THE EFFECTS OF CONTRACT GRADING ON MOTIVATION AND MATHEMATICS ACHIEVEMENT OF UNDERPREPARED COLLEGE STUDENTS

by

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(ABSTRACT)

This study investigated the effects of contract grading on motivation and mathematics achievement of underprepared college students. The study also examined the relationship between motivation and mathematics achievement. The expectancy theory of motivation containing the five components -- anticipated effort, valence of first level, valence of second level, expectancy, and instrumentality -- provided the theoretical basis for this research.

This investigation provided answers to the following questions: Is there a difference in mathematics achievement of students using contract grading as compared to students not using contract grading? Is there a difference in the motivation of students using contract grading and students not using contract grading? Is there a relationship between motivation and mathematics achievement?

There were seventy-four students enrolled in the basic skills arithmetic course involved in this study. These students were in attendance at a small, historically black college. The study took place during the fall semester, 1984.

Analysis of covariance techniques were used with pretest scores as covarites for posttest achievement and motivation means. Pearson correlation was computed for determining a relationship between motivation and mathematics achievement.

Contract grading had a significant effect ($p \leq .02$) on mathematics achievement scores in this study. There was a significant difference between groups on the components of valence of second level ($p \leq .01$) and instrumentality ($p \leq .03$) in favor of contract grading students. There were no significant differences between groups on the components of anticipated effort ($p \leq .42$), valence of first level ($p \leq .07$), and expectancy ($p \leq .76$). Pearson correlation computations found no significant relationship between motivation and mathematics achievement for the contract grading group. Expectancy was significantly correlated with achievement for the noncontract grading group, while the other components were not significant.

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Chapter I

INTRODUCTION

Origin and Background

During the last two decades, educators in many institutions of higher education have expressed concern because students are entering with low motivation and pronounced weaknesses in reading, writing and arithmetic. Without special educational provisions, many of these students have become dropouts because they lack the motivation and necessary skills to achieve success. Our achievement-oriented society expects the educational system to provide an environment that will enhance student success (Cross, 1974; Gallup, 1976; Grant & Hoeber, 1978; Richardson, Martens, & Fisk, 1981). Klemp (in Jacobson, 1977) has suggested that colleges should go beyond helping their students acquire cognitive skills important to occupational success.

The number of students who do not meet the traditional standards of high test scores and a history of academic success for college admission has been increasing since the implementation of open-door admissions and an increase in recruitment efforts (Cross, 1974; Roueche & Mink, 1976). Richardson, Fisk, & Okun (1983) suggest that the trend of accepting these students may continue because colleges are responding to the needs of underprepared students by

providing education through a variety of developmental programs. Daniel (1978) contends that, regardless of the deficiencies students bring, it is imperative that colleges provide developmental programs to assist students in meeting their needs. He suggests that, "colleges include a provision for basic skills mastery so that what we have to offer is truly made available and accessible to all our students" (p. 4) as part of the mission and purpose of colleges.

It is evident that a variety of instructional strategies can be employed that have potential for enhancing the motivation of underprepared students. It is also clear that instructional strategies used in developmental programs do not always affect those variables which may increase achievement (Losak, 1973). Students will be motivated to learn if their environments provide them with (1) the opportunity to be self-determining and (2) activities that are challenging so that their efforts can lead to eventual success (Deci & Ryan, 1982).

Educators have used various techniques to motivate students to increase their effort in course activities. For example, Gaa (1973) examined goal-setting conferences as a way to increase motivation. In that study, students who had weekly goal-setting conferences showed a significantly higher achievement level as compared to students who had no

conference at all. On the other hand, Hammer (1972) used feedback to increase performance. The results of that study indicated a better performance by students receiving specified comments written on their papers than students not receiving comments. In another study, Huck and Long (1973) used behavioral objectives as a means of increasing performance. They reported results that indicated a higher achievement for students who received the behavioral objectives for the class prior to the lecture as compared to students who did not.

Expectancy theory (Mitchell, 1974; Vroom, 1964) can provide a basis for designing motivational treatments. In an academic setting, expectancy theory of motivation allows students to decide or choose what activities to undertake. The students then choose the level of effort they will perform during the course of moving toward a reward. The length of time taken by students to perform activities is viewed as a measure of strength of desire for obtaining a particular reward. As students move along the path toward their reward, they should have relatively free movement. The number of hours per week a student studies specific lesson assignments determines effort. In turn, the desirability of these lesson assignments toward course outcomes determines valence. Consequently, the relationship between effort and performance is a measure of expectancy,

and the relationship between performance and the attainment of a particular personal goal is instrumentality. These are the major components of Vroom's (1964) models that have been modified for use in this study. The expectancy theory components are appropriate for use with the instructional strategy of contract grading to improve motivation and achievement of underprepared students.

The contract grading strategy, in this study, emphasizes effort and a relationship between the immediate course activities and the students' obtaining a goal. The signed contract agreement between the teacher and students specifically point out the performance levels necessary to attain their reward. This study was attempted in order to provide a linkage between the use of the contract and expectancy theory by using all the components of motivation, namely effort, expectancy, instrumentality, and valence.

The study by Polyczynski & Shirland (1977) was the only one reviewed which described an attempt to combine expectancy theory of motivation and contract grading as a motivational force for college students. That study placed emphasis on only one component of expectancy theory, instrumentality, and did not indicate any measure of achievement. The researchers used business administration students and attempted to increase the performance/reward relationship through contractual grading. The contract

contained performance levels necessary to attain a specific reward, in this case, a grade for the course. The results from their motivational questionnaire indicated that contract grading was a suitable way to strengthen the relationship between performance and reward since students' efforts increased significantly. However, there was no measure of achievement reported in the study.

Historically black institutions have motivational strategies as well as courses to reduce basic skills deficiencies in order to help students successfully pursue and complete their college degrees (Willie & Edmonds, 1978). Thompson reports that black colleges have traditionally accepted students regardless of their socioeconomic status and their varying high school records. He notes that due to the history and background of black college students, the faculties of black colleges have dedicated themselves to a highly personalized approach to teaching. These unique students require innovative instructional strategies which meet their needs to enhance motivation to achieve success. Hence, the historically black college is committed to provide learning strategies for the poorly motivated students who may not benefit from the traditional lecture/textbook/discussion teaching method (Thompson, 1973).

Deci and Ryan (1982), Halpin and Halpin (1973), and

Wyatt (1978) indicate a need to look at alternative ways of motivating underprepared students. The study reported here involves one specific method in one subject area.

Purpose of the Study

This study was designed to determine the effects of contract grading on mathematics achievement and motivation of students in a developmental mathematics course. In addition, the study determined the relationship of motivation and mathematics achievement. The specific research questions were:

1. Is there a difference in mathematics achievement of students using contract grading as compared to students not using contract grading?
2. Is there a difference in the motivation of students using contract grading and students not using contract grading?
3. Is there a relationship between motivation and mathematics achievement?

RATIONALE

Expectancy Theory of Motivation.

Expectancy theory of motivation, often referred to as path-goal analysis, states that if a person is given a desired goal and is shown a clear path leading to that goal, the person will become motivated to increase goal-oriented effort (Heneman & Schwab, 1972). Expectancy theory further

suggests that, to induce motivation, not only must a desired goal be presented and a path to that goal explained, but the person must believe that the performance level reached through effort will result in the attainment of the goal (Childs, 1982; Polczynski & Shirland, 1977; Youssef, 1980). Expectancy theory also predicts work motivation on the basis of expectancies and values of outcomes. The theory accommodates different outcomes, needs or goals, and individual differences. It does not propose that all individuals value a specific outcome equally. Expectancy theory proposes that, if a person does value a particular outcome, the degree of valuing will be positively correlated to that person's work or course motivation (Youssef, 1980).

Motivation theories are designed primarily as an explanation of why people make an effort to fulfill a goal. Therefore, the application of expectancy theory in an educational setting seems to be justified for two basic reasons: (a) an individual's (student's) expectancy that his/her task effort will lead to achieving or attaining rewards or outcomes, and (b) his/her valuing of the outcome (Campbell, Dunnette, Lawler, & Weick, 1970).

Contract grading.

The grade contract for this study was a written agreement between the teacher and the student describing what factors are used to determine the student's grade and

the level of performance required to earn the desired grade. The required interaction between the teacher and each student provides a level of freedom in selecting the path to a goal that is not evident in traditional classes (Blankenship, 1977; Dewey, 1922; Newcomb, 1973; Trabont, 1974; Yarber, 1974). Some authors advocate contract grading because of the advantages they believe it provides. For example, Yarber (1974) and Kirschenbaum, Napier, & Simon (1971) stated that a major advantage was the decrease in anxiety felt by students. With contract grading, by completing a certain quantity of work, the students know what grade they will receive in the course. Yarber (1974) also indicated that, because of the element of self-directed learning, student motivation is increased.

According to Kirschenbaum et al. (1971), specifying the quantity of work and the quality of work along with the method of evaluation means that students know the teacher's expectations of them. These specifications may also decrease the subjectivity of students' grades in that the personal factors of teachers toward students' grades may be greatly reduced (Yarber, 1974).

A variety of research has been conducted on contract grading systems; most of it has centered on the variables of final grades, final examination scores, and student attitudes. Contract grading has generally been compared

with traditional or conventional grading systems. The results which have been reported about contract grading have shown no difference between contract grading and traditional grading on posttest measures of achievement (Blankenship, 1977; Chiaramonte, 1979; Newcomb, 1973; Yarber, 1973). However, contract grading has resulted in comparable levels of learning as measured by posttests in a variety of situations. Because each student is an individual, learning needs will differ and will require different stimulii for motivation. Additional information on student achievement and motivation as a result of the effect of contract grading should also aid the instructor in making more valid decisions on choices to motivate students (Blankenship, 1977; Polczynski & Shirland, 1977).

Significance of the Study

Although low achievers and disadvantaged students were included in some research, the findings do not reflect their differences among the variables in any particular study. This study was designed to enhance motivation and improve achievement within a population that may expect little hope of overcoming their academic deficiencies. The contract agreement that was used in this study is based upon a motivation theory that allows every student to exert effort and display performance that can reduce alienation, isolation, and inadequate preparation by freely moving along

a path to attain a specific reward.

If the findings of this study suggest a benefit from contract grading, colleges will have an added means of improving instruction and increasing student academic success. Although not having a direct outcome, this study expands knowledge about a student population in a learning situation rarely included in research literature on mathematics education. The importance of motivation and its relationship to mathematics achievement, as stressed in the development of contract grading, may present insights of value to instructors in other basic skills studies. Additionally, this study contributes empirical evidence to the application of the expectancy theory of motivation in an educational setting.

Limitations of the Study

1. This study was limited to college freshmen enrolled in developmental mathematics classes at an historically black institution.
2. The duration of this study was limited to the Fall semester of 1984.
3. The out of class activities were not controlled.
4. The basic procedure called for random assignment of students, but late arrival of students with scheduling problems, caused class assignments which produced unequal class sizes.

Definition of Terms

Several terms are defined to assist with the understanding of their usage throughout the study. They are:

Motivation refers to the student's determinants of (a) the choice of initiate effort on studying; (b) the choice to expend a certain amount of effort; and (c) the choice to persist in expanding effort over the term in order to accomplish certain course activities which would lead to fulfilling course goals or outcomes (Youssef, 1980).

Components of Motivation

1. Anticipated Effort (AE) refers to one's subjective estimation of how much time was spent to attain the desired personal goal.
2. Expectancy (E) refers to the perceived degree of relationship one sees between level of effort and level of performance.
3. Instrumentality (I) refers to the perceived degree of relationship one sees between the level of performance and the attainment of personal goals.
4. Valence (V) refers to the desirability of course outcomes to students (Youssef, 1980).
   A. Valence of first level (V1) represents how desirable students feel it will be to put an amount of time and effort into the tasks

considered to be important for successfully completing the course.

B. Valence of second level (V2) represents how desirable students believe certain outcomes of taking mathematics courses will be (Youssef, 1980).

Contract Grading refers to a written agreement between the instructor and the student that specifies the required activities to obtain a particular grade. The contract was negotiated between the instructor and the student with options agreed upon for each grade (Blankenship, 1977).

Achievement refers to the measurement of student ability when compared by pretest and posttest scores at the completion of a program of instruction (Cooley & Lohnes, 1976). In this study the Arithmetic Skills Section of the Descriptive Tests of Mathematics Skills (DTMS) of the College Board was the instrument.

Underprepared Student(s) refers to the students who do not meet traditional standards for college attendance in terms of test scores and history of success (Cross, 1974).

Summary

The motivational development of underprepared students is a national concern of educators, parents, and the public. Improvement in motivation should cause an increase in achievement if the importance of an immediate activity

toward attaining a future is emphasized. This study was designed to determine the effects of contract grading modeled after expectancy theory on mathematics achievement and motivation of students in a developmental mathematics course. In addition, the study examined the relationship of motivation to mathematics achievement.

Chapter II

REVIEW OF THE LITERATURE

The review of the literature for this study has been restricted to materials which deal with the underprepared student, motivation, expectancy theory, contract grading, and student achievement. Each of these factors has a direct relationship to the study.

The Underprepared Student

Open door admission policies, coupled with the special admissions programs which permeated two-year and four-year colleges during the latter part of the sixties, opened a Pandora's box in higher education. Because of these programs, a new breed of student found its way into colleges throughout the nation in high numbers. Many of these students entered college underprepared to perform effectively in colleges because the characteristics they brougt in terms of academic abilities, motivation to achieve, and previous academic success were not congruent with college policies that were designed for more traditional students (Astin, 1978; Cross, 1974; Young, 1977).

Underprepared students present a challenge to administrators and faculty members because they can not assume that the vast majority of entering freshmen have the basic skills in reading, writing, and arithmetic needed to

satisfactorily complete traditional college courses. In fact, the Carnegie Council's report (1980) suggests that we can expect more and more underprepared students to enter college in the future. Colleges will have to change their mission statements and prepare themselves to serve a more diversified population, or run the risk of an increased attrition rate. Greater numbers and a greater variety of institutions will need special programs for the underprepared students.

Historical Perspective. Special programs for the underprepared are not new in higher education; however, the need for these programs has increased with the number of underprepared students attending college (Richardson, Martens, & Fisk, 1981). Maxwell (1979) reports that as early as 1900, the need for special programs was evident even at schools such as Harvard, Yale, and Princeton, where over half of the new students could not meet minimum traditional requirements for entrance.

In the 1920's, existing colleges turned to other institutions to provide remedial services for underprepared students. This was one factor giving impetus for the growth of community colleges (Richardson, Martens, & Okun, 1983). The 1940's and 1950's brought to the college a large number of veterans who were in need of special remedial services.

According to Astin, Astin, Bisconti and Frankel (1972),

it was not until the 1960's that a new growth of social consciousness and conscience began to permeate higher education institutions. Institutions became aware of the discrepancy between democratic principles and national practice as campus unrest and the Black revolution spotlighted the lack of adequate educational provisions for the underprepared. Astin, et al. (1972) indicated that

> ...in an attempt to do something fast, in response to the demand that latent talent be identified and developed, special programs for disadvantaged students have proliferated; unfortunately, too many of them are haphazard in design and token in scope. (p. 4)

Students in these programs are assumed to lack the requisite motivation and academic skills to seek and successfully pursue a college education, and thus are considered "disadvantaged" or "high risk."

Characteristics of the Underprepared. Ambiguous terms such as "high-risk student," "educationally underprepared student," "developmental students," and "new students" are used for low achieving students. In today's literature the word "disadvantaged" is used to describe any or all of the above terms (Astin et al., 1972). Cross (1974) defined the high risk students as ". . . those scoring in the lowest third among national samples of young people on traditional tests of academic ability" (p. 13). Similarly, Monroe (1972) defined them as

> ...students who are found in the lowest quartile on the college norms on any standardized aptitude test and who are severely deficient in reading and mathematical skills (p. 110).

Moore (1970) pointed out that too often the low-performing student is considered to be "synonymous with the lower-class, poor white student or any black student" (p. 24). He went on to say, "The high-risk student is not confined to our slums . . . . And there are more differences among underprepared students than there are similarities" (p. 25). Their weaknesses and ambivalences are often contrasted against their intelligence, curiosity and capacity for work (Report of the Committee on the Student in Higher Education, 1968).

In an earlier study, Gordon and Wilkerson (1966) found that low motivation and low self-esteem are factors causing students not to have a real perception of opportunities. They cite studies which indicate that the motivation of underprepared students may not only be lower but may likely be the result of personal goals which are inconsistent with the demands and goals of formal education; that is between making immediate vs. long-range goals. It is their contention that such a depressed level of aspirations is consistent with the student's available perceptions of opportunities and rewards.

The related research reported considers motivation as an influence on achievement performance. According to the

literature, underprepared students have inadequate mathematics backgrounds, poor study habits, a severe lack of motivation, only short-term goals, and very poor reading and writing skills (Cross, 1974; Richardson et al., 1983; Sedlacek, 1983).

Historically Black Colleges

Black colleges have traditionally accepted students regardless of their socioeconomic status and the diversity among high school records. In order for black youths to have the opportunity to develop their talents for service in the community and the nation, black colleges started open admissions. Because their students had a history of denial of access to adequate education presented the early black colleges with the difficult challenge of transforming underprepared students into productive citizens. Then, as now, faculties of black colleges have dedicated themselves to a highly personalized approach to teaching because of the generally low socioeconomic background and limited exposure to higher education of black college students. Black faculty members have combined traditional and innovative approaches to learning (Thompson, 1973).

Monro (1978) says

> The truth is--and all of us on the open-door campuses know this from experience--that a serious percentage of our 'invisible' students are well above average in intellectual ability, either ready right now for the university program or ready after a term or less of

preparatory help. (p. 235)

Motivation

At all levels educators face the question of how to motivate students to produce more effort in course-related activities. Generally, motivation deals with various factors which stimulate and direct an individual's actions (Atkinson, 1964). However, the complexity and controversy surrounding the motivation concept may be reflected in the diversity of ideological stances taken by some theorists concerning the nature of humans. Therefore, the adoption of a specific philosophy about what it means to be human leads to a particular theory of motivation and its empirical application (Graham, 1981).

Like many other terms, motivation has a number of meanings, all of which are extremely broad and general. The concept is difficult to measure because of this ambiguity. For example, "intensity and kind" are the chief aspects of the motivation process considered by Dunkel (1948). He describes "kind" as related to the student's general objectives or goals of taking a course. He called the student's strength (performance) or effort in achieving his/her goals "intensity." According to Vroom (1964), motivation is a process governing choices, made by any organism, among forces of voluntary actions. Assuming that motivated behavior has several aspects, Stotland (1969)

presented a broader definition of motivation that included mental behavior, overt action toward goal attainment, covert symbolic action, and selective attention to relevant aspects of the environment pertaining to one's goals.

Two common factors have surfaced from the theoretical approaches to motivation: (1) motivated behavior is goal directed or purposeful and (2) there are three facets of behavior, namely direction (i.e., preference), intensity or strength (i.e., performance) and endurance (i.e. perseverance or persistence) (Campbell, Dunnette, Lawler and Weick, 1970). These three facets of motivational behavior will vary from one situation to another. Within an academic setting, prior to receiving any reward (i.e., grades), students must decide or choose what activity to undertake. The students continue to choose the level of effort they will exert during the course by being rewarded in a particular manner (i.e., the reinforcement schedule--e.g., grades). The length of time students take to complete course activities can be viewed as a measure of the strength of desire for obtaining rewards (Campbell et al., 1970).

Lawler (1973) described two psychological views about the nature of humans. One view is that humans are driven by inherited, conflicting, unconscious drives that cause them to behave in instinctive and, at times, self-destructive ways. The second view considers humans as rational and

aware of their goals and acting in ways that they feel will help them attain their goals. He further states that the "...majority of human behavior is goal-oriented and is at least rational in the eyes of the behaver" (p. 5). Researchers studying motivation in the area of industrial or organizational psychology take the latter view of the nature of the individual (Campbell, et al., 1970; Lawler, 1973; Porter, Lawler & Hackman, 1975; Steers & Porter, 1975).

Types of Motivational Theories. To some degree, most psychological theories of motivation, both early and contemporary, have their roots in the philosophic position called hedonism (Atkinson, 1964; Lawler, 1973; Steers & Porter, 1975; Vroom, 1964). Hedonism states that individuals tend to seek pleasure and avoid pain. Therefore, they seek experiences that lead to pleasant outcomes and avoid experiences that produce pain. Hedonism is based on the assumption that individuals consciously make intentional decisions or choices concerning future actions and are oriented to increase pleasure and reduce pain (Steers & Porter, 1975). Vroom (1964) saw that this hedonistic assumption had no empirical content and was untestable. Behavior could be explained after the fact, but no form of prediction in advance was possible.

Hedonism eventually evolved into the modern content and process theories of motivation according to Luthans &

Kreitner (1975). Miner & Dachler (1973) subscribed to the same view. According to Campbell et al. (1970), content theories attempt to identify and define the specific entities within a general class of important variables. In other words, these authors pinpoint what specifically motivates people.

Process theories of motivation attempt to explain and describe the process of how behavior is energized, directed, sustained, and eliminated. These theories attempt to specify how the variables interact and influence one another to produce certain kinds of behavior. Furthermore, process theories sometimes attempt to specify the variables making up a class, while content theories try to embed variables in a process framework (Campbell et al., 1970). Expectancy theory is one such process theory.

Expectancy Theory. Expectancy theory is a process motivation theory of behavior heretofore applied mainly in the area of organizational and industrial psychology. The theory was first used in an organizational setting by Georgopoulos, Mahoney, and Jones (1957). However, Vroom was the first to gather data for theoretical formulations of expectancy theory applied to organizational behavior (Mitchell, 1974).

Youssef (1980) cites Tolman's (1932) and Lewin's (1938) behavioral studies as leading to the development of

expectancy theory. She further contends that Tolman postulated that the expectancy of a response leading to the goal stimulus and the incentive value of the goal occurs because behavior is a function of organismic demand. Even though Tolman indicated that the determinants of a behavioral relationship may be multiplicative, he did not specify a mathematical relationship. Lewin stated that when attempting to understand and predict behavior, one must consider the totality of forces acting on the person at the moment in time. When a positive or negative valence is acquired, it is the result of a force acting on a person. A psychological need must exist for a positive or negative valence to occur (Youssef, 1980).

A number of similar theories, with the same basic assumptions of expectancies and valence as the major determinants of human behavior, have been developed as a result of the Tolman and Lewin work. Atkinson (1964) focused on achievement-related behavior. He interpreted motive to be a determinant of an individual's capacity to value specific outcomes and to affect what environmental objects can serve as reinforcers. Individuals will approach achievement-related tasks whenever the motive to achieve success is greater than the motive to avoid failure. All the motives that cause the individual's expectancies of achieving task outcomes strengthen the desire to perform in

this situation.

Georgopoulos et al. (1957) explained the variance in workers' productivity in an industrial area by introducing the concept of instrumentality and use of a path-goal hypothesis. The authors contend that, as workers perceived effective effort as a path to their personal goals, they would exert effort toward effective performance. Because the results of their study supported the basic path-goal hypothesis, they followed by introducing what they called "level of freedom" as a variable. In essence, their argument was that, if a worker's choice was a path of high productivity, he/she actually becomes a high producer only if the desired path contains no interferences. The rendering of motivation to actual productive behavior on a general level may be hindered by interferences, indicating one should have relatively free movement along the desired path.

Since desired outcomes differ for each person, Steers and Porter (1975) noted that expectancy emphasizes individual motivation. Vroom (1964) stated, "We assume that choices made by a person among alternative courses of action are lawfully related to psychological events occurring contemporaneously with the behavior" (p. 14). He used his model to suggest that there were choices among tasks and choices between effort levels within tasks. The valence, or

perceived value of outcomes, and the expectancy, or belief that the work behavior will lead to attaining work outcomes, are two forces of motivation that influence an individual's selection of a specific task or effort level as predicted by Vroom. Thus, the product of force of motivation is expectancy times valence.

Valence, expectancy, and instrumentality are the major concepts of expectancy theory. These concepts are presented as Vroom's (1964) three models: (1) prediction of valences of outcomes; (2) prediction of performance; and (3) prediction of the force toward behavior.

Vroom (1964) defined valence as

> ...an affective orientation toward particular outcomes. In our system, an outcome is positively valent when the person prefers attaining it to not attaining it . . . . An outcome has a valence of zero when the person is indifferent to attaining or not attaining it . . . and it is negatively valent when he prefers not attaining it . . . . It is assumed that valence can take a wide range of both positive and negative values (pp. 14-15).

Anything one wants to attain is an outcome (Mitchell, 1974). Vroom (1964) pointed out that valence alludes to the anticipated satisfaction associated with an outcome and is distinguished from the value of an outcome; the actual satisfaction occurs from the attainment of the outcome (Mitchell, 1974).

Vroom (1964) defines expectancy as "a momentary belief

concerning the likelihood that a particular act will be followed by a particular outcome." An expectancy is a perceived probability ranging from 0 to +1.0. Vroom (1964) also defines instrumentality as the degree to which a person sees an outcome in question as leading to the attainment of other outcomes. Instrumentality varies from +1.0 to -1.0. Thus, an outcome may be leading to another desired outcome (+1.0) or never lead to a second outcome (-1.0) or possibly leading to the outcome, e.g., +.5 (Campbell et al., 1970).

Several modifications of Vroom's expectancy model have been developed by other theorists and researchers. Among them are Campbell et al. (1970), Galbraith and Cummings (1967), Lawler and Porter (1967), Lawler (1970), and Nebeker and Mitchell (1974). The basic expectancy model formulation is accepted, with added variables. Lawler and Porter (1967), for example, offered a distinction between effort and performance. They supported the idea that effort was an indicator of whether rewards were meaningful. The sum total of successful perception or achievement and productivity of physical output indicate performance. In 1968, the authors suggested separating path-goal expectancy into two variables: (1) the expectancy that effort will result in successful performance, i.e., first level outcome, and (2) the instrumentality of the particular level of performance for obtaining certain outcomes, i.e., second level outcome.

Galbraith and Cummings (1967) called the first level outcome work performance and the second level outcome the reward received from the events of the first level outcome.

The expectancy model was extended by Campbell et al., (1970), when they differentiated two types of expectancies: Expectancy I, referring to whether or not an individual will actually accomplish a task goal or work role, and Expectancy II, referring to whether or not rewards are contingent on the achievement of a task goal.

Nebeker and Mitchell (1974) proposed a mathematical modification of the expectancy model. They contend that each behavior continuum (of the dependent variable effort or performance) can be represented by a finite number of equi-distant discrete behavior levels and that the individual's expectancy and valence can be calculated separately for each level of that continuum. An individual's theoretically predicted behavior level is the level with the highest instrumentality-valence within a behavior continuum and can be compared with separate estimates of actual behavior.

From this discussion, one may conclude that the various models of expectancy theory share the basic assertion that the desire to behave in a specific manner depends upon the strength of an expectancy that the act will be followed by a given result and the value the person has of that result (Youssef, 1980). So within an academic setting the strength

of the student's learning behavior is dependent upon the strength of his/her perception that fulfilling course activities will lead to achieving course goals and upon the student's valuation of those goals.

Explanation of human behavior in any performance setting has a sound basis theoretically and practically from expectancy theory. In learning situations, the interest in examining the extent to which students' behavior may be actually governed by cognitive principles is theoretically sound. When such models have empirical support, surely a significant and practical contribution to educational effectiveness will be maintained as conditions leading to higher student motivation and performance are observed (Campbell et al., 1970; Mitchell & Nebeker, 1973).

Expectancy Theory Motivation of Students. Some studies have applied expectancy theory to various student attitudes and behaviors. Instrumentality and valence constructs were used by Constantinople (1967) to predict the satisfaction of the college experience for groups of college freshmen and junior men and women. She used fourteen outcomes of the college experience multiplied by their valence to the student and summed over the outcomes to produce the total score for the student. Satisfaction as an independent measure was correlated with the total score for each student group (class and sex).

Mitchell and Nebeker (1973) used expectancy theory models to predict effort and performance of college students. Their use of the expectancy theory implied that effort is related to the degree to which the behavior is seen leading to several outcomes weighted by the estimate of these outcomes. The average number of hours per week a student studied determined effort, and grade point average indicated performance. Data indicated that the model predicted the effort level and gave a direct measure of attitude towards effort. The expectancy model variables (V, E, I) helped explain further results and so, the authors recommended the continued use of the model in further research. They also found that ability (measured by aptitude test scores and high school grades) significantly predicted college grade point averages while the motivational component added an insignificant amount to variance of performance. There was evidence to support the addition of other independent variables, such as ability, hours spent, and work motivation, to increase the size of explained variance. This job performance model indicates that effort and ability combine to predict performance.

Batlis and Waters (1973) used a full expectancy theory model (with all the components) to examine the moderating influence of locus of control and achievement motivation variables in the prediction of psychology performance. The

study involved 264 males and females at a Mid-western University. Instrumentality was assessed by having students rate the importance of course outcomes. Effort was measured by students rating the importance of working hard to determine whether or not they would get a good grade in the course. Rather than use standardized measures or previous grades, student self-ratings were used to determine ability. The total number of points earned in the introductory psychology course was the predicted criterion measure. Measures of internal-external locus of control and resultant achievement motivation were the moderator variables. The multiplicative model was used in predicting course performance. The results indicate a low ($r=.22$) but significant correlation between scores from the model and course achievement. Only the resultant achievement motivation moderated the relationship between grades and model scores. The model better predicted those students with high resultant achievement motivation than those students low in motivation ($p<.02$).

Schmitt (1975) used a group of introductory psychology students in an attempt to investigate the causal relationships between both expectancy and effort measures as well as between effort and performance measures. Expectancy theory hypotheses were (1) expectancy attitudes cause motivation and (2) effort causes performance. The combined

measures of effort represented students rating their expected time (hours per week) studying psychology and their actual time studying psychology. In twelve course-related outcomes, expectancies and valences were obtained. This model did not contain an ability component. The first and last scores were combined to give the performance in the psychology course. A cross-lagged correlational approach was used to test the possible causal links. Such an analysis cannot prove causal links; it can, however, offer a possible causal direction. The expectancy measures correlated little with performance or effort measures, but performance and effort moderately correlated with each other. The author indicated that the cross-lagged correlational design suggested the strongest possible causal link had performance causing effort.

Matsui and Ikeda (1976) provided support for the expectancy theory model in predicting course performance in a study comparing the effectiveness of self-generated versus standard list expectancy measures. They used 154 high school girls. The group was split in half with one group creating valences on positive study related outcomes while the second group gave valence estimates to a standard list of developed outcomes. The basic expectancy model components with ability as a variable were produced for the students and correlated with the criteria of course

examination scores and course effort. The results indicated that expectancy measures correlated significantly with effort and performance in each group but were highest in the self-generated condition (self-generated r with effort = .44 and performance = .36; standard list r with effort = .28 and performance = .23).

In order to increase the instrumentality of students for the attainment of desired grades in business courses, Polczynski and Shirland (1977) used criterion contract grading. The results of the study lend support to the use of the expectancy theory in that those students who perceived the contract for a grade as an increased instrumentality for their own goals significantly expended more effort in class-related study behaviors.

In educational settings, these studies support the adaptability of expectancy theory in a variety of ways such as predicting college student satisfaction, effort, and performance. Additionally, expectancy theory components aid the explained difference when combined with other traditional independent variables in support of the theory (Graham, 1981).

However, only one of these studies used ability as a variable in the expectancy theory model (Mitchell & Nebeker, 1973). In that case, the ability factor provided a moderate correlation with academic success but expectancy attitudes

did not add to predictability. A setting where academic performance is measured will necessitate using the full expectancy model, with the possible inclusion of ability as a variable. Since the data has indicated no advantage in using a multiplicative model over an additive one, either may be used. In the studies discussed above, only psychology students were used. The results suggest the question about whether this limited support for the expectancy theory model be found using other types of students and particularly in other academic settings where course material learning might pose different learning strategies than in psychology.

Contract Grading

History of Grading. The percent method of grading, in which all the knowledge from a course of study was 100 percent, has been dominant most of the twentieth century. A minimum passing grade usually ranges between 60 and 75 and is assigned according to how much the teacher judged a student had learned. Students are judged against other students so the percent method is called "absolute marking" (Ebel, 1972). Studies conducted by Starch and Elliott (1912) to determine the reliability of teachers' grading found a wide variety from teacher to teacher on the same examination paper in English, mathematics, and history. These results raised serious questions about reliability of the "absolute

marking" used by teachers.

Factors other than achievement, such as attendance and promptness were found to be a part of the grading process (Rugg, 1915). Rugg also found that teachers were interested in changing from numbers to letters with few symbols. This fact sparked an interest in schools to establish a more uniform grading system. During the first decade of the 1900's, normal distribution grading became an important element affecting grading. Thus, "grading on the curve" arrived (Ebel, 1972). Smith and Dobbin (1957) reported that ranking of students to some normal distribution was under discussion during this period.

From 1920 to 1930 increased use of letter grading systems began to take preference to percent grading systems. With the advent of standardized testing during this decade, educators began to be concerned that achievement was being emphasized at the expense of other aspects of a student's education (Smith & Dobbin, 1957).

Comments about grading became more student-centered from 1940 to 1960. The relationship of grades and learning as reasons for grading rather than technical aspects of grading gained more interest among educators (Smith & Dobbin, 1957). As student unrest occurred during the 1960's, grading methods began to change on most college campuses with discussion about and trial of a wide variety

of grading practices. This experimentation and laxness contributed to the fact that the grade point average (GPA) on most campuses had increased (Levine & Weingart, 1973; Scully, 1974). Even now a wide variety of grading methods exists and many criticisms about grading variability among teachers are still prevalent. Presently, there is no universally accepted grading system.

Administration, motivation, guidance, and information are the main functions of grades as reported by Terwilliger (1971). The internal school system uses grades for administrative purposes. Decisions on promotion, honors, probation, transfer, and graduation are based on grades. Students who received high grades are given honors and awards which are widely publicized.

The motivational use of grades is questionable. Terwilliger (1971) contends that greater student effort is a result of grades. Leary (1975) reported that the motivational effects of grades are generally dependent upon abilities of students. Academically talented students receive positive reinforcement from grades. On the other hand, grades are viewed as a direct threat by low-ability students, and most students see grades as a means to an end. Thus, the often heard complaint is that students do not work for the knowledge, but work for the grade (Ebel, 1972).

For guidance, in regards to the school setting, the

grades may be used for internal and external means. Placing students in certain class sections or ability groups, as well as identifying academic areas suitable for students, may occur as a result of grades. Grades will identify strengths and weaknesses, also. Externally, grades are used for determining future career goals. Informational use of grades is the same as reporting grades. As students and their parents are informed of course grades, progress toward educational goals can be determined. Employers, colleges, and graduate schools use grades of prospects as a primary information system.

Even though grades were designed to report levels of achievement, they have been and still are controversial. Educators agree that evaluation is an important part of learning; however, they do not all agree on how the grading should be done (Leary, 1975).

Contract Grading System. Contract grading allows the use of letter grades without too much criticism and presents teachers a grading system which may place more emphasis on students' needs. A general definition of contract grading is that the student and the teacher prepare a formal agreement as to the outcome of their interaction. This agreement indicates the work the student intends to complete and the grade expected for completing that work (Blankenship, 1977).

The introduction of contract grading occurred in the Dalton Laboratory Plan at the high school level (Dewey, 1922; Monroe & Marks, 1938). A plan was developed to include a list of assignments for each course and given to the student on a monthly basis. With the contract plan, the student had the responsibility of satisfactorily completing the assignments before going to the next unit. By following this plan, these theorists maintained that there was improved content mastery. Improved study skills and work habits, a more desirable attitude toward learning, constructive problem solving techniques, and a teacher-student relationship that is more conducive to growth.

Under the name "contract method," there was a renewed interest in the concept in the late sixties. Among the many articles about this "modern" method, few formal, controlled experiments are reported (Yarber, 1974). Trabont (1974) stated that students using contracts learned more than anticipated. Fiske and Kersey (1974) noted the excitement produced by peer interaction. Amsden's (1970) results were statistically satisfactory but indicated contracts needed to be tried over a longer period of time (more than two weeks).

According to Peotter (1975), the contract does not give the teacher an easy way out. "It requires extensive organization in planning and in operation. But the rewards . . . outweigh the amount of work . . . ." Grote (1972)

found students displaying a positive change in attitude toward the course and did more work willingly, while Berta (1974) noted that students set high goals and undertook extra work early. Thompson and Davis (1970) noted great success with low achievers in poverty areas of Knoxville, demonstrated by grade jumps over a six-week period when contracts were used. Poppen and Thompson (1971) had statistically significant results from a similar study. Of 28 students, one failed to meet the contract and received a lower grade.

Contract Grading Research in Higher Education. There are few reported controlled experiments with contract grading in higher education. In one of the few studies, the Dalton Plan was used for four weeks with 23 college juniors, all of whom completed the highest contract (James, 1936). Two did not like it, but sixteen very strongly favored the method. The author complained of the time factor (50 hours using contract versus 12 hours of lecture per week) and the duplication of effort for the instructor, even though many students admitted to studying more effectively. Thus, he was sure every student had a thorough grasp of the important points of the subject matter; and, in terms of content mastery, the contract method was superior to the traditional method. This conclusion was based upon students' comments and their course performance.

Using analysis of covariance procedures, Teel (1967) found a positive significant difference in achievement level favoring the contract approach (n = 80) as opposed to the traditional method (n = 80) of teaching the fundamentals of electricity-electronics. The author recommends further investigation of the effectiveness of the contract approach. Note that this study reported the effect of contract grading on achievement as measured on a standardized test.

In an education course of 31 juniors and seniors, Shirts (1968) found that most contracted for a grade of A but were resentful at the amount of work. He felt the method was worthy of continued investigation.

Ferster (1968) and Dash (1970) used the method in psychology courses. Dash concluded that contracts should be used in many areas: home economics, humanities, industrial arts, natural sciences and social sciences:

> Issue may be taken with the type and number of activities at a given level. The essential point is that students are given a choice followed by class standards of expectation for their performance. Most (students) agree that this important lesson should have occurred much earlier in their school lives. (p. 233)

The contract grading method reduces the problem of failing students, low-achievers, or underprepared students dealing with grades near the end of the semester. Gilbert (1972) said this procedure ". . . does not dehumanize the student with a total audiovisual approach, nor does it bore

him with lectures" (p. 57). This method takes the students where they are and gives them the chance to make progress in understanding the subject.

Heimler and Cunningham (1972) indicated that the reduction of student apprehension and increased motivation and confidence in their abilities caused much renegotiation of contracts. Grimes (1972) observed that there must be a willingness on the part of the instructor to devote time to students needing special direction and assistance. It was pointed out by Harvey (1972) that students who fear failing can learn to approach the subject in a non-threatening atmosphere, even though there is no increase in the total performance. She feels that an integral part of contracting for grades is discussion between teacher and student; therefore, the teacher without the time should not try out the method.

Taylor (1971) conducted a study to assess student opinions regarding the use of contract grading in an educational measurement and evaluation course. The study included eighty-six students randomly selected during the fall semester. The author assumed the students were representative of the total enrollment group since no method was used on the basis of achievement nor any other criteria. Prior to the end of the semester, the author administered a 14-item Likert-type attitude scale that he developed. The

instrument contained positive and negative statements related to grade contracts with six possible responses from strongly agree to strongly disagree without a neutral position. Analysis of the data with regard to attitude indicated a generally favorable opinion toward the grade contract. In comparing the grade contract group with the control group, the grade contract students ranked the fairness of course grading significantly higher. There was no statistically significant difference found between the two groups on the course examination, understanding course objectives, or the standards for the course. From this sample, the results indicate that student opinion was not opposed to the grade contract even though it was not overwhelmingly positive.

When Poppen and Thompson (1971) randomly divided four educational psychology classes into an experimental group (n = 55) to be evaluated by contract grading, and a control group (n = 55), they determined the experimental group (grade contract) had a higher performance although the mean difference between the groups was not statistically significant. They concluded: "the procedure certainly does allow movement toward individualization of instruction and seems to have no real disadvantage as a grading procedure" (p. 422).

Student Achievement

Student achievement, which is a dependent variable in numerous studies, is defined by standardized test results or some criterion measure specific to that individual study. The success in these programs is measured by comparing pretest and posttest scores. In order to measure effectiveness, standardized scores are compared to national norms. The definition of achievement is universally an operational one--achievement as measured by the Iowa Test of Basic Skills, for example, or mastery as measured on criterion-referenced tests (Bloom, 1982). Cooley and Lohnes (1976) define achievement as the assessment of student ability at the completion of a program of instruction; achievement refers to the abilities measured at the termination of a program that are not predictable from any of the available aptitude measures before the program.

According to Madaus, Airasian, and Kellaghan (1980) any testing should measure the intentions or objectives of the program. The test can be the standard for evaluation of the program or teaching to the test may be the real alternative. The researcher must ask what the test will be doing--evaluating or dictating the program. In conclusion, Madaus et al., (1980) contend that standardized tests are indirect measures of learning.

Summary

The review of literature relating to underprepared students indicates that they arrive in college without the basic skills and motivation to achieve. Although these deficiencies are quite apparent, the open door admission policy allows these students an opportunity to receive a college education. They present educators with a challenge to overcome their underpreparedness in reading, writing, and arithmetic through enhanced motivation.

In spite of these students' low scores on standardized tests, they are entering institutions of higher education. Large numbers of students are also readily admitted to historically black institutions in spite of their wide-ranging high school records. These colleges usually present highly personalized approaches to teaching their students.

The literature reviewed points out the importance of the expectancy theory as a means of enhancing motivation. Research by Vroom indicates that motivation is a process governing choices made by any individual. According to expectancy theory, one can follow a path to a goal with a level of freedom. The choice of a task and choice of effort to complete the task will lead to the attainment of a goal as one moves along the desired path. Expectancy theory contains the components of effort, valence, expectancy, and instrumentality. Previous research studies focused mostly

on one component at a time.

The literature related to contract grading explicitly confirms the fact that specific activities allow one to obtain reward. Several studies indicate that the use of contract grading has resulted in significant differences between groups, the contract grading treatment has had an effect in improving achievement. On the other hand, some studies do not support those results, but the non-significance of differences reported by the authors do not suggest the elimination of contract grading.

There was only one research study attempting to use the expectancy theory and contract grading in an academic setting. Then, only one component of motivation, instrumentality, was measured; and achievement scores were not reported.

The present study was conducted to determine the effects of contract grading on motivation and mathematics achievement of underprepared college students. In addition, the study examined the relationship of motivation and mathematics achievement.

Chapter III

METHODOLOGY

This chapter describes the methodology of the study, including descriptions of the population, instruments, the contract, experimental design procedures for the collection of data, and the treatment of the data.

Population and Sample

The accessible population for this study consisted of all freshman students enrolled in developmental mathematics in an historically black college. The sample was composed of seventy-four students enrolled during the fall semester of 1984. The students were randomly selected for the four classes from the total group that signed up for Mathematics 030. Two classes were randomly selected by the toss of a coin to serve as the experimental group and the remaining two classes served as the control group.

Measuring Instruments

Descriptive Tests of Mathematic Skills. Scores on a standardized test were used to assess the academic achievement of the students. Form A of the Arithmetic Skills Test from the Descriptive Tests of Mathematics Skills (DTMS) was used to gather the pretest data. Form B of the Arithmetic Skills Test was used to gather posttest data.

The DTMS of the College Board is designed to provide data which can be used to (a) assist colleges in assessing

students' skills in particular areas of mathematics, (b) assign students to appropriate entry-level courses, (c) counsel students into upper-level courses for which they are qualified, and (d) plan instruction for students needing to improve their skills in a particular area of mathematics. The tests are used in a variety of situations, such as screening and placement of entering students, identifying learning needs, student achievement, and comparing two or more groups of students. The Arithmetic Skills Test has been used for several years at the college where this study was conducted to assess students' skills in mathematics.

The Arithmetic Skills test contains 35 questions divided into four clusters: (a) nine operations with whole numbers; (b) ten operations with algebraic expressions; (c) ten operations with decimals and percent; and (d) six operations with applications involving computations. This test has a reliability coefficient of .87 as computed by Kuder-Richardson-20 (Descriptive Tests of Mathematics Skills of the College Board, 1979).

Motivation Questionnaire. A motivation questionnaire was developed to assess the student's effort, valence, expectancy, and instrumentality (components of motivation). The questionnaire contained the constructs of Vroom's (1964) expectancy theory which he used to determine motivation of persons in the work world. The motivation questionnaire in

this study was based more specifically on Youssef's (1980) modification of Vroom's constructs (Appendix A and B). Youssef prepared her instrument for assessment of motivation in an educational setting.

Youssef (1980) used 102 foreign language students in a pilot study to validate the instrument. There were 212 foreign language students in the research study in which she applied the instrument. By using the coefficient alpha, she established reliability data for each component scale on the questionnaire. The reliability coefficient is included in the description of each component scale. This researcher used 61 freshman mathematics students in a pilot study in order to modify the motivation instrument. The reliability as computed by coefficient alpha from that pilot study is included in the description of each scale. The reliability of the scales computed by coefficient alpha in this study is found in Appendix C. The scale reliability coefficients support the adequacy of the instrument. The motivation questionnaire, therefore, appears to be a valid and reliable instrument that can be used to study the motivation of students in developmental mathematics settings.

Anticipated Effort. The anticipated effort (AE) is a motivational indicator of how much time students plan to study during the course. Data were collected at the beginning of the semester by using the questionnaire which

was designed to determine a student's study plans. Youssef's (1980) reliability coefficient was established at .76, while this researcher obtained a reliability of .65 in the pilot study.

Items 1 and 7 were used to obtain the final AE score in Youssef's study and the pilot study for this research. In this research study, AE contained the two items to determine students' study plans. Thus, the AE score was determined by adding item 1 and item 7 to obtain a maximum AE score of 11 and a minimum score of 2.

Valence. In this model, two valence estimates were important. The valence of first level outcomes (V1) represented how desirable students feel it will be to put an amount of time and effort into the tasks considered to be important for successfully completing the course. Students indicated a choice of 1 (Not Sure) to 5 (Very Desirable) and then the scores for the five items were added to arrive at a total V1 score. Maximum and minimum V1 scores ranged from 25 to 5. The reliability coefficients were established as .80 by Youssef (1980) and .59 by this researcher.

The valence of second level outcomes (V2) represented how desirable students believe certain outcomes of taking mathematics courses will be. Students indicated a choice of 1 (Not Sure) to 5 (Very Desirable) and the scores for the 8 items were totaled to obtain the V2 score. Maximum and

minimum V2 scores were 40 and 8. The reliability coefficients were established as .51 by Youssef (1980) and .72 by this researcher.

Expectancy. Expectancy (E) refers to the perception of students about whether they will feel that if they expend a reasonable amount of effort, they will be able satisfactorily to complete the course task requirements (first level outcomes). That is, E measures whether the students will feel they will do what is required of them in the course, if they put forth the effort. Students indicated a choice of 1 (Neutral) to 5 (Most Definitely), and the scores were added to obtain the overall score within the range of 25 maximum and 5 minimum. The reliability coefficients were established as .87 by Youssef (1980) and .71 by this researcher.

Instrumentality. Instrumentality (I) refers to the perception of the students of the relationship between satisfactory completion of the course task requirements (V1) and desirable course outcomes (V2). In other words, will the students see their completion of course tasks as being instrumental to their obtaining other outcomes as a result of taking the course? Students indicated a choice of 1 (Neutral) to 5 (Definitely Agree) and the scores on the eight items were totaled to obtain the overall score. Scores ranged from 40 to 8. The reliability coefficients

were established as .69 by Youssef (1980) and .75 by this researcher.

The Contract

The students in the contract grading classes were given a list of activities acceptable for each grade for the semester. The students decided which activities they wished to complete and negotiated with the instructor for the grade. The performance level for completion of contracts was set at 80%. The contract grade was determined by a signed written agreement between the instructor and the student with specific activities that would lead to that particular grade, C being the minimum grade.

The contract contained items that were modeled after expectancy theory. Students agreeing to complete course activities for a grade had to spend a specified amount of time on assignments which determined a level of performance. In order to obtain a reward (grade), students could see the desirability of the course outcomes, as well as the relationship of performance to attaining their goal(s) (Appendix E).

Experimental Design

The pretest-posttest control group design described by Campbell and Stanley (1966) was used for this study. This design permitted the analysis of differences in mathematics achievement and motivation resulting from participation in

contract grading.

The design is represented below:

R O_1 X O_2

R O_3 O_4

In the above design R represents randomization process common to both groups, while O_1 and O_3 are pretest measures, O_2 and O_4 are posttest measures, and X is the treatment (contract grading).

Procedure

Students were randomly assigned to four developmental mathematics classes (Math 030) for the 1984 fall semester. However, as students arrived late with scheduling problems, class assignment varied and unequal class sizes resulted. There were periodic conferences between the researchers and the mathematics faculty in order to discuss the details of the research.

Two teachers were involved in this study. One teacher taught only a contract grading class, while the other teacher taught the two control classes and a contract grading class. Because of the schedule of classes, a contract grading class and a control class met simultaneously. In-class assignments for both groups were identical, and daily homework assignments were similar for all groups. Therefore, identical basic concepts were

covered in all Math 030 class sections. A procedures manual was followed by each teacher (Appendices F, G, and H).

Collection of Data

The data for the study were collected in the classroom setting. Pretest data for the DTMS, Form A, were collected on the predetermined date established by the Director of Freshman Studies in September, 1984. Posttest data for the DTMS, Form B, were collected on the predetermined date established by the Director in November, 1984, prior to final exams.

The motivation questionnaire was administered during the month of September, 1984, as a pretest and in December, 1984, before final exams, as a posttest.

Treatment of Data

Data obtained on the pre-test and posttest measures were analyzed by analysis of covariance. Analysis of covariance reduces the effects of initial group differences by making statistical adjustments of the final means on the posttest data. This analysis should reduce the occurrence of statistical differences that do not really exist between the experimental and control group (Kerlinger, 1973). A Pearson correlation coefficient was computed to determine whether a relationship existed between motivation and achievement.

Chapter IV

Results and Discussion

Results

This study was designed to determine the effects of contract grading on achievement and motivation of students in developmental mathematics. In addition, the study was concerned with the relationship between motivation and mathematics achievement. Specifically, research question one addressed mathematics achievement, research question two was concerned with motivation, and research question three addressed the relationship between motivation and mathematics achievement. Analysis of covariance (ANCOVA) was used to test differences in posttest means using pretest scores as a covariate. Pearson product-moment correlations were computed to determine whether a relationship between motivation and mathematics achievement existed. The tables D1, D2, and D3 are found in Appendix D. An alpha level of .05 was used throughout to determine statistical significance.

In the analysis of covariance, parallelism of regression is assumed. Hence, a test of parallelism is required prior to the final selection of the analytic model. The test of parallelism was not significantly ($p \leq .05$) different. Therefore there was no basis for concluding that the slopes of regression between the two groups were

non-parallel.

Research Question One. Is there a difference in mathematics achievement of students using contract grading as compared to students not using contract grading? The results of the analysis showed there were differences in mathematics achievement scores between the contract grading and non-contract grading groups. Table 1 presents a summary of that analysis including the means and standard deviations of pretest, posttest, and adjusted posttest scores. The mean score for the contract grading students increased 7 points from the pretest (17.58) to the posttest (24.58). The mean score for the students not using contract grading (control group) increased 4 points from the pretest (20.07) to posttest (24.07). ANCOVA techniques confirmed a statistically significant difference (F (1,71) = 6.05, $p \leq .05$) in adjusted posttest scores in favor of the contract grading group (25.16) as compared to the control group (23.16).

Research Question Two. Is there a difference in the motivation of students using contract grading and students without contract grading? Motivation was measured using a questionnaire which included five components: anticipated effort (AE), valence of first level (V1), valence of second level (V2), expectancy (E), and instrumentality (I). The pretest, posttest and adjusted posttest means and standard

TABLE 1

Means and Standard Deviations for Mathematics Achievement Scores with Adjusted Post-test

	N	Pre-test		Post-test		Adjusted Post-test
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$
Contract Grading Students	45	17.58	4.42	24.58	4.62	25.16*
Non-Contract Grading Students	29	20.07	4.32	24.07	3.44	23.16

Analysis of Covariance for Mathematics Achievement Scores by Group

Source	SS	DF	MS	F	Level of Significance
Pre-test (covariate)	498.71	1	498.71	45.86	.00
Treatment	65.75	1	65.75	6.05	.02*
Error	772.13	71	10.88		
Total	1336.59	73	1165.34		

* sigificant at the .05 level

deviations of each component for contract grading and control groups are shown in Table 2. The only components that showed significant findings are V2 and I. The contract grading group had a lower pretest mean score (32.31) as compared to the control group (33.03) on valence of second level. On the other hand, the contract grading group did show a higher posttest score (34.04) than the control group (30.72). When pretest scores were used as a covariate, the adjusted posttest mean score for the contract grading group was 34.12 as compared to 30.61 for the control group. Very similar pretest mean scores (32.69 and 33.21) were found for groups on the instrumentality component. The posttest means for this component (I) indicate an increase of 1.4 points for the contract grading group and a decrease of 1.4 points for the control group, (34.09 vs. 31.86), respectively. Examination of Table 2 indicated that when pretest scores were used as a covariate, the adjusted posttest mean was greater for the contract grading group (34.18) as compared to the noncontract grading group (31.72). No statistically significant differences between the groups on the other three components, anticipated effort ($p \leq .42$), valence of first level ($p \leq .07$), and expectancy ($p \leq .76$) were detected (see Table D1 in Appendix D).

Research Question Three. Is there a relationship between motivation and mathematics achievement? In order to

TABLE 2

Descriptive Statistics for the Motivation Components

Component of Motivation (N)	Pre-test $\bar{X}$	Pre-test SD	Post-test $\bar{X}$	Post-test SD	Adjusted Post-test $\bar{X}$
Anticipated Effort (AE)					
Contract (45)	5.60	1.72	5.20	1.91	5.20
Non-Contract (29)	5.59	2.0	5.55	2.08	5.56
Valence of First Level (V1)					
Contract (45)	18.49	4.83	19.89	3.53	19.89
Non-Contract (29)	18.48	4.39	18.31	3.78	18.31
Valence of Second Level (V2)					
Contract (45)	32.31	6.15	34.04	4.99	34.12*
Non-Contract (29)	33.03	5.69	30.72	5.61	30.61
Expectancy (E)					
Contract (45)	18.76	4.99	18.71	4.37	18.92
Non-Contract (29)	20.17	4.04	19.52	3.56	19.20
Instrumentality (I)					
Contract (45)	32.69	5.16	34.09	5.07	34.18*
Non-Contract (29)	33.21	5.23	31.86	5.09	31.72

* significant at the .05 level

determine whether a relationship existed between motivation and mathematics achievement, Pearson product-moment correlation coefficients were computed. The data in Table D2 (Appendix D) indicated very low correlation between motivation and mathematics achievement for the contract grading group (AE - Math, r = -.15; V1 - Math, r = .11; V2 - Math, r = .14; E - Math, r = .01; I - Math, r = .19). Moreover, none of the correlations were statistically significant for motivation and mathematics achievement. All of the correlations, however, were statistically significant between components.

The data in Table D3 (Appendix D) indicate that expectancy was the only component of motivation showing a significant correlation with mathematics achievement (r = .32). Except for AE and V1, the correlations between components were significant for the noncontract grading group.

Discussion

The data in this study revealed statistically significant differences between the contract grading and non-contract grading groups on mathematics achievement in favor of the contract grading group. Thus, question one -- Is there a difference in mathematics achievement of students using contract grading as compared to students not using contract grading? -- is answered affirmatively. Based on

the pretest mean scores and posttest mean scores (Table 1) of each group, the students did not start at the same level; and it seems to be apparent that the treatment did have a positive effect on mathematics achievement of these underprepared students.

The results of this study are consistent with Teel's findings using contract grading with electricity-electronics students. Although other studies using contract grading have been favorable for the contract groups, these studies only indicate that students with contract grading receive higher grades or higher exam scores but were not significant as compared to the non-contract grading groups. However, the findings of this study encourage further use of contract grading as a means of improving achievement.

The literature indicates that expectancy theory consists of several components. In this study, the components of expectancy (motivation) - anticipated effort, valence of first level, valence of second level, expectancy, and instrumentality - were examined in order to answer research question two. The question was: Is there a difference in the motivation of students using contract grading as compared to students not using contract grading? The findings in this study support Polczynski's and Shirland's results regarding the instrumentality component favoring the contract grading group (Table 2). Furthermore,

this study found that the change in component V2 - desirable course outcomes - was statistically significant. Perhaps these two components, I and V2, are very closely related. The results indicate that contract grading did raise students' instrumentality and valence of second level outcomes.

It might be assumed that if contract grading were a motivational force, then the amount of time students spend in class-related activities should be greater for the contract students. On the other hand, if a student's anxiety or concern for the difficulty of the math class caused him to overestimate his anticipated effort, then the difference between the actual effort and anticipated effort would be affected. If students think that contract grading will provide a pathway to achievement or increase the chance for success in the course, they should be willing to expend more effort. Unfortunately, this study did not reveal significant differences between the contract grading and non-contract grading groups on three of the motivation component measures. Perhaps this finding reflects a weakness in Youseff's instrument in that perceived effort may not be an adequate measure of actual effort.

Question three concerned the relationship between motivation and mathematics achievement. Inspection of the correlations reported in Tables D2 and D3 indicates that,

generally, motivation and mathematics achievement were not closely related. Within the non-contract group, there was a significant relationship between expectancy and achievement. The contract grading and non-contract grading groups' motivation and mathematics achievement had low correlation.

The level of student motivation, their reading ability, and experience of their two teachers were factors that were not controlled in this study. The results of this research suggest that these factors may have been important. Characteristics of both the teacher and the learner that are peculiar for the individual and difficult to isolate and measure may have had significant effects on the results. For example, if the level of motivation of a student is high, she may achieve more than a less motivated student, regardless of the teacher or method employed. In a similar vein, students with low reading ability would be hindered by the contract approach which required more reading. Thus, the student's effort and desire to put forth that effort to complete course requirements could be reduced.

On the other hand, the results of this study indicate that regardless of students' characteristics, they are aware of other outcomes upon taking and completing the course (instrumentality). In other words, their satisfactory performance provided an ample reward. It seems that as these students realized that a specified grade would result

from their reaching a particular performance level, they acquired a feeling of having more control over the results of their effort. In other words, the higher the level of instrumentality, the higher the level of perceived control.

Within the realm of the limitations and uncontrolled factors, mentioned above, it appeared that contract grading was a means used to increase the perceived relationship between performance and reward. However, effort was not increased, as had been expected, nor did it seem that students felt the need to put forth the effort in order to do what is required for the course. These findings lead one to suggest no further research involving all of the components of motivation with underprepared students as this study has done. Although if stronger generalizations about outcomes are to be made, then larger populations using this study should be undertaken.

The ten inter-correlations among the motivation components for the contract grading group were all positive. Except for between AE and V1, the non-contract grading group had positive correlations between components. (Youssef's (1980) results showed AE did not correlate with any of the other components.) It seems that AE was measuring something different than V1 but had some relationship with the other components. Based on the findings in the present study, the contract grading students had moderate to low relationships

among components of motivation, while the non-contract grading students had strong to low relationships among the same components. Although the correlations were low, they were in the expected direction (positive). Since V1, V2, E, and I are related to course tasks and course outcomes, this finding seems reasonable. It is interesting to note the correlations found between valence of second level and instrumentality for the contract grading group (r=.62) and the non-contract grading group (r=.76) are relatively consistent with Youssef's (1980) overall finding of r=.71.

Conclusions

Based on analyses of the performance of subjects in this study, there are several conclusions that can be made regarding effects of contract grading on motivation and mathematics achievement of underprepared college students:

1. The contract grading group had significantly greater improvement in mathematics achievement than non-contract grading students.

2. Underprepared students using contract grading have demonstrated that they recognize that their level of performance affects the attainment of a goal.

3. The relationship between motivation and mathematics achievement showed little correlation.

Implications

The conclusions and information from this study suggest

the following implications:

1. Replication of this study should be undertaken at other higher education institutions that admit underprepared students to give a broader and more accurate picture, thus enabling strong generalizations about the outcomes.

2. The duration of the treatment period should be extended to see if motivational levels change -- decrease, remain the same, or increase -- in a longitudinal study. For example, it might be found that some of the components are more important in influencing or determining which students continue their college careers. That is, variables such as valence of second level outcomes and instrumentality might influence continued enrollment in mathematics courses or the number of additional courses that students take.

3. Although it was not the purpose of the present study, it might be instructive to develop a measure of "attitudes toward mathematics" and add it to the motivational components in the expectancy theory model. Measurement of this type of individual difference variable might tap the extent to which a student views mathematics as being useful and, therefore, would better reflect their willingness to expend considerable effort to satisfactorily complete a mathematics course.

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APPENDIX A

PRETEST MOTIVATION QUESTIONNAIRE

YOUR ANSWERS WILL BE COMPLETELY CONFIDENTIAL, SO BE AS FRANK AS YOU WISH. This is not a test--your opinion is the only right answer.

Please indicate your answers to the following questions by circling your preference.

NAME _____ SOC. SEC. _____

SEX _____

I. ANTICIPATED EFFORT - AE

1. At this point in time, approximately how many TOTAL hours per week do you think you will spend on studying for this mathematics course?

   1. 0 to 4 2. 5 to 9 3. 10 to 14
   4. 14 or more

As you know, studying mathematics involves various components of study. Using your estimated time in 1, what PERCENTAGE do you plan to spend on each of the following?

2. Listening Comprehension

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

3. Studying Vocabulary

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

4. Studying Concepts

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

5. Problem Solving

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

6. Use of Supplementary Materials Outside Textbook

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

7. How many days of the week (7 days) do you think you will spend some time studying mathematics?

   1. 0 to 1 2. 2 3. 3 4. 4 5. 5 6. 6 7. 7

8. Considering other courses you are taking or have taken, how much time do you think this mathematics course will take (compared to other courses)?

   1. This course will take much more time
   2. This course will take an above-average amount of time
   3. This course will take an average amount of time
   4. This course will take somewhat less than an average amount of time
   5. This course will take very little time

9. Considering what your total work schedule is (taking courses, working, other commitments), do you feel that you will have a satisfactory amount of time to spend on the study requirements for this course?

   1. Yes 2. I am not sure 3. No

II. VALENCE - V1

Please rate each of the following tasks as to how desirable you think it is to spend time and effort on each task in order to complete the requirements of the course. Remember, what is being asked here is your feeling of positiveness towards doing each of the following tasks.

10. Listening Comprehension

    1. Not sure 2. Very undesirable
    3. Somewhat undesirable
    4. Somewhat desirable 5. Very desirable

11. Studying Vocabulary

    1. Not sure 2. Very undesirable
    3. Somewhat undesirable
    4. Somewhat desirable 5. Very desirable

12. Studying Concepts

    1. Not sure 2. Very undesirable
    3. Somewhat undesirable

4. Somewhat desirable 5. Very desirable

13. Problem Solving

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

14. Use of Supplementary Materials Outside Textbooks

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

III. VALENCE - V2

Many students report that there are positive outcomes (goals) of taking, and doing well in, a mathematics course like this one. Some of the more common outcomes or goals are listed below. Please rate how desirable these outcomes are to you. Make your choice according to how important it is for you.

15. Being able to use fundamental mathematics skills (general)

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

16. Helpful in obtaining or keeping a job (business related)

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

17. Learn about other careers

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

18. Fulfilling specific degree or credit requirements

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

19. Helps me learn more about computation

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

20. It broadens my general education (more rounded person)

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

21. I find pleasure and satisfaction in studying mathematics

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

22. This course will increase my grade point average

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

IV. EXPECTANCY - E

Please indicate for each of the following whether, if you put forth a reasonable amount of effort, you feel you will be able to complete each of the following tasks satisfactorily.

23. Listening Comprehension

1. Neutral 2. Definitely not 3. Probably not
4. Fairly sure 5. Most definitely

25. Studying Concepts

1. Neutral 2. Definitely not 3. Probably not
4. Fairly sure 5. Most definitely

26. Problem Solving

1. Neutral 2. Definitely not 3. Probably not
4. Fairly sure 5. Most definitely

27. Use of Supplementary Materials Outside Textbook

1. Neutral 2. Definitely not 3. Probably not
4. Fairly sure 5. Most definitely

V. INSTRUMENTALITY - I

It has previously been mentioned that mathematics involves a number of course requirements or tasks: listening comprehension, studying vocabulary, studying concepts, problem solving, and the use of supplementary materials outside the textbook. Consider all these together. How likely or probable is it that your successful completion of these course requirements or tasks will allow you to achieve each of the following course outcomes or goals? That is, in your opinion, is there a connection between your satisfactorily completing the course requirements which will allow you to achieve the course outcomes or goals?

28. Being able to use fundamental mathematics skills (general)

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

29. Helpful in obtaining or keeping a job (business related)

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

30. Learn about other careers

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

31. Fulfilling specific degree or credit requirements

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

32. Helps me learn more about computation

1. Neutral 2. Definitely disagree
3. Somewhat disagree

4. Somewhat agree 5. Definitely agree

33. It broadens my general education (more rounded person)

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

34. I find pleasure and satisfaction in studying mathematics

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

35. This course will increase my grade point average

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

APPENDIX B

POSTTEST MOTIVATION QUESTIONNAIRE

YOUR ANSWERS WILL BE COMPLETELY CONFIDENTIAL, SO BE AS FRANK AS YOU WISH. This is not a test--your opinion is the only right answer.

Please indicate your answers to the following question on the answer sheet.

DO NOT MARK ON THIS SHEET I. ANTICIPATED EFFORT - AE

1. At this point in time, approximately how many TOTAL hours per week do you think you did spend on studying for this mathematics course?

   1. 0 to 4 2. 5 to 9 3. 10 to 14
   4. 14 or more

As you know, studying mathematics involves various components of study. Using your estimated time in 1, what PERCENTAGE did you spend on each of the following?

2. Listening Comprehension

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

3. Studying Vocabulary

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

4. Studying Concepts

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

5. Problem Solving

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

6. Use of Supplementary Materials Outside Textbook

   1. 1 to 4% 2. 5 to 10% 3. 11 to 15%
   4. 16 to 20% 5. 20% or more

7. How many days of the week (7 days) did you spend some time studying mathematics?

   1. 0 to 1 2. 2 3. 3 4. 4 5. 5 6. 6 7. 7

8. Considering other courses you are taking or have taken, how much time do you think this mathematics course took (compared to other courses)?

   1. This course took much more time
   2. This course took an above-average amount of time
   3. This course took an average amount of time
   4. This course took somewhat less than an average amount of time
   5. This course took very little time

9. Considering what your total work schedule is (taking courses, working, other commitments), do you feel that you had a satisfactory amount of time to spend on the study requirements for this course?

   1. Yes 2. I am not sure 3. No

II. VALENCE - V1

Please rate each of the following tasks as to how desirable you think it was to spend time and effort on each task in order to complete the requirements of the course. Remember, what is being asked here is your feeling of positiveness after doing each of the following tasks.

10. Listening Comprehension

    1. Not sure 2. Very undesirable
    3. Somewhat undesirable
    4. Somewhat desirable 5. Very desirable

11. Studying Vocabulary

    1. Not sure 2. Very undesirable
    3. Somewhat undesirable
    4. Somewhat desirable 5. Very desirable

12. Studying Concepts

    1. Not sure 2. Very undesirable
    3. Somewhat undesirable
    4. Somewhat desirable 5. Very desirable

13. Problem Solving

    1. Not sure 2. Very undesirable
    3. Somewhat undesirable

4. Somewhat desirable 5. Very desirable

14. Use of Supplementary Materials Outside Textbooks

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

III. VALENCE - V2

Many students report that there are positive outcomes (goals) of taking, and doing well in, a mathematics course like this one. Some of the more common outcomes or goals are listed below. Please rate how desirable these outcomes are to you. Make your choice according to how important it was for you.

15. Being able to use fundamental mathematics skills (general)

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

16. Helpful in obtaining or keeping a job (business related)

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

17. Learn about other careers

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

18. Fulfilling specific degree or credit requirements

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

19. Helps me learn more about computation

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

20. It broadens my general education (more rounded person)

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

21. I find pleasure and satisfaction in studying mathematics

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

22. This course will increase my grade point average

1. Not sure 2. Very undesirable
3. Somewhat undesirable
4. Somewhat desirable 5. Very desirable

IV. EXPECTANCY - E

Please indicate for each of the following whether, if you put forth a reasonable amount of effort, you feel you have completed each of the following tasks satisfactorily.

23. Listening Comprehension

1. Neutral 2. Definitely not 3. Probably not
4. Fairly sure 5. Most definitely

25. Studying Concepts

1. Neutral 2. Definitely not 3. Probably not
4. Fairly sure 5. Most definitely

26. Problem Solving

1. Neutral 2. Definitely not 3. Probably not
4. Fairly sure 5. Most definitely

27. Use of Supplementary Materials Outside Textbook

1. Neutral 2. Definitely not 3. Probably not
4. Fairly sure 5. Most definitely

V. INSTRUMENTALITY - I

It has previously been mentioned that mathematics involves a number of course requirements or tasks: listening comprehension, studying vocabulary, studying concepts, problem solving, and the use of supplementary materials outside the textbook. Consider all these together. In your opinion, was there a connection between your satisfactorily completing the course requirements and the obtaining of the course outcomes or goals?

28. Being able to use fundamental mathematics skills (general)

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

29. Helpful in obtaining or keeping a job (business related)

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

30. Learn about other careers

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

31. Fulfilling specific degree or credit requirements

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

32. Helps me learn more about computation

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

33. It broadens my general education (more rounded person)

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

34. I find pleasure and satisfaction in studying mathematics

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

35. This course will increase my grade point average

1. Neutral 2. Definitely disagree
3. Somewhat disagree
4. Somewhat agree 5. Definitely agree

APPENDIX C

Reliabilities of Motivation Questionnaire and Component Scales of This Study

Reliability of Motivatoin Questionnaire
and Each Component of This Study

Motivation Questionnaire	r = .90
Components:	
Anticipated Effort	r = .67
Valence of First Level	r = .78
Valence of Second Level	r = .76
Expectancy	r = .70
Instrumentality	r = .77

APPENDIX D

List of Tables

TABLE D1

Summaries of the ANCOVA Posttest Motivation Components Using Pretests as Covariates

Components of Motivation	Total MS	Total df	Covariate MS	Covariate df	Covariate F	Covariate Prob.	Treatment MS	Treatment df	Treatment F	Treatment Prob.
Anticipated Effort	48.71	73	43.08	1	12.78	.00	2.26	1	.67	.42
Valence of First Level	103.21	73	46.63	1	3.67	.06	43.88	1	3.45	.07
Valence of Second Level	430.49	73	188.01	1	7.45	.01	217.24	1	8.61	.01*
Expectancy	231.69	73	216.59	1	15.73	.00	1.33	1	.10	.76
Instrumentality	520.33	73	393.24	1	19.07	.00	106.47	1	5.16	.03*

* significant at the .05 level

TABLE D2

The Correlation Between Post-test Mathematics Achievement With the Five Post-test Motivation Components and the Intercorrelations Among the Post-test Motivation Components for the Contract Group

	AE (1)	V1 (2)	V2 (3)	E (4)	I (5)	Math (6)
1	1.0000	.3229*	.2629*	.2817*	.2791*	-.1470
2		1.0000	.7039***	.6214***	.4131**	.1071
3			1.0000	.5319***	.6207***	.1358
4				1.0000	.5881***	.0085
5					1.0000	.1889
6						1.0000

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

TABLE D3

The Correlation Between Post-test Mathematics Achievement With the Five Post-test Motivation Components and the Intercorrelations Among the Post-test Motivation Components for the Non-Contract Group

	AE (1)	V1 (2)	V2 (3)	E (4)	I (5)	Math (6)
1	1.0000	.1818	.4663**	.4421**	.5066***	-.0753
2		1.0000	.4806**	.7329***	.5888***	.1218
3			1.0000	.6095***	.7588***	.0287
4				1.0000	.8235***	.3203*
5					1.0000	.1392
6						1.0000

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

APPENDIX E

1. Contract
2. Selected Articles

GRADE CONTRACT

The grading system in this class is based on a contractual agreement between the instructor and the student. The contract lists the requirements to be fulfilled to obtain a certain grade.

In order to receive a grade of C, I agree to:

1. Attend all of the meetings of the course. If I cannot be present at any class meeting, a) I will have an acceptable excuse that is verifiable and b) I will take the responsibility for satisfactory completion of the missed work.

2. Read the text material, chapters 1 through 6. Submit, from each chapter discussed, a list of terms and definitions with an example. Make two visits to Learning Resource Center in library for listening to tapes dealing with each chapter for a total of 12 visits.

3. Be prepared to take quizzes and a test on each chapter with 80% accuracy. If 80% is not obtained on the previous test, I may retest upon completion of: a) scheduling an immediate appointment with the instructor to determine additional assistance to understand material and b) scheduling a retest date with instructor.

4. Achieve a minimum of 80% on the midterm and final examination. The dates have been fixed by the college calendar. Only the midterm exam may be retaken if 80% is not obtained and I will schedule an immediate appointment with the instructor to review and determine retest date. NO RETAKE OF FINAL EXAM.

5. Complete twenty-five assigned problems which are due two weeks before finals. Problems may be submitted anytime before the two weeks deadline.

6. Do <u>either</u> <u>6a</u> <u>or</u> <u>6b</u>.
   a) Read and summarize one journal article related to mathematics, which is due three weeks before finals. May be submitted anytime before the three weeks deadline. The summary must contain: a) the literature citation (author, title, periodical, volume, page, and date); b) the author's purpose; c) a summary not less than two

(2) paragraphs; and d) my reaction to the article.

b) Complete ten additional problems (total of 35).

In order to receive a grade of B, I agree to:

1. Complete the activities 1, 2, 3, and 4 stated above for a C.

2. Forty assigned problems due two weeks before finals. Problems may be submitted anytime before the two weeks deadline.

3. Select one of the following options:

   a. One journal article summary (3 weeks before final) and ten additional problems (2 weeks before final).

   b. Three journal article summaries three weeks before finals.

In order to receive a grade of A, I agree to:

1. Complete the activities 1, 2, 3, and 4 stated above for a C.

2. Fifty-five assigned problems due two weeks before finals.

3. Select two of the following options:

   a. five journal article summaries three weeks before finals

   b. three journal article summaries (three weeks before finals) and 15 additional problems

   c. a five (5) page paper related to mathematics

I have read the activities required for each grade, and I wish to work toward a grade of _____. I realize that my achievement of this grade will depend upon my own performance on graded activities. If I fail to fulfill the requirements for this grade, I will accept the grade for which I have qualified. I understand that I have the option to renegotiate this contract with the instructor, no later than the fourth class session after midterm exams.

Student	Instructor	Date

Read the article carefully. Write a summary of the article in two (2) or more paragraphs. Write your reaction to the article in one (1) or more paragraphs. In total, one or two typewritten pages or three handwritten pages for the summary and reaction.

Beard, Earl N. L., and A. Richard Polis. "Subtraction Facts with Pattern Explorations." Arithmetic Teacher, 29 (December 1981), 13-14.

Bernard, John. "Creating Problem-Solving Experiences With Ordinary Arithmetic Processes." Arithmetic Teacher, 30 (September 1982), 52-53.

Fennell, Francis. "The Newspaper: A Source for Applications in Mathematics." Arithmetic Teacher, 30 (October 1982), 22-26.

Jones, Billie N. "Put Your Students in the Picture for Better Problem Solving." Arithmetic Teacher, 30 (April 1983), 30-33.

King, Julia A. "Missing Addenda: A Case of Reading Comprehension." Arithmetic Teacher, 30 (September 1982), 44-45.

Peterson, John C. "Fourteen Different Strategies for Multiplication of Integers of Why (-1)(-1)=+1." Arithmetic Teacher, May 1972), 396-403.

Shaw, Joan G. "Mathematics Students Have a Right to Write." Arithmetic Teacher, 30 (May 1983), 16-18.

Wright, Jane P., and Nancy K. Stevens. "Improving Verbal Problem-Solving Performance." Arithmetic Teacher, 31 (October 1983), 40-42.

Alexick, Helen F., and F. Richard Kidder. "Why Is a Rectangle NOT a Square?" Arithmetic Teacher, 27 (December 1979), 26-27.

Moses, Barbara. "Individual Differences in Problem Solving." Arithmetic Teacher, 30 (December 1982), 10-14.

APPENDIX F

PROCEDURE MANUAL

PROCEDURE MANUAL

Introduction

Educators are faced with the problem of using grades to motivate students and the constant problem of reducing the negative effects of grades such as threat, anxiety, and lack of individualization. If the motivational aspect of grades is to be retained while reducing the negative aspects of grades, another method of assigning grades is necessary. Therefore, teachers and students must arrive at a system that will be acceptable to each of them.

As more students enter college lacking the basic skills in reading, English and mathematics, the need for motivating to increase performance is essential. Grading, then, is the primary incentive for these underprepared students. Thus, an interest in using a method to improve students' performance in achievement and motivation is important.

This study is designed to investigate the effects of contract grading on achievement and motivation of underprepared college students. There is a scarcity of research related to contract grading as a motivational factor to improve achievement. Specifically, I found there is no research reported in the literature regarding this problem in mathematics.

The outcome of this study may be invaluable in giving teachers an approach for improving their students' knowledge

and effort. In addition, teachers will have more information about contract grading. This information should help them make more valid decisions concerning selection of grading systems. Giving students the opportunity to negotiate a contract for their grade allows them to have input and reaction to what is required for a grade. Student concerns can be met by teachers putting forth effort to becomeo interested in student views and allow more student input.

Procedure

Students will be randomly assigned to the four Math 030 classes for the semester and classes will be designated as control or treatment classes by a random selection process. The mathematics faculty of these classes are requested to give their assistance in order to provide the opportunity for a successful study. The expected outcomes should be meaningful for planning future classes in mathematics.

Each teacher will have an experimental (contract grading) class and a control (non-contract) class. The instructional procedure must be the same in all classes. In-class assignments, for both groups, must be the same. Daily homework assignments must not be different for the two groups. Identical basic concepts will be covered in all Math 030 class sections.

Contracts have been prepared for the experimental

class. The teacher is requested to schedule a conference with each student for the purpose of reaching agreement for the grade.

In the conference to negotiate for a grade:

1. discuss the written contract
2. inform the student of options allowed
3. inform the student of the opportunity to repeat assignments and tests if the performance level is not 80%.
4. request that students schedule periodic conferences, so that they will not get behind
5. inform students of the importance of not waiting until deadlines to pass in assignments, so that ample time is available for checking and feedback
6. circle on the contract the option(s) agreed upon for grade
7. when contract is signed by both teacher and student, make two copies - retain the original for your file and one copy for Mr. Parker. Give one copy to the student.
8. tape at least ten of the conferences (each teacher). You may tape more or all.

Classroom Procedure

1. In both the experimental and control groups, instructional procedures must be the same. Identical daily class activities and homework must be given.

Identical or equivalent tests must be given.

2. The pretest and posttest dates for mathematics have been established by the Director of Freshman Studies. The scores should be submitted immediately after testing.
3. The pretest motivation questionnaire will be administered in all Math 030 classes on September 10, 1984. The questionnaire should take approximately fifteen (15) minutes to complete. Please permit students to use the time necessary to complete the questionnaire. Students will mark the op-scan sheets supplied by the researcher. Number 2 pencils are required.
4. The posttest motivation questionnaire will be administered during the last class session before final exams. Again, the questionnaire should take fifteen minutes to complete. Op-scan sheets will be supplied.
5. The contract grading classes will be given their contracts on September 14. This will give the students a chance to review them during the weekend. Students should make appointments with the instructor starting Monday, September 17 through Friday, September 21, 1984 for negotiation of the contract.
6. When agreement has been reached between the teacher and the student, the contract should be assigned. Two copies of the contract should be made, one for the

student, one for the researcher, and the original is kept by the teacher.

7. The teacher is expected to ask students in the contract grading classes to schedule periodic conferences. A discussion of the progress with the activities for the grade contracted for is essential. The student needs to know if the performance level is being maintained. The regular conference will also be used so that last minute work will not pile up on the teacher or the student.
8. For the contract classes, teachers should prepare a schedule for submitting assignments. This procedure should eliminate last minute papers and/or problems (see 7 above). Let students know that papers may be submitted anytime before the scheduled due date.
9. For the contract grading classes, teachers may prepare scientific assignments for students in preparation for tests (e.g., Learning Resource Center, tutoring, etc.). Retesting is unlimited for chapter tests, but you (teacher) may use your judgment on last dates. The midterm exam may be retaken also. ((Midterm retake for contract group, not for control group.))
10. For contract grading classes, encourage students to attempt the highest grades reasonable for them by emphasizing the opportunity to take tests over and/or redoing articles until they are acceptable. Indicate

that the acceptable level of performance is at the performance level established for each grade. Again, the purpose of regular conferencing with students is to enable the instructor to know the status of students' activities and to offer the students support for doing as well as possible.

11. Students may renogotiate their contract (see contract for time)
    a. Other options may be presented by teacher or student for the grade already contracted.
    b. A lower or higher grade may be contracted for with the already stated options.
    c. You, the teacher, will know the student by this time and may suggest additional activities to fulfill the contract. These alternative activities must be equivalent to those in the original contract and an accurate record of any such changes must be provided to Mr. Parker.
12. The control classes (noncontract) will be graded in your usual manner and according to the course outline.
13. Mr. Parker will be available for questions at anytime by phone (, home; , office). Mr. Parker will make periodic on-site visits during the semester.
14. Note reactions/comments to assignments. They may

provide some insight about the study as well as aid in better execution of the treatment.

15. Submit copies of final grades, chapter tests, midterm and final exams, and course outlines to Mr. Parker.
16. Mr. Parker will share with you, the teacher and the college, the results of the study.
17. Thank you for your cooperation and assistance with this study.

APPENDIX G

COURSE DESCRIPTION AND OUTLINE

DEPARTMENT _____

COURSE _Math 030_____Freshman Math_____MWF_____3 Hrs._
Number Title Days Credit

COURSE DESCRIPTION

This course is designed to give a firmer background in the basic skills of Arithmetic, and such additional training that students will need and find useful in dealing with problems of today and/or necessary in subsequent courses.

TEXTBOOK: Keedy, M. L. & Bittinger, M. L. Arithmetic, 4th edition, Reading, MA: Addison-Wesley Publishing Company, 1983.

MAJOR TEACHING STRATEGIES

There will be fifty minutes (MWF) during which time this course will be taught basically through demonstrations, discussions, explanations, audio-tutorial and small group activities.

EXPECTED STUDENT PARTICIPATION

Each student is expected to participate through discussions, demonstrations, explanations and group activities of solving problems he/she may have. Each student will work at his/her own pace to develop a healthy attitude toward mathematics.

1. Each student is expected to attend all of the meetings scheduled for the course.

2. Each student is expected to be in class on time.

3. Each student is expected to have an attitude that will not create a negativism in the classroom.

4. Each student is expected to complete all assignments.

5. Each student is required to take all examinations, quizzes, and tests.

6. Each student is expected to do all work on 8 1/2 x 11 inch paper.

7. Each student is expected to put his/her name and date on each paper to be turned in.

EVALUATION

The evaluation of Mathematics 030-031 will involve three major areas: Performances on quizzes, tests, homework and other assignments, class attendance and performance on standardized tests. Students will be tested using standardized tests as well as teacher-made tests.

Class participation, Homework, Quizzes	25%
Tests	30%
Mid-Term Examination	20%
Final Examination	25%

At the end of the semester, students who earn an A in the course, who score above the 70th percentile on a standardized test (arithmetic skills); and who satisfy other requirements, will be placed in Mathematics 130. Students who earn a B and/or a C in the course and who score between the 69th and 40th percentile on a standardized test (arithmetic skills) will be placed in Mathematics 031. Studentes who achieve less than 60% on assignments, tests, etc., and whose standardized test scores (arithmetic skills) are below the 40th percentile will be continued in Mathematics 030.

ATTENDANCE REQUIREMENTS

1. Each student is required to attend all of the meetings of the course for which registration is completed. There is no official cut system.

2. Absences do not relieve any student of the responsibility for the satisfactory completion of all course work. If absences are unavoidable, written documentation for the absence must be filed in the Office for Academic Affairs.

3. The failure to comply with items 1 and 2 above may result in suspension from the course or the institution after review by the appropriate committee.

4. Any student who ceases to attend a course without official drop approval will receive a grade of "F". No student will be allowed to drop a course after the dates stated in the College calendar.

MAKE-UP WORK

Each student is required to be present at each testing date. There will be no make-up tests given without an official excuse.

SOCIAL BEHAVIOR

Students are expected to conduct themselves in a manner which is positive. Cheating on tests, quizzes, etc., will result in dismissal from the College.

ANTICIPATED CHAPTER TO BE DISCUSSED

Ch-1	Addition and Subtraction of Whole Numbers
Ch-2	Multiplication and Division of Whole Numbers
Ch-3	Multiplication and Division of Fractions
Ch-4	Addition and Subtraction of Fractions
Ch-5	Addition and Subtraction of Decimals
Ch-6	Multiplication and Division of Decimals

APPENDIX H

1. Problems for Contract Grading Group
2. Problems for Noncontract Grading Group

MATH 030

DIRECTIONS: Show your work for each of the following problems. All students will do the problems with the plus sign. The "B" students will add to the problems with the minus sign, in addition to those with the plus sign. The "A" students will add to the plus and minus signs, the problems with the x sign.

CHAPTER I

\+ 1. Write standard notation for: Thirty-two thousand, twenty-three

\+ 2. Write an addition that corresponds to the following situation: Chuck has 21 marbles and wins 19 more. How many marbles does he now have altogether?

\+ 3. Add: 2413 + 2472

4. Add: 7834 + 4673 + 6019 + 582

\- 5. Babe Ruth hit 714 home runs. Henry Aaron hit 755 home runs. How many did they hit together?

x 6. Write a subtraction that corresponds to the following situation. You have 60 minutes to take this test, 47 minutes have gone by. How many minutes do you have left to finish?

\+ 7. Subtract: 5762 - 3421

\- 8. Solve: 1276 + x = 3952

\- 9. Brand X TV sells for 279 per set while brand Y sells for 297 per set. How much more is a brand Y TV set?

\+ 10. The brand of jeans with the fancy pockets costs 20. The plain pocket brand costs 13. How much more is a pair of fancy pocket jeans?

11. Round to the nearest hundred: 769

\- 12. Estimate the sum by rounding to the nearest ten: 47 + 31 + 61

CHAPTER II

+ 13. Multiply: 250 x 31

- 14. Multiply: 262 x 132

x 15. A typist can type 63 words per minute. How many words can be typed in 59 minutes?

+ 16. A family pledges 110 to their church each month. How much would be pledged in one year (12 months)?

x 17. Divide: 7794 - 18

+ 18. Divide: 5974 - 295

19. Solve: 6 x X = 90

- 20. A bank wishes to put 1000 nickels into rolls. If there are 40 nickels per roll, how many rolls of nickels will there be?

+ 21. A rectangular lot measures 356 meters by 722 meters. What is the area of the lot?

x 22. A sack of apples weighs 32 lb. A sack of peaches weighs 27 lb. Find the total weight of 27 bags of apples and 62 bags of peaches.

+ 23. A customer buys 28 pieces of lumber at 12 each and pays for them with 10 bills. How many 10 bills does it take?

- 24. There are 859 cans of soda. How many 8-can packages can be filled? How many are left?

CHAPTER III

+ 25. Find the prime factorization of 350.

26. Determine which of the following are divisible by 3:

123,456 322 5104 8262

x 27. Multiply: 4 x 7/11

28. Multiply: 3/5 x 4/7

- 29. A jar holds 2/5 of a liter. How much will it hold when it is 1/3 full?

+ 30. Test for equality: 22/17, 7/23

- 31. Multiply and simplify: 3/5 x 10/13

+ 32. A recipe calls for 2/3 cup of sugar. How much sugar do you need to make 1/2 of the recipe?

33. Find the reciprocal of 1/9

x 34. Divide and simplify: 2/3 - 11/9

- 35. How many sugar bowls can be filled from 12 cups of sugar if each bowl holds 3/4 cup?

+ 36. A piece of rope 9/10 of a meter long is to be cut into 6 pieces of the same length. What is the length of each piece?

CHAPTER IV

37. Add and simplify: 10/15 + 5/15

+ 38. Add and simplify: 1/2 + 9/13

- 39. A teacher walked 5/8 mile from his office to the library and then walked 2/3 mile from the library to the cafeteria. How far did he walk altogether?

x 40. Find the LCM for: 8, 12

x 41. Subtract and simplify: 25/38 - 16/38

42. Which is greater 5/8 or 8/15?

+ 43. Convert to fractional notation: 3 5/8

44. Convert to a mixed numeral: 345/36

+ 45. Add: 72 1/6 + 35 3/8

- 46. Subtract: 431 1/4 - 211 1/8

+ 47. Multiply: 52 3/7 x 13 2/3

+ 48. Divide: 83 2/5 - 22 8/9

CHAPTER V

+ 49. Write a word name for: 254.768

50. Write the following in standard notation: Three hundred forty-two and sixty-two ten thousandths

x 51. Write fractional notation for: 71.09

52. Write decimal notation for: 21 11/100

53. Round to the nearest thousandth: 1.0006

+ 54. Add: 7.231 + 9.405

- 55. Add: 4.1172 and 9.37

+ 56. Subtract: 3.7204
$\underline{-\ 0.42}$

x 57. Subtract: 84.678
$\underline{-\ 0.42}$

- 58. A math book costs 17.37. Taxes were .69. Carlos bought it with a 50 bill. How much change did he get?

+ 59. Ersell sold her car for 1750.55. She then bought a Moped for 525.77. How much money does she have left?

x 60. Reginald bought a Michael Jackson album for 12.98. He also bought a Ray Parker, Jr. album on sale for 5.79. Taxes on the items ere .75. How much did he spend? He paid for both with a 20 bill. How much change did he get?

CHAPTER VI

+ 61. Multiply: 42.629 x 1000

62. Multiply: 0.0734 x 0.24

63. Divide: 48.01 - 4

+ 64. How much does gasoline cost per gallon if 22 gallons costs 28.60?

x 65. How much would 3.2 pounds of cheese cost if it sells for 1.70 per pound?

66. Estimate by rounding to the nearest tenth: 2.2822 + 1.6716

- 67. A stereo sells for 401.16. About how many stereos could you buy for 1600?

x 68. Find decimal notation for 3/17 to nearest hundredth

x 69. Round to the nearest hundredth? 7.83

70. How many pack mules can you rent if you have a fifty dollar bill and each mule rents for 15?

x 71. How many bottles of pop can you buy if you have a five dollar bill and each bottle costs 0.89?

72. Pete Rose won the National League batting title by getting 218 hits in 627 at bats. What was his batting average? Round to the nearest thousandth.

MATH 030

DIRECTIONS: Show your work for each of the following problems. Complete all of the problems.

CHAPTER I

1. Write expanded notation for: 4230
2. Write a word name for 4,023
3. What does the digit 2 mean in the given number? 13,420
4. Add: 3752 + 2143
5. Add: 6738 + 738 + 42 + 7
6. Subtract: 7664 - 4232
7. Subtract: 9458 - 7579
8. Jack weighs 210 pounds. Bob weighs 159 pounds. How much weight does Jack need to lose to weight the same as Bob?
9. Round to nearest ten: 4726
10. Estimate the sum by rounding to the nearest ten: 47 + 31 + 61

CHAPTER II

11. Multiply: 614 x 26
12. A typist can type 54 words per minute. How many words can the typist type in 48 minutes?
13. Divide: 5434 - 19
14. Solve: 5 x X = 70

15. At a basketball game the gate receipts were 16,170. Tickets were 7 each. How many attended?

16. In the problem below, what is the 5 called? 5 - 3 = 2

17. In the problem below, what is 11 called? 5 + 6 = 11

18. A student bought 6 coats at 84 each and paid for them with 20 bills. How many 20 bills did it take?

CHAPTER III

19. Find all the factors of 48

20. Find the prime factorization of 252

21. Simplify: 126/126

22. Multiply: 4 x 3/5

23. Multiply: 8/18 x 4/20

24. A recipe calls for 3/5 cup of sugar. How much sugar do you need to make 1/2 of the recipe?

25. Simplify: 42/18

26. Multiply and simplify: 5/6 x 8/13

27. Find the reciprocal for 2/3

28. Divide and simplify: 2/3 - 5/6

CHAPTER IV

29. Add and simplify: 3/10 + 5/10

30. Add and simplify: 3/16 + 4/32

31. A jogger ran 8/11 mile north and then 9/22 mile west. What is the total distance that she ran?

32. Find the LCM for: 8, 14

33. Subtract and simplify: 15/12 - 13/12

34. Convert to fractional notation: 12 3/4

35. Convert to a mixed numeral: 27/5

36. Joe buys 12 1/2 lb. of peanuts and 8 3/4 lb. of cashews. How many lb. of nuts did he buy?

37. Multiply 16 x 3 1/5

38. Divide: 2 1/5 - 3 1/4

CHAPTER V

39. Write a word name for: 2546.78

40. Write fractional notation for: .091

41. Write fractional notation for: 27.382

42. Write decimal notation for: 223 41/1000

43. Round to the nearest hundredth: 31.56563

44. Add: 54.116 and 44.3726

45. Subtract: 1.047 - 0.038

46. Bill bought 7.89 worth of groceries with a 20 bill. How much change did he get?

47. On her backpacking trip, Gwen walked 19.75 miles on her first day, 23.66 miles on her second day, and 25.17 miles on her third day. How far did she walk on her first three days?

48. Sally saved 250 for her vacatoin. When she got home she had 23.72. How much money did she spend on her vacation?

CHAPTER IV

49. Multiply: 0.235 x 100

50. Divide: 83.16 - 9

51. What is the cost of 9.5 pounds of hamburger if it is sold for 1.48 per pound?

52. A lamp sells for 29.95. About how many lamps could you buy for 120?

53. Find decimal notation for 32/122

54. Round to nearest hundredth: 6.247

55. How many cats can you buy if you have a hundred dollar bill and each cat costs 15?

56. How many pack mules can you rent if you have a fifty dollar bill and each mule rents for 20?

APPENDIX I

CONSENT AGREEMENT

INFORMED CONSENT FORM

I consent to participate in a study of grading practices conducted by W. H. Parker, Jr. during the Fall Semester, 1984. I understand that I will be asked to complete two motivation questionnaires. I understand that I will also be asked to release data from my educational records maintained by the Director of Freshman Studies.

I understand that the potential benefits of this study will provide an increased understanding about student motivation and a system of grading in colleges. Further, I understand that: (1) my responses will be kept completely confidential; (2) data will not be reported in a way that my responses or grades can be identified; (3) I may ask the researcher or my instructor questions regarding the procedures of the study at any time; and (4) I may choose not to participate or to leave the study at any time, without any negative effect on the evaluation of my class activities.

_____ _____

Date Signature

_____

Print Name

Faculty Agreement

I agree to assist William H. Parker, Jr., a graduate student at Virginia Polytechnic Institute and State University in a research study. The study is designed to investigate the effects of contract grading on achievement and motivation on underprepared college students. I will conduct one class using contract grading and a second class without contract grading. I will administer the contract treatment, pretest and posttest for the arithmetic skills and the motivation questionnaire.

_____ _____

Date Signature

_____

Name (Please Print)

_____

College and Department

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