diego State University	Lecturer	1990-1991	Ed. Tec.
San Diego State University	Assistant Professor	1991-1992	Ed. Tec.

## Consultancies

Academic Geriatric Resource Center, UCSD, La Jolla, CA, 1992.

San Diego County School District, San Diego, CA, 1991.

Church of Jesus Christ of Latter Day Saints: Salt Lake City, UT, 1991.

Franklin, Beedle & Associates Publishers, Irvine, CA, 1991.

Digital Equipment Corporation, Boston, MA, 1991.

IBM/National Geographic, Atlanta and Washington, DC, 1990-91.

Wyoming State Department of Education, Laramie, WY, 1989.

## Publications

Browne, D., & Ritchie, D. C. (1991). Cognitive apprenticeships: A model of staff development for implementing technology in schools. *Contemporary Education* 63 (1) 28-34.

Ritchie, D. C., & Dodge, B. (1992). "Integrating technology usage across the curriculum through educational adventure games." *Proceedings: Society for technology and teacher education*; 639-642. Charlottesville, VA: Association for the advancement of computing in education.

- Ritchie, D. (1989). *Instructional manual for the Wyoming SEEDS program*. Logan, Ut: Mountain-Plains Regional Resource Center.
- Ritchie, D. (1980). *Factors which affect visitor satisfaction within the marine areas of the National Park System*. Laramie, WY: University of Wyoming.

### National Presentations

- Ritchie, D. C., & Dodge, B. J. (1992). *Integrating technology usage across the curriculum through educational adventure games*. Association for Educational Communications and Technology. National convention; Washington DC.
- Dodge, B. J. & Ritchie, D. C. (1992). *Development of interactive educational adventure games for students*. Association for Educational Communications and Technology. National convention; Washington, DC.
- Ritchie, D. C. (1992) *Using the cognitive apprenticeship approach to assist teachers in increasing their educational technology skills*. Society for Technology and Teacher Education. National convention; Houston, TX.
- Ritchie, D. C., & Dodge, B. J. (1992). *Integrating technology usage across the curriculum through educational adventure games*. Society for Technology and Teacher Education. National convention; Houston, TX.
- Ritchie, D. C., & Johnston, K. (1991). *Using IBM's LinkWay as an instructional design tool*. Association for Educational Communications and Technology. National convention; Orlando, FL.
- Ritchie, D. C. (1991). *Goal setting and academic achievement relationships to mastery learning*. Association for Educational Communications and Technology. National convention; Orlando, FL.
- Merrill, M. D., & Ritchie, D. C. (1989). *Content organization vs. cognitive organization in the science curriculum*. Association for Educational Communications and Technology. National convention; Dallas, TX.
- Ritchie, D. C. (1989). *The theory of elaboration strategies at the micro- and macro-levels of instruction*. Association for Educational Communications and Technology. National convention; Dallas, TX.

### Honors

- Recipient of national Dorthea Weinman Scholarship for outstanding graduate work in the field of Instructional Technology, 1989.
- Appointed to co-chair the 1993 Society for Technology and Teacher Education national convention.