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RELATIONSHIPS AMONG COLLEGE STUDENTS’ SELF-RELATED COGNITIONS AND ACADEMIC ACHIEVEMENT:
A STRUCTURAL EQUATION MODELING APPROACH

by

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A Dissertation Submitted to the Faculty of Graduate Studies through the Department of Psychology in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy at the University of Windsor Windsor, Ontario, Canada 1990
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Abstract

This study examined a hypothesized model of the relationships among self-related cognitions and academic achievement in a group of college students. The self-related constructs of interest are: perceptions of academic competence (academic self-concept) defined as evaluations of one's academic competence and degree of importance of achievement-related activities; expectation for future academic performance (expectation) defined as the students' realistic expectation of their grade point average and the degree of commitment to this expectation; perceptions of control over academic outcomes defined as the amount of understanding about the causes of one's successes and failures in school (level of understanding) and the extent to which these causes are viewed as attributable to internal factors versus powerful others (relative internality); and motivational orientation towards academics defined as the extent to which the student prefers to make autonomous judgments regarding his/her scholastic performance (autonomous judgment); and the relative intrinsic versus extrinsic motivational orientation the student adopts towards school work (mastery motivation). Two theoretical models relating self-related cognitions to achievement are the Causal Attribution Model (Weiner, 1979, 1980 & 1985) and the Intrinsic Mastery Motivation Model (Harter, 1978, 1981b). The models differ in their predictions about specific relations among constructs. For example, the perception of control variables (i.e., level of understanding and relative internality) are predicted to have indirect effects on academic achievement through intervening variables in the former model but direct effects in the latter model. The link between the perception of control variables
and the specific intervening factors are postulated to be a function of the dimension (i.e., locus, stability, or control) of the control variables. A theoretical model of academic achievement, derived from the two more general models of achievement and existing research was translated into an empirically testable model. Two hundred and twenty-four college students enrolled in an introductory psychology course participated in the study. Self-related constructs were assessed by means of self-report measures. Academic achievement was represented by the students' grade point averages. The quality and overall goodness of fit of the hypothesized model was assessed by structural equation modeling techniques (LISREL VI; Joreskog & Sorbom, 1984). Consistent with Weiner's model, the perception of control variables had only indirect effects on academic achievement. However, these effects were not always consistent with the effects suggested by Weiner's model. For example, the locus dimension linked to expectation for future academic achievement rather than academic self-concept as predicted by Weiner's model. Contrary to Harter's Model, mastery motivation had no effect, direct nor indirect, on academic achievement as measured by grade point average. Academic self-concept had only indirect effects on academic achievement through expectation. The greatest impact on academic achievement came from prior academic achievement. Implications of the results for the role of self-related cognitions in adult academic achievement are discussed together with implications for intervention programs and future research.
This dissertation is dedicated to Carrie-Anne and Paul.
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CHAPTER 1
INTRODUCTION

The present study is concerned with adults' self-related cognitions pertaining to achievement and the relationship among these constructs and academic achievement. Recently, student characteristics have become an important focus in investigations of determinants of academic achievement, with a particular emphasis on the independent or self-regulated learner (e.g., Brown, Armbruster, & Baker, 1986; Corno, 1986; McCombs, 1984, 1986; Paris, Cross, & Lipson, 1984; Paris, Lipson, & Wixon, 1983; Schunk, 1986; Zimmerman & Pons, 1986). The central question is “What does the learner bring to the school situation and how do these characteristics influence learning?” Regardless of their particular orientation, theorists in the field point to the critical role of self-related cognitions as “person characteristics” which serve as the mediators of performance and persistence (see Appendix A for a review of these areas as they relate to academic performance). These self-related cognitions include one’s thoughts about one’s competence, one’s expectation for future performance, one’s understanding of who or what controls whether one succeeds or fails, one’s beliefs about one’s ability to make independent judgments and evaluate one’s own performance, and one’s motivational orientation towards school achievement.

Numerous studies have examined links between self-related constructs and academic achievement (see Appendix A for a review). Studies from the psychological literature are usually correlational, often using the achievement variables as a validity
marker for a particular self-related construct (see Calsyn & Kenny, 1977; Purkey, 1970; Scheirer & Kraut, 1979). Other studies have used achievement as a control variable in order to examine relationships among self-related constructs and other behaviors (e.g., seeking help, Ames & Lau, 1982; persistence on task, Licht, Kistner, Ozkaragoz, Shapiro, & Clausen, 1985) within groups of high and low achievers. In a third class of studies, academic achievement is the dependent variable being predicted (usually in multiple regression analysis) by a variety of self-related constructs (e.g., expectation and valence, Malloch & Michael, 1981; various causal attributions and expectation, Kovenklioglu & Greenhaus, 1978; various dimensions of self-concept, Kubiniec, 1970). Unfortunately, such techniques fail to address the interaction or synergistic effects among various self-related constructs.

As the number of variables in the academic achievement equation increases, a major issue emerges concerning useful techniques which provide a clearer picture of the specific relationships among these variables, thereby permitting theory construction and testing. In this regard, empirical questions that need to be addressed include: Which of these self-related constructs is the "prime mover," so to speak? Which of these variables affect each other? Which variables affect academic achievement directly and which have indirect effects? What are the specific intervening variables? What is the relative importance of the self-related cognitions and prior academic achievement on subsequent achievement?

In an attempt to answer such questions, several researchers (e.g., Calsyn & Kenny, 1977; McCombs, 1986; Rubin, Maruyama, & Kingsbury, 1979; Schunk, 1990) point to the advantage of causal modeling approaches in the study of relationships between self-related constructs and academic achievement. Unlike traditional
correlational approaches to the present area, causal modeling approaches such as path analysis and structural equation modeling examine the relationships among several variables simultaneously, allowing the researcher to hypothesize not only a relationship but the actual direction of influence of a specific variable upon others in a predetermined network of variables. Such techniques lend themselves to theory construction and testing (Keith, 1988). Consistent with such recommendations, the present study uses structural equation modeling to examine a model of academic achievement.

Another issue in the literature on self-related cognitions and academic achievement concerns the difficulty of operationalizing the construct of "the self" in a meaningful way (Connell, 1981). As a result, researchers interested in the role of "person characteristics" in academic achievement have chosen to examine classes of component constructs which are assumed to be related to the overall functioning of "the self" (e.g. Connell, 1981; Feather, 1988; Forsyth & McMillan, 1981). The present study adopted this strategy. The component constructs of self comprise the network of variables tested.

Four general classes of self-related constructs were examined in the present study: (a) perceptions of academic competence (academic self-concept) defined as evaluations of one's academic competence and degree of importance of achievement-related activities; (b) expectation for future academic performance (expectation) defined as the student's realistic expectation of their grade point average and the degree of commitment to this expectation; (c) perceptions of control over academic outcomes defined as the amount of understanding about the causes of one's successes and failures in school (level of understanding) and the extent to which these causes are
viewed as attributable to internal factors versus powerful others (relative internality); and (d) motivational orientation toward academics defined as the extent to which the student prefers to make autonomous judgments regarding his/her scholastic performance (autonomous judgment) and the relative intrinsic versus extrinsic motivational orientation the student adopts towards school work (mastery motivation). These constructs are identified as critical aspects of "the self" in relation to academic achievement in varying combinations by Harter's (1978, 1981b) Intrinsic Mastery Motivation Model of Achievement, Weiner's (1979, 1980, 1985) Attributional Theory of Achievement Motivation, and prior research (see Appendix A). The approach taken in the present study to use structural equation modeling techniques and to test opposing theories is consistent with recommended strategies for research in education (Schunk, 1990).

Furthermore, to the author's knowledge, no study has examined the relationship between motivational orientation, as defined in Harter's theory, and constructs involving perceptions of academic competence, perceptions of control over academic outcomes, and expectation for future academic performance with an adult population. Although motivation to achieve has been examined in the literature (e.g., Battle, 1965; Centi, 1965; Covington & Omelich, 1984b; Nicholls, 1984; Wentzel, 1989), its definition has differed from Harter's conceptualization of mastery motivation. Achievement motivation is generally conceptualized as the level of one's motivation to engage in achievement behaviors based on the interaction of such variables as need for achievement, expectancy of success, and the incentive value of success. As well, no studies are available which have examined these variables together in a model in order to determine their relative degree of importance on academic achievement.
At this point, a note on terminology is needed. While essentially the same self-related constructs are discussed in the present study as in Harter's (1978, 1981b) and Weiner's (1979, 1980, 1985) models, different terminologies are applied. In the present study perception of competence is referred to as academic self-concept and includes the individual's evaluation of academic competence and the degree of importance to the individual of academic-related activities. Harter uses the term competence evaluation while Weiner refers to self-esteem or feelings of competence. With regard to perceptions of control, the present study uses the two terms, level of understanding (about the causes of one's academic successes/failures) and relative internality (a measure of the degree of one's attribution of successes/failures to internal causes). Harter uses the terms unknown control and internal-powerful others, respectively. These two measures represent examples of Weiner's causal attribution construct. The motivational orientation construct is represented by mastery motivation and autonomous judgment in both the present study and Harter's model. Weiner refers to motivational indicators such as direction of goal directed activity and intensity, quality, and persistence of behavior, not assessed in the present study. The term expectation in Weiner's model refers to one's expectation for future academic performance. In the present study expectation refers not only to one's expectation for future academic performance but also to the degree of commitment to this expectation. Although Harter refers to children's expectations of future academic performance as determinants of academic achievement, she does not include the construct in her model of children's academic achievement.

Prior to proceeding, a brief explanation of the importance components of academic self-concept and expectation is warranted. Recent developments in
understanding self-concepts, as reflected in the work of Harter (1986) with children and Neeman and Harter (1986) with adults (see also Markus, 1977), have incorporated importance ratings into the measurement of self-concept. Neeman and Harter, for example, asked college students to rate the importance of the domains to the self as a person. It was found that college students do appraise these factors, both weighing and comparing their competence and the importance of success in different domains. These appraisals also influenced the students’ sense of self-worth. The importance component stems from the classical theoretical work of William James (1890). James conceptualized self-esteem as resulting from one’s evaluation of the congruence of one’s competence to one’s attitudes concerning the importance of success in that domain.

Just as the importance rating was seen as a component that needed to be included in the definition of academic self-concept, so was the importance rating included as a component of expectation in the present study. For example, a student may state that he/she expects to obtain an “A” as a grade point average and feels that it is very important for him or her to do so. Another student with a similar expectation to obtain an “A” may claim that it is not at all important to him or her to achieve the grade. One might predict that the two students will differ in their actual achievement as a function of their own commitment level. To the author’s knowledge no previous study has included the commitment component in models of academic achievement despite its theoretical implications.

The next section presents the major aspects of each of Weiner’s and Harter’s theoretical models and existing research as they relate to the present study. In the subsequent section, the hypothesized model to be examined is translated into an
empirically testable model. The model is designed to be tested using maximum likelihood analysis of structural equations with latent (unobserved) variables.

*Causal Attributional Model of Achievement*

Weiner's Causal Attribution Model of Achievement addresses three of the four self-related constructs of interest in the present study, namely: perceptions of control over academic outcomes, perceptions of academic competence, and expectation for future academic performance. The fourth construct of interest, motivational orientation, is not addressed by the causal attribution model. A brief description of the aspects of Weiner's model relating to these constructs follows.

*Perceptions of Control over Academic Outcomes*

A basic assumption of attribution theory is that the search for understanding is the "prime mover" or "spring of action" (Weiner, 1979, 1980) for achievement-related behaviors. That is, individuals are motivated by their search for understanding, wishing to discover why an event has occurred, seeking to identify the causes of their successes and failures. The individual's explanations for their successes and failures are referred to as causal attributions. In terms of the present study, the two variables assessing perceptions of control relate to causal attributions. That is, *level of understanding* is a measure of the amount of understanding one claims to have about the causes of one's academic successes and failures while *relative internality* is a measure of the extent to which these causes are viewed as attributable to internal factors versus powerful others.
Perceptions of Academic Competence

Feeling or emotional states are considered essential to the understanding of achievement-related behaviors within causal attribution theory (Weiner, Russell, & Lerman, 1978, 1979). Research investigations have documented that in achievement-related contexts, there are multiple sources of affect following success and failure (e.g., Weiner et al., 1978, 1979). Weiner (1984, 1985) suggests that emotions such as pride, competence, and self-esteem are experienced as a consequence of attributing a success to the self (internal locus, e.g., ability, effort), while negative self-esteem or low feelings of competence are experienced when a failure is ascribed to oneself. External locus attributions for success or failure outcomes are not believed to influence feelings about the self (Weiner, 1985) but, rather, feelings of anger for a failure attributable to others (Weiner et al., 1978, 1979) and gratitude for a success attributable to others. In terms of the present study, the variable academic self-concept, a measure of students' perceptions of academic competence together with the degree of importance of academic tasks, is similar to the feeling or emotional state of competence and self-esteem described in the causal attribution theory.

Expectation for Future Academic Performance

According to the causal attribution theory, outcome behavior is in large part determined by the subjective estimates of goal attainment (i.e., expectancy of success). In terms of the present study, expectation is a measure of the students' subjective estimate of goal attainment together with their commitment to their goal. The hypothesized determinants of expectancy of success will be discussed in the section concerning relationships among the constructs.
Motivational Orientation Towards Academics

According to causal attribution theory, affective reactions work in combination with subjective expectancy through a variety of motivational indicators to bring about action. Motivational indicators in Weiner's theory refer to persistence, intensity, quality, and directionality of activities. Weiner does not speak of motivational orientation as defined in the present study. However, there are indications that motivational orientation may also serve as motivational indicators. It is commonly accepted that those students who are intrinsically interested in an activity, may show more persistence and intensity while engaged in that activity than those who are extrinsically motivated.

Relationships among Constructs

Causal attribution theory predicts specific sequence and relationships among these self-related constructs and academic achievement. The search for understanding is believed to initiate the process. A number of functions of causal search have been speculated. One function is the reduction of surprise under unexpected or aversive outcomes (Pettit, 1981). Another important function is to aid in subsequent goal attainment. Understanding why one has failed might increase subsequent chances for success because relevant instrumental actions could now be implemented. Causal attributions are of primary importance in explanations of academic achievement in Weiner's theory. It should be emphasized, however, that his theory predicts only indirect effects of causal attributions on academic achievement mediated by such intervening constructs as affective reactions, expectancy change, and motivational indicators. In the same vein, in terms of the present study, level of understanding and
relative internality (forms of causal attributions) may relate to academic achievement through such intervening variables as academic self-concept, expectation and perhaps motivational orientation.

The specific links between causal attributions and intervening variables are not randomly determined. Causal attribution theory has specific predictions in this regard. This issue is the focus of the following section.

Within the academic domain, there is a great deal of evidence that success and failure are often attributed to a range of causes including ability, effort, bias of others, physiological factors, task difficulty, and luck or chance (see, Cooper & Burger, 1980; Frieze & Snyder, 1980). Given the vast array of causes a classification scheme has been identified. The underlying properties of causes have been ascertained and their similarities and differences determined. These bases for comparison are referred to as causal dimensions.

Causal attributions are postulated to vary along three bipolar dimensions: locus, stability, and controllability (Weiner, 1979, 1980, 1985; Weiner, Nierenberg, & Goldstein, 1976). In the locus dimension, causes are either internal to the person (e.g., ability, effort, mood) or are external (e.g., task difficulty, luck, bias of others). In the stability dimension, some causes such as ability, task difficulty, and bias are perceived as relatively stable, whereas other causes, such as effort, luck and mood, are subject to moment-to-moment or periodic fluctuations. In the controllability dimension, some causes such as effort are perceived as under one's volition or optional control, whereas other causes, such as ability, task difficulty, bias, luck and mood are not. Each of the dimensions of causality is postulated to have a primary psychological function or linkage. That is, different attributions for any success or failure have distinct
consequences for the individual's expectancy of future success, affective reaction and subsequent outcome behavior. This assumption has received empirical attention in various achievement-related situations (for reviews see Bar-Tal, 1978, Weiner, 1979, 1980, 1985). The following section briefly reviews the relevant findings regarding the psychological linkages among the four relevant self-related constructs and academic achievement based on the three dimensions of causal attributions.

The first dimension, locus of causality, emphasizes factors that originate within the person or arise from environmental sources. The main link of the locus dimension is to feeling or emotional states (Weiner et al., 1978, 1979) such as feelings of competence or positive self-esteem. Within the attributional conception, cognitions are considered sufficient determinants of feeling states (see Weiner, 1982, 1984). In the present study, relative internality is a measure of the subject's degree of internal locus of causality. Thus, relative internality might be expected to have a direct link to academic self-concept, a measure of self-esteem, or competence. In other words, to the extent that one attributes academic success to internal causes, one is more likely to feel academically competent; to the extent that one attributes academic failure to internal causes, one is more likely to feel academically incompetent.

The second dimension, stability of causes, refers to the fact that some causal factors fluctuate whereas others remain relatively constant. For example, ability is perceived as a constant (stable) capacity while effort and luck are perceived as more variable (unstable), changing from moment to moment or from situation to situation. The psychological linkage or consequence of the stability dimension is presumed to relate to the individual's expectation for future performance. If conditions (causes) are expected to remain the same (stable), then the outcome(s) experienced in the past will
be expected to recur. On the other hand, if the causal conditions are perceived as likely to change (unstable), then the present outcome may not be expected to recur, leading to uncertainty about subsequent outcomes or a belief that something different will result. In fact, Weiner (1984) actually suggests that "the linkage between perceived causal stability and expectancy change be considered a fundamental law in psychology" (pp. 26-27). There is considerable experimental support for the stability-expectancy link (e.g., Feather & Simon, 1971; Kovenklioglu & Greenhaus, 1978; McMahan, 1973). For example, in one study (Weiner, Nierenberg, & Goldstein, 1976), college students who believed they had done well on a task were asked to report their expectation concerning future performance and to estimate the cause of their success. Locus of the cause was not related to expectation; rather, expectancy increments were associated with the perceived stability of the causal factor.

Thus far, we see that it is the locus dimension which impacts certain affective reactions and the stability dimension which is a determinant of subjective expectancy. We now address the consequences of the third dimension of causality namely, the volitional or optional control one has over a factor. For example, although mood and effort are both internal/unstable causes, mood is considered less controllable than effort. The psychological linkage of the controllability dimension of causal attributions is not well known. However, some evidence suggests that it may be an important influencing factor in both expectancy and affective reactions, particularly after failure (Forsyth & McMillan, 1981). Although previous research attested to the importance of locus of causality and stability, these dimensions may have been confounded with controllability.
For example, Covington and Omelich (1979) reported that effort attributions after failure are linked with decreases in shame. However, the question may be raised whether this relationship emerges from the instability of effort or the controllability of effort. In an educational setting, Forsyth and McMillan (1981) reported that those college students who felt they controlled the causes of their performance provided more positive affective reactions that focused on general satisfaction (e.g., fulfilled, relaxed, happy, delighted, elated, and satisfied) than those students who believed they did not control the cause of their outcome. However, control was not found to relate to self-evaluations of competency and pride. In addition, a failing grade was significantly related to lower expectation when students believed their score was produced by environmental factors beyond their control. Thus, the control dimension was linked to both affective reactions and expectation.

In the present study, the variable “level of understanding” is a causal attribution. It remains an empirical question, however, whether level of understanding links directly to academic self-concept, expectation, or both. To the extent that level of understanding reflects stability, it would be expected to link to expectations. To the extent that it reflects locus of control, it would be expected to link to academic self-concept. However, should it reflect controllability, it might be expected to link to both academic self-concept and expectation as predicted by Weiner's (1979, 1985) Causal Attribution Theory.

Summary

According to the Causal Attributional Model of Achievement, affective reactions such as feelings of competence, motivational indicators, and expectations
concerning future outcomes are determined by students' attributional conclusions concerning their academic experiences. Attribution theory is concerned primarily with the relationship between such causal attributions and subsequent action by way of intervening variables like expectancy, feelings of competence, and motivation. As derived from attribution theory, the present study proposes that level of understanding and relative internality would have indirect effects on academic achievement: level of understanding through academic self-concept and/or expectation and relative internality via academic self-concept. Of the self-related constructs within the present study, expectation would be most directly related to subsequent academic achievement. As attribution theory does not address motivational orientation, predictions of its relation to the other self-related constructs and academic achievement were not made based on this theory. However, motivational orientation is given primary consideration in the Intrinsic Mastery Motivation Model to be discussed in the next section.

The question of relative degree of influence of the various self-related constructs on each other and academic achievement is not directly addressed by Weiner's Causal Attribution Theory. However, based on the above theoretical predictions and research findings, there are implications that certain links, such as those between relative internality and academic self-concept and expectations and academic achievement, might be stronger than those between academic self-concept and academic achievement or relative internality and expectations.
Intrinsic Mastery Motivation Model of Achievement

Harter's (1978, 1981b) Intrinsic Mastery Motivation model emphasizes the importance of one's motivational orientation in achievement-related situations. Her theorizing is based on Robert White's (1959) notion of effectance or competence motivation. A basic assumption of intrinsic mastery motivation theory is that the need for mastery or competence over one's environment (motivational orientation) is the "prime mover" or "spring of action" for achievement-related behaviors. Thus, motivational orientation serves the same purpose in Harter's model as the search for understanding does in Weiner's attribution theory.

However, this effectance motive, which impels the organism toward competence, was considered too global. Thus, Harter's (1981c) initial efforts were directed toward specifying measurable components of White's (1959) effectance motivation as it applied to the domain of classroom learning with children.

Components of Motivational Orientation

Mastery Motivation. The first component identified is called mastery motivation. This component reflects motivation in that it relates to what the individual wants to do, likes to do, and prefers. It includes: (a) preference for challenge - is the individual intrinsically motivated to seek challenging material to master vs a preference for easy work?; (b) curiosity - is the individual intrinsically motivated to learn new things, is he/she inquisitive or is the individual merely interested in pleasing the teacher and getting good grades?; and (c) independent mastery - is the individual motivated to figure things out on his/her own or is he/she dependent on the teacher?
Autonomous Judgment. The second component is referred to as autonomous judgment and reflects cognitive-informational structures. It includes: the individual's (a) independent judgment versus reliance on teacher's judgment (i.e., whether the individual feels that he/she is capable of making certain judgments about what to do in contrast to dependence on the teacher's opinion) and (b) internal criteria for success/failure versus external criteria (i.e., does the individual know on his/her own if he/she has succeeded or failed in academic tasks or does the individual require external sources of evaluation such as grades or teacher's feedback).

Unlike White's (1959) emphasis on the intrinsic properties of the effectance motive system, Harter sought to identify both intrinsic and extrinsic motivational factors. She considers the relative strengths of a child's intrinsic versus extrinsic motivational orientation as an individual differences variable.

It should be noted that the construct of motivational orientation refers to the type of motivational stance which is taken toward classroom learning as opposed to the level of achievement motivation. One may engage in academic endeavors for intrinsic reasons--because the work presents a challenge, is enjoyable or arouses one's curiosity, or alternatively, one may engage in schoolwork for extrinsic reasons--to obtain approval or because it is required.

Correlates of Motivational Orientation

Although Harter's (1978, 1981b) model identifies both antecedents and correlates of a child's motivational orientation, only the correlates relate to the present study. Two psychological constructs or self-perceptions identified as critical correlates of motivational orientation are: perceived academic competence and perceived control over achievement.
In the course of measurement construction efforts, Harter and her colleagues (see, Connell, 1985; Harter, 1981b, 1981c, 1982b) found that each of the two correlates of motivational orientation was more differentiated than it had appeared in the original theorizing. The perceived academic competence construct emerged as two separate variables: (a) "competence evaluation" which refers to a cognitive appraisal of one's own academic abilities (it is this component that is of interest in the present study) and (b) "competence affect" which refers to one's feelings (either positive or negative) about one's academic work (Harter, 1982b).

The perceived control over achievement construct (see Connell, 1985) also emerged as two separate variables. (a) "Unknown control" or "Level of understanding" refers to the degree of knowledge an individual claims to have about the reasons for his/her successes or failures in the academic domain. This variable is believed to reflect lack of experience or knowledge concerning the particular cause of an outcome as opposed to non-contingent experience. (b) "Internal-Powerful Others" or "Relative internality" refers to a contrast between the two possible sources of known control - internal control and external control in the form of powerful others. This variable reflects: "Of what the individual does know, how internal are these perceptions?" These two perceived control variables are similar to Weiner's causal attribution constructs.

**Relationships between Motivational Orientation and Its Correlates**

Harter's (1978, 1981b) model postulates relationships among motivational orientation in the classroom (intrinsic mastery motivation and autonomous judgment), perceived academic competence (competence evaluation and competence affect), perceived control over academic events (unknown control and internal-powerful
others), and actual scholastic achievement. The model hypothesizes that an individual who has an intrinsic motivational orientation, (that is, one who has a preference for challenge, curiosity, and independent mastery and relies on independent judgment and internal criteria in judging his or her competence) within a given mastery domain would also perceive him/herself to be relatively competent in that domain and to feel in control of his/her successes and failures. Alternatively, an individual who has an extrinsic motivational orientation (that is, one who prefers easy work, pleasing others, is dependent on others, and relies on others' judgment and external criteria in judging his/her performance) is expected to have lower feelings of competence and to feel less responsible for successes and failures within that given domain.

The model postulates that an individual's motivational orientation and self-related perceptions should predict actual academic achievement, objectively assessed. Thus, high levels of intrinsic mastery motivation are expected to lead to relatively high levels of perceived academic competence and perceptions of control over achievement and high levels of academic achievement, while an extrinsic motivational orientation would be expected to lead to relatively low levels of perceived academic competence and perceptions of control over achievement and low levels of academic achievement.

As with the Causal Attribution Model, the Intrinsic Mastery Motivation Model does not directly address the question of relative degree of impact of the various self-related constructs on academic achievement. However, there are implications based on the theoretical assumptions that the link between the prime mover, motivational orientation, and academic achievement might be stronger than some of the other relationships, such as that between academic self-concept and academic achievement or that between relative internality and academic self-concept. Thus, the relative strength
of importance of college students' self-related constructs and academic achievement on each other remains an empirical question to be addressed in the present study.


In a recent empirical investigation, Harter and Connell (1984) generated four plausible models which could account for relationships among academic achievement and the six self-related variables described in the preceding sections. Each of the models specifies one variable as the "prime mover." The first model, based on Harter's (1978, 1981b) theoretical work, identifies "intrinsic mastery motivation" as the "prime mover." The role of "prime mover" is assigned to academic achievement in Model 2, to "competence evaluation" in Model 3, and to "unknown control" in Model 4. (See Figure 1, Appendix A for a schematic representation of the models.)

Using structural equation modeling analysis, the researchers determined the best-fitting model for elementary (grades 3 through 6) and junior high school (grades 7 through 9) pupils in a cross-sectional study. Subjects completed self-report scales assessing the above-noted six self-related variables. Academic achievement was assessed by the Iowa Test of Basic Skills, a group administered achievement test given by the school system a year prior to data collection.

For both elementary and junior high school students, the model which postulated "unknown control" as the "prime mover" (see Model 4, Figure 1, Appendix A) best fit the obtained data, supporting the work of those theorists who emphasize cognitive-attributional variables as determinants and mediators of behavior (e.g., Bar-Tal, 1978; Covington & Omelich, 1979, 1984a; Marsh, 1984; Marsh, Cairns, Relich, Barnes, & Debus, 1984; Weiner, 1979, 1980, 1985). Thus, these results failed to
support Harter's assumption that motivational orientation is the "prime mover" of achievement related behavior. Indeed, neither mastery motivation nor autonomous judgment was found to even impact academic achievement.

Harter and Connell (1984) found that "unknown control" had a direct negative influence on academic achievement, suggesting that having a sense of "what makes you tick"--what makes you succeed and what makes you fail--is an important starting point for successful performance in school related activities. Although this finding supports Weiner's (1979, 1980, 1985) assumption that causal attributions are the "prime movers" of achievement related behaviors, it is inconsistent with Weiner's prediction that causal attributions have only indirect effects on academic achievement.

For both elementary and junior high school students, the major causal chain involved unknown control influencing actual achievement which in turn impacts competence evaluation. Competence evaluation, then, influences both competence affect and one's motivational orientation (mastery motivation). The level of knowledge or perception of control over academic outcomes as reflected in the unknown control score also influences the degree to which one feels personally responsible for outcomes. Thus, Harter's theoretical prediction that an individual's self-related perceptions should predict actual achievement, objectively assessed, was only partially supported by the empirical data. Although the "unknown control" variable directly impacted academic achievement, neither perceptions of academic competence nor motivational orientation was found to impact academic achievement.
Relationship of Theory and Research to the Present Study

The Causal Attribution and Intrinsic Mastery Motivation Theories of Achievement are two models of "person characteristics" in achievement situations which have been briefly reviewed. They share certain characteristics in that both models hypothesize a "prime mover" and both postulate a process or chain of events among self-related constructs and academic achievement although not in the same sequence. Yet several differences have also been indicated in the preceding review. The differences that are most pertinent to the present study are summarized below.

With regard to the "prime mover" for achievement-related behaviors, Harter assigns mastery motivation while Weiner assigns causal attributions to this role. Within the context of assessing the viability of the hypothesized model, the present study also sought to identify the prime mover for college students.

With regard to the hypothesized influence of perceptions of attributions of control on actual achievement, Harter, in a modified version of her model (Harter & Connell, 1984), postulates a direct impact of perceptions of control on academic achievement, while Weiner speaks of an indirect effect mediated by intervening variables such as academic self-concept, expectation of future academic performance and motivation. It is these intervening variables that are assumed to influence future performance.

With regard to the intervening variables, the two models also differ in their inclusion of expectation for future academic achievement. Although Harter speaks of expectation, she does not identify this variable as a correlate of mastery motivation. According to Weiner's (1979) Attribution Model of Achievement, expectation of success is a critical intervening variable between causal attributions and subsequent
achievement. Thus, a fair test of the relationship between perceptions of control and subsequent achievement must include expectation in the causal model. The present study was one attempt to do so.

**The Present Model**

The purpose of the present study is to examine a model of adults' self-related cognitions pertaining to academic achievement and the relationships among these constructs and academic achievement. The self-related constructs of interest are: motivational orientation toward academics, perceptions of control over academic outcomes, perceptions of academic competence, and expectations for future academic performance.

The general empirical model for the present study, derived from Harter's Intrinsic Mastery Motivation (Harter, 1978, 1981) and Weiner's (1979, 1980, 1985) Causal Attribution models of achievement as well as existing research, is outlined in Figure 1 in the conventional notation of structural equation modeling. The circles in Figure 1 represent the latent constructs, and the rectangles represent the measured variables. The arrows indicate the proposed causal relationships among the variables. The diagram also specifies the measurement model for each latent construct.

As indicated previously, in relation to the purpose of the present study, the model (see Figure 1) contains four classes of self-related constructs. With regard to motivational orientation, the model contains two variables: (a) mastery motivation, which measures what the individual wants, likes, and prefers to do, and (b) autonomous judgment, which measures whether subjects feel they are capable of making decisions about what to do in the academic setting in contrast to relying upon
Figure 1. Proposed empirical model for testing the relationships among self-related constructs and academic achievement (GPA) as suggested by the Causal Attribution and Intrinsic Mastery Motivation Models of Achievement.
the instructor's judgment about what to do and whether subjects feel they know on their own if they have succeeded or failed in academic tasks.

There are two variables assessing perceptions of control: (a) level of understanding, which represents the amount (or lack) of knowledge the student claims to have regarding what controls his/her academic successes or failures, and (b) relative internality, which represents the student's degree of internal attributions of control relative to external attributions in the form of powerful others.

Academic self-concept or perceptions of academic competence is a latent construct measured by two variables: (a) competence evaluation (i.e., Harter's measure of academic competence evaluation), which refers to one's cognitive assessment of one's competence within the academic domain and (b) importance rating. Harter's (1986) work suggests that the relationship between self-worth and domain specific self-perceptions is mediated by the perceived importance or salience of the specific domains. If one is successful in domains deemed important, then one will possess high self-esteem. Conversely, if one is unsuccessful in areas where one aspires to be competent, the result will be low self-esteem. For the purpose of the present study, academic self-concept was defined as one's evaluation of competence mediated by its relative importance to the individual.

Expectation is another latent construct measured by two variables: (a) expected GPA representing the students' expected grade point average, and (b) commitment which refers to the individual's commitment to the expected grade (goal). It was hypothesized that the more important it is to the individual to achieve his/her expected grade, the stronger the commitment to the expectancy. Thus, expectation was defined as an individual's general level of expected future performance within the academic domain and his/her commitment to that expectation.
The model includes two achievement variables: Achievement Time 1 refers to students' grade point average for the academic term prior to data collection while Achievement Time 2 refers to students' grade point average for the end of the term during which data were collected.

The model hypothesizes specific relationships among the self-related constructs and academic achievement. Level of understanding, relative internality, and achievement Time 1 are hypothesized to be correlated and not causally related. Because these three variables are not causally explained by the variables in the model, they are said to be "exogenous" variables. A path from level of understanding to academic achievement Time 2 was included in the model to test the hypothesis that the relationship between this causal attribution measure and academic achievement is in fact a direct one as suggested by Harter and Connell's (1984) results with children. Weiner's (1979, 1980, 1985) opposing view that the relationship between causal attributions and academic achievement is an indirect one was also tested. Thus, level of understanding was hypothesized to be related to academic achievement via academic self-concept and expectation. Should "level of understanding" reflect the locus dimension, then it would be expected to link only to academic self-concept; should it reflect the stability dimension, then it would be expected to link only to expectation. However, should it reflect the controllability dimension, then it might be predicted to link to both expectation and academic self-concept. Based on the findings of Harter and Connell (1984), level of understanding was also expected to relate to relative internality and autonomous judgment. Relative internality was expected to relate only to academic self-concept, as Weiner's theory suggests that the locus of causality dimension is a determinant of self-concept. Thus, these paths allowed for an empirical
test of what the indirect pattern of relationships might be between causal attributions and academic achievement. For example, is the relationship between level of understanding and academic achievement mediated by academic self-concept, expectation, or both, or is the path from academic self-concept to mastery motivation and then to achievement?

In the Harter and Connell (1984) study, no relationship was found between mastery motivation and actual achievement despite the prediction of such a relationship by Intrinsic Mastery Motivation Theory, which states that mastery motivation is the "prime mover" of achievement-related behaviors. One possible explanation for this result is that the Harter and Connell achievement measure was obtained prior to the measure of mastery motivation and thus may not have been a valid test of this relationship. The model examined in the present study included a path from mastery motivation to Achievement Time 2 to test this relationship. It will be recalled that Achievement Time 2 refers to the students' grade point average obtained subsequent to the measure of mastery motivation. If mastery motivation is the "prime mover," then the hypothesized path from it to Achievement Time 2 in the present study should be significant. Should the path from mastery motivation to Achievement Time 2 not be significant, then mastery motivation cannot be the "prime mover." Should the perception of control variables--level of understanding and relative internality--show a causal chain of relationships leading from them to Achievement Time 2, as predicted by Weiner, then causal attributions are the "prime movers." Should both these predictions occur, then the construct with the largest total effect on Achievement Time 2 would suggest which construct is the "prime mover."
Achievement Time 1 was predicted to relate directly to subsequent achievement, expectation, and academic self-concept, as these relationships are well established in the literature (e.g., Bachman & O'Malley, 1977; Byrne, 1986; Calsyn & Kenny, 1977; Centi, 1965; Holen & Newhouse, 1976; Kimball & Gray, 1982). Academic self-concept was expected to influence expectation, as predicted by Weiner's Attribution Theory, mastery motivation as predicted by Harter's Intrinsic Mastery Motivation Theory, and Achievement Time 2 as numerous existing studies (e.g., Anderson & Evans, 1974; Purkey, 1970; Reynolds, 1982) have demonstrated.

In summary, the major purpose of the present study was to test the validity of the hypothesized model of college students' academic achievement by examining the relationships among motivational orientation, perceptions of control, perceptions of academic competence, expectation for future academic performance, and actual academic achievement and the overall goodness-of-fit of the model to the observed data. The study was motivated in part by the paucity of empirical data with college students. At the same time, attempts were made to resolve some theoretical issues by determining: (a) the "prime mover." Is the basis of achievement-related behavior mastery motivation or causal attributions?; (b) the opposing views of the relationship between perceptions of control and subsequent academic achievement, that is, is this relationship direct or indirect? If the relationship is found to be an indirect one, the proposed model allows for some clarification about the functions or links of the dimensions of causal attributions to various intervening variables, such as academic self-concept, expectation, autonomous judgment, and mastery motivation; (c) the role and importance of expectation on college students' academic achievement; and (d) the relative strength of importance of college students' self-related constructs and prior academic achievement on subsequent academic achievement.
CHAPTER 2
METHOD

Subject Pool and Sample

A total of 426 student volunteers enrolled in an introductory psychology course at the University of Windsor agreed to participate in a study of "university students' self-related cognitions and learning." Of the 426 questionnaire packets distributed, 373 were returned, providing a response rate of 88%. Those subjects who participated in the study were given credit towards their final course mark. The final sample was chosen by excluding subjects who were 25 years of age or more, were not registered at the university during the fall term, 1988, or had provided incomplete or incorrect data.¹

The study was based on information provided by 52 male and 172 female university student volunteers. The majority of students were in their first year and single, ranging in age from 18 to 24 years, with a mean age of 19.6. Over half of the subjects lived with their families and at least a third lived in university residence. Approximately half the subjects were employed on a part time basis.

¹ Excluded subjects reported higher levels of relative internality, and lower GPAF and GPAW than the final sample. The two groups did not differ on any of the other measures.
**Measures**

The self-related constructs tested in the present study are summarized in Table 1. The operational definition of each of the variables comprising the constructs, together with their relevant scoring key, is also outlined.

*Academic Self-Concept or Perception of Academic Competence.* This construct was composed of two indicators, competence evaluation and importance rating. Competence evaluation was measured by the scholastic competence subscale of the Self-Perception Profile for College Students (Neuman & Harter, 1986; Appendix B). The scale is based on the assumption that the self-concept is multidimensional and situationally specific (Harter, 1982a, b; Marsh, 1986; Shavelson & Bolus, 1982). The scale is comprised of a global self-worth subscale and 12 domain specific subscales broken down into two main categories: (a) competence or abilities (i.e., creativity, intellectual ability, scholastic competence, job competence, and athletic competence) and (b) social relationships (i.e., appearance, romantic relationships, social acceptance, close friendships, parent relationships, finding humor in one's life, and morality). In the present study, only the scholastic competence subscale was administered.

In order to offset the tendency to give socially desirable answers, the scale uses a "structural alternative question format." The student is given a statement such as: "Some students do very well at their studies but other students don't do very well at their studies." The format implies that while some students share one type of self-perception, other students may feel quite differently. Respondents are asked to decide with which reference group they most identify. The student then indicates whether that description is "sort of true" or "really true" for him/her. Each item is scored on a 4-point ordinal scale where a score of 4 indicates high perceived competence and 1
Table 1

Operationalization of the Self-Related Constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items or Subscales comprising composite</th>
<th>Scoring Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptions of Academic Competence:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Self-Concept</td>
<td>Competence Evaluation&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1 - 4</td>
</tr>
<tr>
<td></td>
<td>1. confident vs. not confident about coursework</td>
<td>low high</td>
</tr>
<tr>
<td></td>
<td>2. do well vs. don't do well at studies</td>
<td>Composite Score:</td>
</tr>
<tr>
<td></td>
<td>3. trouble vs. no trouble figuring out homework</td>
<td>average of 4 items</td>
</tr>
<tr>
<td></td>
<td>4. intellectually competent vs. not intellectually competent at studies</td>
<td></td>
</tr>
<tr>
<td>Importance Rating&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1. important vs. not important to do well at studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. being good in coursework important vs. not important</td>
<td>low high Composite Score: average of 2 items</td>
</tr>
<tr>
<td>Expectation for Future Academic Performance:</td>
<td>Expected GPA</td>
<td>1 - 10</td>
</tr>
<tr>
<td>Expectation</td>
<td>Estimated Grade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Point Average for current term</td>
<td>(F) (A+)</td>
</tr>
<tr>
<td>Commitment</td>
<td>How important to achieve estimated GPA</td>
<td>1 - 4</td>
</tr>
<tr>
<td></td>
<td>low high</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Scholastic Competence Subscale of Self-Perception Profile for College Students (Neeman & Harter, 1986)

<sup>b</sup>Scholastic Subscale of Importance Ratings of College Students (Neeman & Harter, 1986)
Perceptions of Control:

**Level of Understanding**

<table>
<thead>
<tr>
<th>Unknown Subscale Items&lt;sup&gt;c&lt;/sup&gt;</th>
<th>1 - 4</th>
<th>low high</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. good grades, don't understand why</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. don't do well in school, don't know why</td>
<td>Composite Score: average of 4 items</td>
<td></td>
</tr>
<tr>
<td>3. bad grade in school don't know why</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. do well in school, can't figure out why</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Relative Internality**

<table>
<thead>
<tr>
<th>Internal Subscale Items&lt;sup&gt;c&lt;/sup&gt;</th>
<th>1 - 4</th>
<th>low high</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. want to do well in school, up to me to do it</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. do poorly in school, own fault</td>
<td>Internal Score</td>
<td></td>
</tr>
<tr>
<td>3. good grades, up to me</td>
<td>average of 4 items</td>
<td></td>
</tr>
<tr>
<td>4. don't do well, my fault</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Powerful Others Subscale Items&lt;sup&gt;c&lt;/sup&gt;</th>
<th>1 - 4</th>
<th>low high</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. do well in school, instructor likes me</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. have a bad instructor, won't do well in school</td>
<td>Powerful Others Score</td>
<td>average of 4 items</td>
</tr>
<tr>
<td>3. don't have a good instructor, won't do well</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. best way to get good grades, get instructor to like me</td>
<td>Composite Score: Internal minus Powerful</td>
<td></td>
</tr>
</tbody>
</table>

---

**Note.** Revised version of the Cognitive Domain Subscale of A Multidimensional Measure of Children's Perceptions of Control (Connell, 1980)
Motivational Orientation:

<table>
<thead>
<tr>
<th>Mastery Motivation</th>
<th>Subscales&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preference for challenge vs. preference for easy work (composed of 6 items)</td>
<td>1 - 4 low high intrinsic</td>
</tr>
<tr>
<td>2. Curiosity vs. working for extrinsic goals (composed of 6 items)</td>
<td>Composite Score:</td>
</tr>
<tr>
<td>3. Independent mastery vs. dependence on instructor (composed of 6 items)</td>
<td>average of 3 subscales</td>
</tr>
</tbody>
</table>

Autonomous Judgment

<table>
<thead>
<tr>
<th>Subscales&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Independent judgment vs. reliance on instructor's judgment (composed of 6 items)</td>
</tr>
<tr>
<td>2. Internal vs. external criteria for success and failure (composed of 6 items)</td>
</tr>
</tbody>
</table>

Note. <sup>d</sup>Revised version of A Scale of Intrinsic Versus Extrinsic Orientation in the Classroom (Harter, 1980)
indicates low perceived competence. (For a discussion of the rationale and
effectiveness of this format, see Harter, 1982b.) Responses to the four items of the
scholastic competence subscale were averaged to determine the competence evaluation
score.

Importance rating was assessed with the scholastic subscale of the Importance
Rating Scale (Neeman & Harter, 1986; Appendix C). This subscale includes two items
asking how important success in the academic domain is to the student. The
questionnaire format is similar to that of the Self-Perception Profile. Each item is
scored on a 4-point ordinal scale where a score of 4 indicates high importance and a
score of 1 indicates low importance. The importance rating score was the average of
the two items.

Neeman and Harter (1986) report that both the Self-Perception Profile and
Importance Rating Scale were developed with college student samples. The mean age
of their subjects was 19.8 years. Neeman and Harter used coefficient alpha to assess
the internal reliability of the scales. For the four-item Self-Percept subscales, they
reported values ranging from .76 to .92 for the group as a whole. The reliability
coefficient for the scholastic competence subscale was .84. The means for this subscale
were 2.78 ($SD = .66$) for females and 2.94 ($SD = .69$) for males, indicating no ceiling
or floor effects. The standard deviations revealed adequate item variability. For the
2-item scales of the Importance Rating Scale, values ranged from .53 to .94. The
reliability coefficient of the scholastic importance subscale was .78. The means for this
subscale were 3.68 ($SD = .47$) for females and 3.42 ($SD = .67$) for males. These means
are relatively high, as expected for college students. Although standard deviations are
relatively low, Neeman and Harter report that there were individual differences
reflecting a reasonable range of responses.
**Expectation.** This construct was composed of two indicators, expected GPA and commitment. Expected GPA was assessed by requesting students to estimate, as realistically as possible, their grade point average (GPA) for the current term using the university's grading system, in which grade point average scores range from F to A+ (F, D, D+, C, C+, B, B+, A-, A, A+). This grading system, in principle, comprises 10 possible outcomes. For the purpose of the analyses, letter grades were converted to a number from 1 (worst possible, F) through 10 (best possible, A+).

Commitment to expected GPA was assessed by requesting students to indicate how important it was for them to achieve their estimated GPA. This item was scored on a 4-point ordinal scale where a score of 4 indicates "very important" and 1 indicates "not at all important" (see Appendix D).

**Level of Understanding** and **Relative Internality.** These variables were assessed using the cognitive/academic domain subscale of the present author's revised version of Connell's (1980) Multidimensional Measure of Children's Perception of Control. Connell's scale is a 48-item self-report measure designed to assess children's domain-specific judgments of perceived control in the cognitive/academic, social, and physical domains. A fourth general subscale is also included. The scale assesses the following three sources of control within each behavioral domain: internal--factors which arise from within the individual, powerful others--control attributed to others (e.g., instructors), and unknown control--the lack of knowledge or understanding about the particular cause of an outcome.

It was deemed essential for the purpose of the present study to assess domain-specific perceptions of control and the unknown control attribution. A problem with existing locus of control scales for adults is that they assess only generalized
expectations of control. Therefore, Connell's (1980) scale, developed for children, was revised to make it more appropriate for college level students. Only the cognitive/academic domain subscale of the revised version was used (see Appendix E). This subscale includes 12 items measuring the three sources of control: internal \((n = 4)\) powerful others \((n = 4)\), and unknown \((n = 4)\). In each case, two items measure success outcomes and two items measure failure outcomes. The items are in the form of statements such as: "The best way for me to get good grades is to get the instructor to like me." Respondents are asked to indicate whether this statement is "very true," "sort of true," "not very true," or "not at all true" for them. These responses are scored 4, 3, 2, 1, respectively.

Pilot research was conducted by the present author to evaluate the psychometric properties of the revised scale. The sample consisted of 84 undergraduate students (31 male and 53 female) with a mean age of 21.5 years and a range of 18 to 24. Measures of internal consistency for the three cognitive subscales were acceptable by Nunnally's (1967) standards: unknown = .65, powerful others = .71, and internal = .66. Test-retest reliability measures based on a subsample of 31 over a period of six weeks were moderately high: unknown, \(r = .53, p < .001\); powerful others, \(r = .60, p < .001\); internal, \(r = .59, p < .001\).

Construct validity of the revised scale was assessed by comparing it with Levenson's Internality, Powerful Others, and Chance Scales (Levenson, 1972). Although Levenson's scales are established measures of adults' locus of control, they were deemed too global for the present study (see Appendix A for further discussion of this issue). Construct validation theory predicts that if the two scales measure the same construct, the two should be highly related. If, however, Connell's revised scale
is accounting for a unique portion of variance (e.g., cognitive domain as opposed to a
global general measure), the correlations between the measures should fall in the low to
moderate range. As predicted, Connell’s revised “unknown” scale showed a low
correlation with Levenson’s Powerful Others, \( r = .22, p < .02 \) and Chance, \( r = .29, p < .003 \) scales. Connell’s revised “powerful others” scale showed a moderate correlation
with Levenson’s Powerful Others scale, \( r = .33, p < .001 \) and a low correlation with
Levenson’s Chance scale, \( r = .19, p < .04 \). Connell’s revised “internal” scale showed a
moderate correlation with Levenson’s Internal scale, \( r = .38, p < .001 \), a low negative
correlation with Levenson’s Powerful Others scale, \( r = -.27, p < .006 \), and a moderate
negative correlation with Levenson’s Chance scale, \( r = -.31, p < .002 \).

Two scores measuring different variables were created from the revised subscale.
The first, labelled Level of Understanding, was calculated by taking the average of the
subject’s responses to the “unknown” items. Unknown control items are worded as not
knowing who or what is in control, e.g., “When I do well in school, I usually can’t
figure out why.” For the purpose of the present study the data were recoded so that
the higher the unknown scores, the more the respondent claims to know about the
contingencies for successes or failures. A low unknown score suggests that the
respondent is less aware of the reasons for such outcomes.

The second variable, labelled Relative Internality, represents a contrast between
the two possible sources of known control. That is, of what the subject does know,
how internal are these perceptions? This score was calculated as the average internal
control score minus the average powerful others control score.

Mastery motivation and Autonomous Judgment. These variables were measured
by the relevant subscales of the present author’s revised version of A Scale of Intrinsic
Versus Extrinsic Orientation in the Classroom (Harter, 1980). As Harter's scale was developed for children (see Harter, 1981c for reliability and validity measures) and no equivalent scale is available for an adult population, it was also revised for the present study (see Appendix F). Pilot research on the revised scale was conducted with the sample of 84 undergraduate students described previously. Measures of internal consistency were derived using the alpha coefficient. For the entire scale (30 items), the internal consistency was .86. Internal consistency was .70 for Mastery Motivation and .62 for Autonomous Judgment. Test-retest reliability measures from a subsample of 31 over a period of six weeks were high (mastery motivation, \( r = .86, p < .001 \), autonomous judgment, \( r = .87, p < .001 \)).

Three of the five revised subscales were used to measure the mastery motivation variable: (a) Preference for Challenge versus Preference for Easy Work Assigned (6 items), (b) Curiosity or Intrinsic Interest versus Working to Please the Teacher and/or Get Good Grades (6 items), (c) Independent Mastery (liking to figure things out on one's own) versus Dependence on Teacher (6 items).

Questions in Harter's scale are of the "structured alternative format" similar to the Perceived Competence scale. For example, "Some students work really hard to get good grades but other students work hard because they really like to learn things." Items are scored according to a 4-point scale on which 4 represents the maximum intrinsic orientation and 1 represents the maximum extrinsic orientation. The mastery motivation score was the average of the three subscales.

The remaining two of the five revised subscales were used to measure autonomous judgment: (d) Independent Judgment versus Dependence on Teacher's Judgment (6 items), and (e) Internal Criteria for Success and Failure (one knows how
well one has done without external feedback) versus External Criteria for Success and Failure (dependence on teacher feedback, grades) (6 items).

Items are scored according to a 4-point scale on which 4 represents the maximum intrinsic orientation and 1 represents the maximum extrinsic orientation. The autonomous judgment variable score was the average of the 12 items of the two subscales.

*Measures of actual achievement.* Achievement was measured by students' grade point average (GPA) which ranged from F to A+. For the purpose of the analyses, letter grades were converted to a number from 1 (worst possible, F) through 10 (best possible, A+). Achievement Time 1 was represented by students' GPA for the fall term, the term immediately preceding data collection. Achievement Time 2 was represented by students' GPA for the winter term, the term during which data were collected.

*Testing Procedures*

Students enrolled in first year psychology courses during the winter semester, 1989, were asked to participate in this study. They were approached in their classrooms approximately six weeks prior to the end of the term. Students were told that the research was about self-related cognitions and learning and that they would be asked to answer questionnaires about their thoughts and beliefs in relation to themselves and learning which would require approximately 45 to 75 minutes of their time. They were also asked to sign a consent form permitting the registrar to release their grade point averages for the fall and winter terms (see Appendix G). The consent form indicated that all their data would be kept confidential.
Students were given an envelope containing the consent form and relevant questionnaires and instructions. Subjects were requested to complete the questionnaires on their own time and to return them in a sealed envelope (provided by the experimenter) to their instructor within two weeks. Current and previous GPAs for each subject were obtained from the registrar after the completion of the term.

Data Analysis

Scales were scored using SPSSX (1988). SPSSX was also used to determine Cronbach alpha (Cronbach, 1951) internal consistency estimates of reliability for the composite variables. Plots for each combination of measured variable pairs were examined to ensure that there were no serious violations of the assumptions of linearity. The degree of skewness and of kurtosis were determined for each of the measured variables.

Causal modeling using LISREL VI. The major data analysis was done by LISREL VI (Joreskog & Sorbom, 1984). This procedure has several advantages over other statistical analyses that examine relationships among variables (e.g., correlations and multiple regressions): LISREL VI examines simultaneous relations among the variables in the hypothesized structural model; estimates errors of measurement for, and correlations between, the variables; and tests the direction of causality for both direct and indirect effects (Anderson, 1987; Biddle & Marlin, 1987; Lavee, McCubbin, & Patterson, 1985; Martin, 1987; Mulaik, 1987). Thus, of particular relevance to the present study, LISREL VI has two main advantages over other statistical techniques. It can analyze the relationships between measures which are essentially error-free and it has the potential for clearly depicting and testing a complete theory (Huba & Harlow,
1986). For a brief review of the LISREL VI data analytic technique and some cautions in its use see Appendix H.
CHAPTER 3

RESULTS

The results of the present study will be discussed in three major sections. The characteristics of the data are presented first. Next, the development of the best-fitting model is reported. Finally, the effects of each variable on the other variables are outlined.

Characteristics of the Data

Reliabilities of variables. The internal consistency reliabilities (Cronbach alpha, a measure of the degree to which items are intercorrelated) of each of the six composite variables included in the analyses are presented in Table 2. The measures which comprise each composite score are also listed. The reliability estimates for each of the variables were computed using item level data. The reliabilities were within an acceptable range (.45 to .79) considering the number of scores contributing to each of the composite variables and considering the breadth of the constructs being assessed.

Descriptive statistics. Score range, mean, standard deviation, skewness, and kurtosis for each of the measures used in the LISREL VI analyses are presented in Table 3. Several of the measured variables had moderate negative skewness and
<table>
<thead>
<tr>
<th>Variable</th>
<th>Alpha</th>
<th>Measures included in Compositea</th>
</tr>
</thead>
</table>
| Competence Evaluation  | .65   | 1. confident vs. not confident about coursework  
|                        |       | 2. do well vs. don't do well at studies  
|                        |       | 3. trouble vs. no trouble figuring out homework  
|                        |       | 4. intellectually competent vs. not intellectually competent at studies  |
| Importance Rating      | .51   | 1. important vs. not important to do well at studies  
|                        |       | 2. being good in classwork important vs. not important  |
| Level of Understanding  | .79   | 1. do well in school, can't figure out why  
|                        |       | 2. bad grade in school, don't know why  
|                        |       | 3. good grades, don't understand why  
|                        |       | 4. don't do well in school, don't know why  |
| Relative Internality   | .69   | 1. best way to get good grades, get instructor to like me (-)  
|                        |       | 2. want to do well in school, up to me  
|                        |       | 3. don't do well, my fault  
|                        |       | 4. bad instructor, won't do well (-)  
|                        |       | 5. do well, instructor likes me (-)  
|                        |       | 6. want good grades, up to me  
|                        |       | 7. get bad grades, own fault  
|                        |       | 8. don't have good instructor, won't do well (-)  |
| Mastery Motivation     | .73   | 1. Preference for Challenge vs. preference for Easy Work  
|                        |       | 2. Curiosity vs. Working for Extrinsic Goals  
|                        |       | 3. Independent Mastery vs. Dependence on Instructor  |
| Autonomous Judgment    | .45   | 1. Independent Judgment vs. Reliance on Instructors Judgment  
|                        |       | 2. Internal vs. Extrinsic Criteria for Success and Failure  |

Note. aMeasures beginning with capital letters are composites of items except where indicated. Other measures are at the item level.

bMeasures followed by (-) are weighted -1 in the composite score. All other measures are weighted +1.
Table 3

Descriptive Statistics

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Score range</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected grade</td>
<td>3-9</td>
<td>6.04</td>
<td>1.17</td>
<td>-.04</td>
<td>-.23</td>
</tr>
<tr>
<td>Commitment</td>
<td>1-4</td>
<td>3.74</td>
<td>.56</td>
<td>-2.50</td>
<td>7.30</td>
</tr>
<tr>
<td>GPA Fall</td>
<td>1-10</td>
<td>5.60</td>
<td>1.74</td>
<td>-.21</td>
<td>.09</td>
</tr>
<tr>
<td>GPA Winter</td>
<td>1-10</td>
<td>5.46</td>
<td>1.84</td>
<td>-.07</td>
<td>-.50</td>
</tr>
<tr>
<td>Mastery Motivation</td>
<td>1.33-3.83</td>
<td>2.60</td>
<td>.38</td>
<td>-.18</td>
<td>.89</td>
</tr>
<tr>
<td>Autonomous Judgment</td>
<td>1.75-3.92</td>
<td>2.88</td>
<td>.40</td>
<td>.14</td>
<td>-.02</td>
</tr>
<tr>
<td>Competence Evaluation</td>
<td>1-4</td>
<td>2.82</td>
<td>.54</td>
<td>-.12</td>
<td>.11</td>
</tr>
<tr>
<td>Importance Rating</td>
<td>2-4</td>
<td>3.62</td>
<td>.55</td>
<td>-1.20</td>
<td>.29</td>
</tr>
<tr>
<td>Level of Understanding</td>
<td>1.25-4.00</td>
<td>3.19</td>
<td>.56</td>
<td>-.36</td>
<td>-.12</td>
</tr>
<tr>
<td>Relative Internality</td>
<td>-1-3</td>
<td>1.50</td>
<td>.63</td>
<td>-.55</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Note. aPossible ranges: Expected Grade, GPA Fall, and GPA Winter 1 to 10; Relative Internality -3 to 3; all other 1 to 4.
positive kurtosis. Measures of Commitment and Importance Rating had the highest
degree of negative skewness with Commitment also having a moderately high positive
kurtosis. This was probably caused by a restriction in range. Individuals attending
university are more likely to be committed to academic goals and to rate academics as
important to them than the general public. The measure of Relative Internality also
had negative skewness and moderate positive kurtosis. Social science data are often
marked by skewness and kurtosis, and the data for this study were no exception.
Nonetheless, the degree of the skewness and kurtosis did not severely violate the
assumptions of LISREL VI analysis.

With regard to linearity, plots of all combinations of pairs of measured
variables used in the study were examined for violations of this assumption. Although
heteroscedasticity was evident in some of the scatterplots, there were no obvious signs
of nonlinearity.

Data transformation. Prior to accessing LISREL VI (LIinear Structural
RELations, Joreskog & Sorbom, 1984), the raw data for all the variables except GPAF
and GPAW were transformed using an algorithm of alternating least squares with
optimal scaling type (Young, De Leeuw, & Takane, 1979; Young, Takane, & De
Leeuw, 1978). This transformation was performed for the following two reasons.

First, LISREL's use of maximum likelihood estimation, the most commonly
used method of estimation of the goodness of fit of the observed to the reproduced
correlation matrix, is based on the assumption that the observed variables follow a
multivariate normal distribution. Several investigators have suggested robustness for
the maximum likelihood estimations against violations of normality (e.g., Huba &
Bentler, 1983; Joreskog & Sorbom, 1984). However, the validity of the chi-square test
and the standard error estimates remain suspect with non-normal data since a fundamental mathematical assumption is violated (Browne, 1984).

Second, and most important to the present study, procedures utilizing variances, covariances and product-moment correlations make the implicit assumption that variables are at least measured on an interval-level scale (Huba & Harlow, 1987). When the observed variables in a LISREL analysis are all ordinal or are of mixed scale types (i.e., ordinal and interval), as in the present study, the use of ordinary product moment correlations is not recommended (Joreskog & Sorbom, 1984). Although Joreskog and Sorbom suggest that estimates of polychoric and polyserial correlations may be computed and a matrix of such correlations analyzed, t...y do caution that there is no guarantee that such a matrix will be positive definite. Even if the matrix is positive definite, the correlations are unlikely to behave like ordinary sample moments even asymptotically. Under such circumstances even if the maximum likelihood method is used to fit the model, one is cautioned against the use of standard errors and chi-square goodness-of-fit measures.

In order to circumvent the above potential problems, De Leeuw (1988) proposes a two-step procedure which first scales the variables optimally and then fits a simultaneous equations model such as LISREL. This two-stage procedure was adopted in the present study. The raw data were optimally scaled using the PRINCALS statistical package (Van P'jckeversel & De Leeuw, 1979), a standard pre-processor to doing structural equation modeling. Grade point averages were not transformed as they are already interval scales with a fairly normal distribution. The PRINCALS program transforms the data using principle components by alternating least squares analysis. This form of analysis is based on the principle of conjoint
measurement theorem (Luce & Tukey, 1964). The resulting data are transformed to interval-level scales, standardized with a mean of 0 and a standard deviation of 1. As a result of this process, the data come closer to being normalized and better meet the assumptions of multivariate analysis which permits the application of maximum likelihood estimation. PRINCALS was also used to derive two variables included in the model, academic self-concept and expectation, by expressing their respective indicators (i.e., competence evaluation and importance, and expected GPA and commitment) as linear combinations of the latent variables. For each of the six variables, the item component loadings were moderate to high, ranging from .40 to .80.

Correlations. A matrix of Pearson correlations of the six transformed variables and the two GPAs (i.e., fall and winter) was determined (see Table 4). It is this pattern of correlations that the hypothesized model described in the introduction is attempting to explain.

The highest correlation in this matrix is between the two measures of academic achievement, GPAF and GPAW \( r = .77 \). This correlation indicates that academic achievement is a stable characteristic of students over time, consistent with those researchers who argued for the stability of academic achievement (e.g., Bloom, 1964). This finding is also consistent with the results of studies using structural equation modeling. For example, in a longitudinal study, Maruyama, Rubin, and Kingsbury (1981) found academic achievement to be highly stable across the age range of nine to fifteen years. Byrne (1986) found that academic achievement of high school students was highly stable over a seven month period. Similarly, Holen and Newhouse (1976), using a sample of college students, found high stability between high school GPA and college GPA as well as between previous college GPA and subsequent course grades.
Table 1:

Correlations Among Self-Related Variables and Achievement

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Relative Internality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Level of Understanding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Autonomous Judgment</td>
<td>-.01 ns</td>
<td>.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Mastery Motivation</td>
<td>.14 ns</td>
<td>.20*</td>
<td>.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Academic Self-Concept</td>
<td>.17 ns</td>
<td>.26</td>
<td>.09 ns</td>
<td>.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Expectations</td>
<td>.23*</td>
<td>.09 ns</td>
<td>.01 ns</td>
<td>.18 ns</td>
<td>.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Grade Point Average Fall</td>
<td>.10 ns</td>
<td>.03 ns</td>
<td>.05 ns</td>
<td>.29</td>
<td>.39</td>
<td>.30</td>
<td></td>
</tr>
<tr>
<td>8. Grade Point Average Winter</td>
<td>.07 ns</td>
<td>-.02 ns</td>
<td>.02 ns</td>
<td>.22*</td>
<td>.32</td>
<td>.36</td>
<td>.77</td>
</tr>
</tbody>
</table>

Note. All r's p<.01 except where indicated.

* p<.05
The next highest relationships are between GPAF and Academic Self Concept (r = .39) and Expectation (r = .30); between GPAW and Expectation (r = .36) and Academic Self Concept (r = .32); and between Academic Self Concept and Mastery Motivation (r = .33). The next highest relationships are between GPAF and Mastery Motivation (r = .29); Expectation and Academic Self Concept (r = .28); and Mastery Motivation and Autonomous Judgment (r = .28). The next highest are the relationships between Level of Understanding and Relative Internality (r = .26), Autonomous Judgment (r = .28), and Academic Self Concept (r = .26). The lowest significant relationships are between Mastery Motivation and Level of Understanding (r = .20); Mastery Motivation and GPAW (r = .22); and Expectation and Relative Internality (r = .23). All other relationships were nonsignificant. These data are consistent with previous correlational studies attesting to the importance of the relationships among self-related cognitions and academic achievement. However, the major focus of the present study was on the chain or sequence of relationships among these constructs rather than the simple correlations among them. I now address this major issue.

**Development of the Accepted Model**

Prior to presenting the development of the accepted model based on the observed data, a brief explanation of the procedures will be reviewed and the criteria adopted for developing an acceptable model will be established. Four issues will be addressed: the method of estimation, judging the quality of the model, assessment of the overall fit of the model and the respecification of effects of variables.
Methods of estimation. LISREL VI provides three methods of estimation: unweighted least squares, maximum likelihood, and generalized least squares. However, maximum likelihood estimates were used in this study guided by four considerations.

First, although unweighted least squares estimation has the advantage that it can be used with skewed data and unidentified parameters, it is of limited value as it lacks statistical indices. Second, generalized least squares estimation has not been available in the previous versions of LISREL. It is only mentioned sporadically in the LISREL VI manual. Neither the fitting functions involved nor the assumptions underlying them are explained. Third, maximum likelihood estimation is the most readily available method. LISREL produces a full information maximum likelihood solution which makes use of all information in the data about each parameter (Joreskog, 1969; Joreskog & Sorbom, 1978). The maximum likelihood estimates are optimal in the sense of being most precise in large samples (i.e., > 200). Finally, maximum likelihood estimation is recommended for theory testing and development (Anderson & Gerbing, 1988; Joreskog & Wold, 1982).

Judging the quality of the model. In addition to the fit of the data to the overall model, the quality of the model itself can be evaluated by various criteria. Two sets of criteria recommended by Joreskog and Sorbom (1984) were adopted in the present study. The first set of criteria involved indications of proper model specifications. These indicators included program convergence, all matrices being positive definite, all parameters being identified, no estimates having "impossible" values (e.g., correlations greater than 1.0, negative squared multiple correlations, negative coefficients of determinants), no very highly correlated parameter estimates or extremely high
standard errors suggesting a nearly non-identified model, and a Stability Index smaller than 1.0, suggesting that there will be no difficulty with convergence upon replication. 

The second set of criteria involved four indications of good quality parameters. First, sample parameters fit the model well as judged by small fitted residuals and normalized residuals of less than 2 (indicating that corresponding relationships in the sample matrix are accounted for in the model). Second, parameters are significant as judged by T-values exceeding the critical value for each of the free parameters. The T-value is defined as the parameter estimate minus the parameter divided by its standard error. T-values can be interpreted as z-scores. The LISREL VI manual (Joreskog & Sorbom, 1984) suggests 2.0 as a critical value (a conservative estimate of a two-tailed test with \( p < .05 \) and a critical value of 1.96). If the valence of a parameter has been hypothesized, a one-tailed test with \( p < .05 \) could be used with a critical value of 1.65. Third, estimates of the amount of variation explained for each endogenous variable by its relationships with other endogenous variables and with the exogenous variables are reliable as judged by adequate squared multiple correlations (R\(^2\)) for each. R\(^2\) range from 0 to 1, with 1 being optimal. Fourth, the structural equations are generally reliable as judged by their coefficients of determination (CD). The CDs range from 0 to 1, with values close to 1 being optimal. The CD for equations measures how well all of the equations serve as measures of the dependent variables jointly.

For the purpose of the present study, the models were first examined for misspecification. If the model had been properly specified according to the specific criteria, it was then examined for quality in general. If the quality was judged adequate, the model was examined for overall goodness of fit.
Assessment of overall fit of models. Several goodness of fit measures for the overall model have been suggested in the literature (e.g., Bentler & Bonnett, 1980; Hoelter, 1983; Joreskog & Sorbom, 1984; Mulai, James, Van Alstine, Bennett, Lind, & Stilwell, 1989). In accordance with the general recommendations of the literature, a number of statistical and subjective measures of fit were used. The next section explains each of these measures. All of the fit indices discussed below were used.

The first two measures of goodness-of-fit are the chi-square ($\chi^2$) statistic with its associated probability level and the chi-square statistic with its degrees of freedom. The chi-square statistic and probability level were used only as a guide because of the problems associated with this index. The chi-square statistic, when taken in conjunction with the probability level, provides a test of the proposed model against the alternative that the variables are merely correlated to an arbitrary extent. In other words, this test may be seen as indicating the likelihood that the model in question and the model from which these data emerged are one and the same. This test provides an estimate of how dissimilar the set of observed relationships is to the set of relationships that one could expect if this model were true (Connell, 1981). Thus, the lower the chi-square value, the better the fit of that model to the observed data and the higher the probability level associated with the chi-square value, the better the fit. In essence, a nonsignificant chi-square is desired which indicates that there is no difference between the predicted model and the observed data.

There are several problems with this use of the chi-square statistic, however. The statistic is only valid if all the observed variables have a multivariate normal distribution, the analysis is based on the sample covariance matrix, and the sample size is fairly large (Joreskog & Sorbom, 1984). Typically, for most models, the researcher
obtains significant values, suggesting that the model should be rejected. However, according to Mulaik et al. (1988), in many of these cases, a careful inspection of the residuals representing the difference between the elements of the unrestricted sample covariance matrix and those of the estimated hypothetical model covariance matrix for the observed variables reveals that they are small in an absolute sense. This would seem to suggest that the models may not be so theoretically off-target as suggested by the significance of the chi-square statistic. As several investigators (e.g., Bentler & Bonnett, 1980; Maruyama & McGarvey, 1980) have pointed out, the probability of rejecting any model increases as sample size increases. In very large samples the most trivial discrepancy between the model and data will require rejection of the model by the chi-square statistic. Conversely, the probability of accepting a model increases as sample size decreases. But this situation merely reflects a lack of power (Bentler & Bonnett, 1980). The problem of sample size has been reviewed in the literature (e.g., Boomsma, 1982; Hoelter, 1983; Marsh, Balla, & McDonald, 1988; Tanaka, 1987), and many caution that no firm basis could be offered for what sample size constitutes an adequate fit. However, Hoelter (1983) suggested a critical value of 200 as a reasonable starting point for suggesting that differences between the model and the data may be unimportant. Because of the above noted problems, it has been suggested that the probability level of the chi-square statistic should be used primarily as a guide rather than as a rule (e.g., Bentler & Bonnett, 1980; Joreskog & Sorbom, 1984; Maruyama & McGarvey, 1980; Tanaka, 1987).

The use of the chi-square statistic, with its associated degrees of freedom, has been suggested as a better indication of the model's overall goodness of fit. This measure is based on the relative chi-square ($\chi^2/df$) rather than on its absolute value.
Rather than viewing the chi-square as a test statistic, Joreskog and Sorbom (1984) recommend that it should be regarded as a goodness (or badness) of fit measure with large values corresponding to bad fit and small values corresponding to good fit. The degrees of freedom serve as a standard by which to judge whether chi-square is relatively large or small. In LISREL VI, degrees of freedom are determined by the number of parameters, not the sample size. For well fitting models, the expected value of this ratio is 1.0. However, reported ad hoc rules for the acceptance of well-fitting models on the basis of this statistic have ranged from 2.0 to 5.0 (Marsh & Hocevar, 1985). Wheaton, Muthen, Alwin, and Summers (1977) suggest a chi-square degrees of freedom ratio of 5/1 as an acceptance/rejection criterion while Carmines and McIvor (1981) prefer a more conservative ratio of 3/1. With large samples (i.e., > 200) and large numbers of structural relationships (i.e., > 10) a chi-square to degrees of freedom ratio of between 2 and 3 to 1 has been recommended as a general rule of thumb for an adequate fit (Connell, 1981). Given the large sample size and large number of structural relationships in the present study, this latter criterion was adopted.

Three measures that do not rely on the chi-square statistic were also used as goodness of fit measures for the overall model. First, the Goodness of Fit Index (GFI) (Tanaka, 1987; Tanaka & Huba, 1985) is a normed measure of the relative amount of variances and covariances jointly accounted for in the model. It is independent of sample size and relatively robust against departures from normality. However, the statistical distribution of the GFI is not known. Values typically range from 0 to 1, but a poor fit can produce negative values. High values suggest good models, but this is a subjective judgment.
Second, the Adjusted Goodness of Fit Index (AGFI) is the GFI adjusted for
degrees of freedom. While the unadjusted GFI measures the fit of the model as a
whole, without consideration for the number of parameters in the model, the AGFI
incorporates a penalty function for additional parameters. The AGFI corresponds to
using mean squares instead of total sums of squares (Marsh, Balla, & McDonald,
1988).

Finally, the Root Mean Square Residual (RMR) (Joreskog & Sorbom, 1984) is
a measure of the average of residual variances and covariances. This is a useful
measure when all observed variables are measured in the same metric. For correlation
matrices RMR values range from 0 to 1. Values close to 0 indicate a good fit.

Respecification of effects of variables. This section describes the criteria that
were adopted in the present study for making modifications to the hypothesized model.
LISREL VI provides modification indices for fixed parameters which indicate the
minimum drop in chi-square if that parameter were to be set free or relaxed, permitting
the inclusion of the parameter in the model. Joreskog and Sorbom (1984) suggest
modifications can be made when modification indices are 5 or more, if the modification
improves the fit of the data to the model as judged by fit indices. Parameters with
normalized residuals larger than 2 in magnitude are also indicative of a specification
correction error in the model. Such parameters can also be set free or fixed, one at a time, to see
if there is a significant improvement in fit by including or removing the parameter from
the model. Thus, while modifications to the model are easy to make, such
modifications should only be made if justified by theory (Maruyama & McGarvey,
1980). In accordance with such cautions, modifications in this study were made only
to those parameters with a modification index over 5, a normalized residual larger than
2, and if such modifications could be theoretically justified.
Having reviewed the major issues related to the techniques and criteria for determining the acceptable model, now I will proceed to examine the model fitting process. Advancement from the initially hypothesized model (see Figure 2) to the final best-fitting model (see Figure 6) required several respecifications and reestimations of parameters. The model-fitting process is presented next.

Model 1 - Examination of the initial model. Table 5 presents the maximum likelihood estimates for the hypothesized initial structural model (see Figure 2 for a graphic presentation of the model) together with the associated standard errors and T-values. The squared multiple correlations (R²) for each structural equation and the coefficient of determination for structural equations jointly are also provided in Table 5. The coefficient of determination, a measure of the predictive accuracy of the model and the strength of linear associations among the variables, indicates that the model accounts for a relatively high proportion of the variance in the endogenous variables (CD = .67).

Quality and goodness of fit measures for Model 1 are presented in the first row of Table 6 (see Model 1 Original). In its original form, the hypothesized model fits the observed correlation matrix reasonably well and cannot be rejected: \( \chi^2 (10) = 25.49, p < .01; \) the ratio of chi-square to degrees of freedom is 2.55; the goodness-of-fit index (GFI) is .97; the adjusted goodness-of-fit index (AGFI) is .90; and the root mean square residual (RMR) is .06. However, there are indications that the model could be improved. Examination of the modification indices revealed four possible respecifications with the largest modification index being 13.11 for Mastery Motivation to Academic Self Concept. Examination of the normalized residuals revealed two which exceeded the critical value of 2.0. In light of these modification indices, a path from mastery motivation to academic self-concept was included in Model 1a.
Figure 2. Model of the hypothesized relationships among self-related constructs and academic achievement.
### Table 5

**LISREL Estimates for Structural Model**

*(Relations among Variables) - Original Model*

<table>
<thead>
<tr>
<th>Path between Variables</th>
<th>Maximum Likelihood</th>
<th>Standard Errors</th>
<th>Critical T</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXP/GPAW</td>
<td>.14</td>
<td>.05</td>
<td>3.22**</td>
</tr>
<tr>
<td>AUTOJ/EXP</td>
<td>-.03</td>
<td>.07</td>
<td>-0.48</td>
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<td>MASTERY/GPAW</td>
<td>-.01</td>
<td>.04</td>
<td>-0.29</td>
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<td>MASTERY/AUTOJ</td>
<td>.23</td>
<td>.06</td>
<td>3.71**</td>
</tr>
<tr>
<td>ASC/GPAW</td>
<td>.02</td>
<td>.05</td>
<td>0.34</td>
</tr>
<tr>
<td>ASC/EXP</td>
<td>.18</td>
<td>.07</td>
<td>2.46*</td>
</tr>
<tr>
<td>ASC/MASTERY</td>
<td>.33</td>
<td>.06</td>
<td>5.17**</td>
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<td>LEVEL/GPAW</td>
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<td>.06</td>
<td>3.63**</td>
</tr>
<tr>
<td>LEVEL/ASC</td>
<td>.23</td>
<td>.06</td>
<td>3.75**</td>
</tr>
<tr>
<td>RELINT/ASC</td>
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<td>.06</td>
<td>1.14</td>
</tr>
<tr>
<td>GPAF/GPAW</td>
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<td>.05</td>
<td>15.57**</td>
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<td>GPAF/ASC</td>
<td>.38</td>
<td>.06</td>
<td>6.38**</td>
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</table>

$R^2$: GPAW = .62 EXP = .12 AUTOJ = .12 MASTERY = .11 ASC = .22

Coefficient of Determination for Structural Equations = .67

**Note.** EXP = Expectation, GPAW = Grade point average winter,
AUTOJ = Autonomous Judgment, MASTERY = Mastery Motivation,
ASC = Academic Self-Concept, LEVEL = Level of Understanding,
RELINT = Relative Internality, GPAF = Grade point average fall.
*p<.05, **p<.01.
Table 6
Quality and Goodness of Fit Measures for Proposed Model and Sequentially Modified Models

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$\chi^2$/df</th>
<th>GFI</th>
<th>AGFI</th>
<th>RMR</th>
<th>CDeq.</th>
<th>Alter</th>
<th>Stab.I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td></td>
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<td>Original</td>
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<td>2.55</td>
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<td>.90</td>
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<td>.67</td>
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<td>.14</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>MASTERY/ASC</td>
<td>11.97</td>
<td>9</td>
<td>1.33</td>
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<td>.95</td>
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<td>.35</td>
<td>1 - 1</td>
<td>.61</td>
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<tr>
<td>Model 1b free</td>
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<td></td>
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</tr>
<tr>
<td>GPAF/MASTERY</td>
<td>17.35</td>
<td>9</td>
<td>1.93</td>
<td>.98</td>
<td>.92</td>
<td>.04</td>
<td>.68</td>
<td>1 - 1</td>
<td>.10</td>
</tr>
<tr>
<td>Model 1c free</td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>RELINT/EXP</td>
<td>9.94</td>
<td>8</td>
<td>1.24</td>
<td>.99</td>
<td>.95</td>
<td>.03</td>
<td>.69</td>
<td>0 - 0</td>
<td>.09</td>
</tr>
<tr>
<td>Final Model Simplified</td>
<td>13.27</td>
<td>14</td>
<td>.95</td>
<td>.99</td>
<td>.96</td>
<td>.04</td>
<td>.68</td>
<td>0 - 0</td>
<td>.09</td>
</tr>
</tbody>
</table>

Note. $\chi^2$ = chi square, df = degrees of freedom, $\chi^2$/df = relative chi square, GFI = goodness of fit index, AGFI = adjusted goodness of fit index, RMR = root mean square residual, CDeq. = coefficient of determination for structural equations, Alter = no. of modification indices + no. of critical residual indices, Stab.I = stability index, MASTERY = Mastery Motivation, ASC = academic self-concept, GPAF = grade point average fall, RELINT = relative internality, EXP = expectations.
**Model 1a - Inclusion of path from Mastery Motivation to Academic Self Concept.**

Model 1a is graphically presented in Figure 3. The maximum likelihood estimates are also included for each parameter in Figure 3. The initial model was respecified to permit the estimation of a path from Mastery Motivation to Academic Self Concept in accordance with the largest modification index. This respecification is theoretically justifiable according to the Intrinsic Mastery Motivation Model which maintains that mastery motivation is the "prime-mover" which leads to all other self-related constructs.

The quality and goodness of fit measures for Model 1a are presented in the second row of Table 6 (see Model 1a free Mastery/ASC). The overall fit of the model is judged very good: \( \chi^2 (9) = 11.97, p > .22; \) relative chi-square is 1.33; GFI is .99; AGFI is .95; and RMR is .04. However, measures of the overall fit of the model to the data do not express the quality of the model judged by any other criteria. The overall fit of the model could be very good with one or more relationships in the model very poorly determined, however, as judged by the squared multiple correlations (Joreskog & Sorbom, 1984). Recall that the first criteria for judging the quality of a model involves examining proper model specifications including no estimates having "impossible" values such as negative squared multiple correlations. Examination of the squared multiple correlations of Model 1a reveals a poor quality. This modified model provides a negative squared multiple correlation for structural equations: Mastery Motivation \( (R^2 = -.08) \) and Academic Self Concept \( (R^2 = -.25) \). In addition, the coefficient of determination for structural equations drops from .67 in the original model to .35 in Model 1a. Thus, Model 1a is rejected as an acceptable model and the path from Mastery Motivation to Academic Self Concept cannot be set free.
Figure 3. Model 1a including path from Mastery Motivation to Academic Self Concept.
Model 1b - Inclusion of path GPAF → Mastery Motivation. A reexamination of
the modification indices and normalized residuals of the initial model revealed the next
largest modification index of 8.00 for GPAF to Mastery Motivation with a
corresponding normalized residual of 2.43. Thus, the path from GPAF to Mastery
Motivation was set free. This respecification would be supported theoretically by those
investigators who claim that achievement is the all-important, direct factor accounting
for all self-related cognitions and affects. This position is typical of many back-to-
basics and compensatory educational programs (e.g., Bereiter & Englemann, 1986).
Such positions assume that high levels of achievement will lead to a relatively intrinsic
motivational orientation (Harter & Connell, 1984). The maximum likelihood estimates
are presented in Figure 4, while the quality and goodness of fit measures are provided
in the third row of Table 6 (see Model 1b free GPAF/Mastery).

As can be seen in Table 6, both quality and overall goodness of fit measures
reveal that this revised model is a good fit to the observed data and an improvement
over the original model: \( \chi^2 (9) = 17.35, p < .04; \) relative chi-square is 1.93; GFI is .98;
AGFI is .92; RMR is .04; and coefficient of determination for structural equations is
.68. Examination of the modification index reveals one significant modification (7.22)
for Relative Internality to Expectation. The corresponding normalized residual (2.45)
also exceeds the critical value for modification.

Weiner's Causal Attribution Theory postulates that perceived stability, and not
the locus dimension of the cause, is related to expectation. Thus, Relative Internality
was not predicted to relate to expectation. However, the Relative Internality measure
in the present study did not differentiate among the actual causes of achievement
outcome such as ability, effort, task difficult, or luck. When one considers both the
Figure 4. Model 1b including path from Achievement Time 1 to Mastery Motivation.
causes and causal dimensions, ability is an internal and stable cause, effort is internal but unstable, task difficulty and bias of significant other are external and stable, and luck is external and unstable (Weiner, Nierenberg, & Goldstein, 1976). If subjects attribute their successes/failures to ability, then their relative internal locus is also perceived as a stable characteristic. Theoretically, it could thereby influence subjects' expectation for the future.

**Model 1c - Inclusion of path from Relative Internality to Expectation.** The next modification in the model allows the path from Relative Internality to Expectation to be set free. It is graphically presented in Figure 5. The maximum likelihood estimates are provided for each parameter. The quality and goodness of fit measures are presented in the fourth row of Table 6 (see Model 1c free Relint/Exp). These measures reveal that this modified model fits the data very well: \[ \chi^2 (8) = 9.94, p > .27; \] relative chi-square is 1.24; GFI is .99; AGFI is .95; RMR is .03; and the coefficient of determination for structural equations is .69. Examination of the modification indices and normalized residuals indicate no modifications. Thus, all measures indicate that only marginal improvements in the model's fit to the data are possible. This model is therefore accepted as a good description of the data.

**Trimmed or Simplified Model.** While the accepted model may be a very good fit, it is plausible that some parameters are actually not needed since they are statistically insignificant. Deleting such insignificant paths could provide a more parsimonious explanation of the observed data. As a final analysis, the nonsignificant paths (i.e., level of understanding to expectation, level of understanding to GPAW, relative internality to academic self-concept, academic self-concept to GPAW, mastery motivation to GPAW, and autonomous judgment to expectation) were deleted to test
Figure 5. Model 1c including path from Relative Internality to Expectation. Accepted Model all paths included.
the hypothesis that these paths did not contribute to the fit of the model. This revised model is presented in Figure 6. The path coefficients are also shown in Figure 6. Maximum-likelihood estimates, with corresponding errors and critical T-values, are presented in Table 7.

Quality and goodness-of-fit measures for the simplified/trimmed model are presented in the bottom row of Table 6 (see Final Model Simplified). The goodness-of-fit measure of the revised model is $\chi^2 = 13.27$ with 14 degrees of freedom. This represents an increase in $\chi^2$ by 3.33 with 6 degrees of freedom, an insignificant ($p > .70$) change in the model's overall fit indicating that the statistically insignificant paths do not contribute to the fit of the model. The other measures of goodness of fit changed only marginally, further supporting the notion that these paths may be deleted with little change to the fit of the model. Thus, the trimmed model reproduces the original correlation matrix as well as model 1c, the final untrimmed model. The trimmed model has the added advantage of accounting for the relationships among the variables with fewer paths.
Figure 6. Accepted Model. Trimmed of nonsignificant paths.
Table 7

LISREL Estimates for Final Model - Relations Among Variables

<table>
<thead>
<tr>
<th>Path between Variables</th>
<th>Maximum Likelihood</th>
<th>Standard Errors</th>
<th>Critical T</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXP/GPAW</td>
<td>.14</td>
<td>.04</td>
<td>3.18***</td>
</tr>
<tr>
<td>MASTERY/AUTOJ</td>
<td>.23</td>
<td>.06</td>
<td>3.71***</td>
</tr>
<tr>
<td>ASC/EXP</td>
<td>.18</td>
<td>.07</td>
<td>2.36*</td>
</tr>
<tr>
<td>ASC/MASTERY</td>
<td>.25</td>
<td>.07</td>
<td>3.71***</td>
</tr>
<tr>
<td>LEVEL/AUTOJ</td>
<td>.23</td>
<td>.06</td>
<td>3.63***</td>
</tr>
<tr>
<td>LEVEL/ASC</td>
<td>.25</td>
<td>.06</td>
<td>4.16***</td>
</tr>
<tr>
<td>RELINT/EXP</td>
<td>.18</td>
<td>.06</td>
<td>2.83**</td>
</tr>
<tr>
<td>GPAF/GPAW</td>
<td>.73</td>
<td>.04</td>
<td>16.59***</td>
</tr>
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<td>3.30***</td>
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<td>GPAF/MASTERY</td>
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<td>2.86**</td>
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<td>GPAF/ASC</td>
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<td>.06</td>
<td>6.48***</td>
</tr>
</tbody>
</table>

\[ R^2: \] GPAW = .61  EXP = .15  AUTOJ = .12  MASTERY = .14  ASC = .22  Coefficient of Determination for Structural Equations = .68

Note. EXP = Expectation, GPAW = Grade point average winter, MASTERY = Mastery Motivation, AUTOJ = Autonomous Judgment, ASC = Academic Self-Concept, LEVEL = Level of Understanding, RELINT = Relative Internality, GPAF = Grade point average fall.  *p<.05, **p<.01, ***p<.005.
Effects of Variables

In this section, the effects of the self-related variables on each other and on academic achievement are decomposed into direct and indirect components, as recommended by Alwin and Hauser (1975), to elucidate hypothesized causal interpretations. The sum of the direct effect and all indirect effects of a variable on another variable is referred to as the total effect. The total effect of one variable on another is the part of their total association which is neither due to their common causes, to correlation among their causes, nor to unanalyzed correlation (Duncan, 1971). A total effect tells us how much change in a consequent variable results from a specific increase or decrease in its antecedent variable, regardless of the mechanisms by which the change may occur (Alwin & Hauser, 1975). Indirect effects are those parts of a variable’s total effect which are mediated by intervening variables between the cause and effect of interest. The direct effect of one variable on another is that part of its total effect which is not transmitted by intervening variables. Thus, it is the change that occurs when intervening variables are held constant. Direct, indirect, and total effects of exogenous and endogenous variables on Academic Achievement (GPAW), Expectation, Autonomous Judgment, Mastery Motivation, and Academic Self Concept are presented in Table 8.

Effect on Academic Achievement (GPAW). An examination of Figure 6 and Table 8 reveals that the most important effect on subsequent academic achievement (GPAW) is attributable to previous academic achievement (GPAF) with a strong positive direct effect (.73) plus a small positive indirect effect (.04) via Academic Self-
Table 8

Direct, Indirect, and Total Effects of Self-Percepts on each other and Academic Achievement

<table>
<thead>
<tr>
<th>Variable</th>
<th>Direct</th>
<th>Indirect</th>
<th>Total</th>
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</thead>
<tbody>
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<td><strong>Exogenous</strong></td>
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</tr>
<tr>
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<td>.01</td>
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<td>GPAF</td>
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<tr>
<td><strong>Endogenous</strong></td>
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<tr>
<td>Expectation</td>
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<td>.14</td>
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<tr>
<td>Autonomous Judgment</td>
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<td>Mastery Motivation</td>
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Concept which in turn affects Expectation for a total effect of .77. In other words, with measurement error extracted, we find that academic achievement is very strongly linked to prior academic achievement. This finding is consistent with existing research with children (e.g., Norwich, 1987), adolescents (e.g., Meece, Wigfield, & Eccles, 1990), and college students (e.g., Holen & Newhouse, 1976; Malloch & Michael, 1981; Vollmer, 1986).

Consistent with Weiner's Causal Attribution Theory, the measures of perceptions of control (i.e., relative internality and level of understanding) have no direct effects on GPAW, only indirect effects. This finding is in contrast to that reported by Harter and Connell (1984) that Level of Understanding has a strong direct effect on academic achievement. However, as already noted, the small indirect effect (.03) of the locus dimension, Relative Internality, via Expectation, noted in the present study, is inconsistent with the predictions of Weiner's Causal Attribution Theory.

Level of Understanding, has a small indirect effect (.01) via Academic Self-Concept which in turn impacts Expectation.

As predicted, Expectation has a modest direct effect (.14) on GPAW. Of the four endogenous variables, Expectation alone has a direct effect on academic achievement. Academic Self-Concept has an indirect effect (.02) through its effect on Expectation. Measures of motivational orientation (i.e., Autonomous Judgment and Mastery Motivation) have no effect, either direct or indirect, on subsequent academic achievement, contrary to Harter's Mastery Motivation Theory which predicts that high levels of intrinsic motivational orientation lead to high academic performance as objectively measured. However, it is consistent with the results reported by Harter and Connell (1984).
Effect on Expectation. Of the exogenous variables, GPAF has the largest total effect on Expectation with a direct effect of .22, plus an indirect effect via Academic Self Concept of .06, for a total effect of .28. Contrary to expectation, based on Weiner's Causal Attribution Theory which states that the dimension of stability, not locus, is related to expectation, Relative Internality (i.e., locus dimension) has a direct effect on Expectation. Level of Understanding has a small indirect effect as transmitted through Academic Self Concept.

Academic Self Concept is the only endogenous variable affecting Expectation with a direct effect of .16 and no indirect effect. Neither of the two motivational orientation variables affect Expectation. Thus, Expectation appears to receive its greatest effect from prior academic achievement along with a moderate direct effect from both Relative Internality and Academic Self Concept and a small indirect effect from Level of Understanding via Academic Self-Concept.

Effect on Autonomous Judgment. As expected, Level of Understanding and Mastery Motivation both show moderate direct effects on Autonomous Judgment.

Effect on Mastery Motivation. Mastery Motivation receives its greatest impact from GPAF with a direct effect of .20 and an indirect effect via Academic Self Concept of .10 with a total effect of .30. Academic Self Concept has a direct effect (.25) on Mastery Motivation.

Effect on Academic Self Concept. Examining the final endogenous variable, it is evident that both Level of Understanding and GPAF have a substantial direct effect on Academic Self-Concept. The direct effect of Level of Understanding (.25) suggests that the more one claims to know about what causes successes or failures in the academic domain, the greater one's academic self-concept. As expected, the effect of GPAF on Academic Self Concept is a strong positive one (.39).
Summary.

1. There are no effects, direct nor indirect, of Mastery Motivation on Academic Achievement (GPAW).

2. Both perceptions of control measures (i.e., Level of Understanding and Relative Internality) had only indirect effects on Academic Achievement, consistent with Weiner's Causal Attribution Theory. However, the indirect effects of the control measures were not always consistent with those effects suggested by Weiner's model.

3. Level of Understanding had a direct effect on Academic Self Concept, both a direct and indirect effect on Autonomous Judgment, and a small indirect effect on GPAW and Mastery Motivation.

4. Relative Internality had a direct effect on Expectation, contrary to predictions based on Weiner's Model, and only a small indirect effect on GPAW.

5. Of the endogenous variables, only Expectation had a significant total effect on GPAW. Academic Self Concept had a small indirect effect mediated by Expectation.

6. Prior Academic Achievement (GPAF) had a significant direct effect on each of the endogenous variables with the single exception of Autonomous Judgment.
CHAPTER 4
DISCUSSION

The present study was concerned with the relationships among four sets of self-related constructs within the domain of school-related activities: perceptions of competence (academic self-concept), perceptions of control (level of understanding and relative internality), perceptions of motivational orientation (autonomous judgment and mastery motivation), and expectation for future performance (expectation). The constructs were integrated into a conceptual framework which hypothesized specific relationships among them and academic achievement based on predictions derived from previous research, Harter's (1978, 1981b) Mastery Motivation, and Weiner's (1979, 1980, 1985) Causal Attribution models of achievement.

The major purpose of the present study was to assess the viability of the proposed model of adult academic achievement by using structural equation modeling. Previous research found significant relationships between various self-related cognitions and academic achievement (see, Bar-Tal & Bar-Zohar, 1977; Byrne, 1984; Centi, 1965; Eccles, 1983; Gottfried, 1985; Hansford & Hattie, 1982). The correlational data of the present study confirm the importance of some self-related cognitions in relationship to academic achievement. Significant correlations in the present study were observed between academic achievement and subsequent academic self-concept and expectations for future academic performance; between academic self-concept and expectations and subsequent academic achievement; between academic self-concept and mastery
motivation. Important relationships were also found between academic achievement and subsequent mastery motivation; and between mastery motivation and autonomous judgment. Important relationships also emerged between the two perceived control variables, academic self-concept, and expectations.

A limitation of much of the previous research, however, is their reliance on simple correlational research designs. The present study differs from the past research and extends previous findings by simultaneously examining the relationships among these self-related cognitions and academic achievement with an adult population. Thus, the focus of the discussion in the present study will be on the overall fit of the model.

Having established the likelihood that the model was a plausible explanation of the relationships, the study sought to answer the following questions: (a) Is causal attribution or mastery motivation the “prime mover” of academic-related behaviors? (b) Is the relationship between perceptions of control or causal attributions and academic achievement best described as direct or as indirect? If the relationship is indirect, then what are the intervening variables, and what are the specific functions or links between dimensions of causality and the other self-related constructs? (c) What is the relative importance of expectation of future academic performance to actual academic achievement and what is (are) the determinant(s) of expectation?; and (d) What is the relative strength of importance of the self-related constructs and prior academic achievement on subsequent academic achievement?

The discussion of the results are addressed in three major sections. The question of the overall fit of the hypothesized model is presented first. Next, the specific relationships within the model are addressed in the sequence of the above
stated questions with their theoretical and educational implications. The third section addresses the limitations of the present study and recommendations for future research are suggested.

**Accepted Model of Adult Academic Achievement**

The original hypothesized model, with two subsequent modifications that are discussed in the next section, fits the data well. The results represented by the accepted model (see Figure 6) support a basic chain from prior academic achievement (GPA Fall) and perceived control to academic self-concept to expectation to subsequent academic achievement (GPA Winter). This pathway of effects is consistent with Weiner's (1979, 1980, 1985) model.

Interpreting this processing chain yields the following picture for college students: previous good academic achievement (Time 1) and the sense that one is aware of factors associated with such outcomes (level of understanding) leads to high perceptions of academic competence (academic self-concept) which in turn increases one's expectation for future success in academic tasks (expectation) and ultimately subsequent academic achievement (Achievement Time 2). Conversely, a lack of awareness of factors associated with prior poor academic achievement would lead to low perceptions of academic competence, decreasing one's expectation for future success, and lower subsequent academic achievement.

According to the accepted model, two variables were found to initiate a path from academic self-concept to mastery motivation and to autonomous judgment. These variables were prior academic achievement (Time 1) and level of understanding. In essence, good prior academic achievement or one's awareness of factors associated
with these outcomes lead to positive evaluations of one's academic competence which in turn leads to high intrinsic as opposed to extrinsic motivation and the preference for one's own criteria for success or failure. These two sequences replicate the results found in Harter and Connell (1984) with junior high school students. As in Harter and Connell's study, neither of these two chains lead to subsequent academic achievement. A direct path from level of understanding to autonomous judgment in the present study replicated Harter and Connell's finding of a direct path from unknown control to autonomous judgment. These paths suggest that an awareness of factors associated with one's academic outcomes leads to a preference for the acceptance of one's own criteria for success or failure.

This accepted model provides evidence to support the notion, based on traditional correlational studies, that adult self-related cognitions do play critical roles as determinants of academic achievement. However, the present investigation goes beyond traditional correlational studies by simultaneously considering relationships among all variables in the model. Such an approach may reveal relationships not suggested by the traditional correlational approach. For example, in the present study, level of understanding had an insignificant correlation with Achievement Time 2. However, the accepted model revealed that level of understanding had a significant indirect effect on subsequent academic achievement mediated by academic self-concept and expectations. The importance of level of understanding to subsequent academic achievement would not have been revealed in traditional correlational analysis.

The model also has certain advantages over Harter's Intrinsic Mastery Motivation Model and Weiner's Causal Attribution Model of Achievement. First, the accepted model provides a more comprehensive understanding of adult academic
achievement in that it includes constructs not included in either of the previous models. For example, Harter’s model does not include the expectation construct and Weiner’s model does not address motivational orientation. Yet expectation for future academic performance was found to be an important construct within the accepted model. Expectation was the only self-related cognition that had a direct impact on subsequent academic achievement. As well, expectation served as an important mediating variable from level of understanding, relative internality, previous academic achievement (Time 1), and academic self-concept to subsequent academic achievement (Time 2). Although the motivational orientation variables (mastery motivation and autonomous judgment) did not impact subsequent academic achievement, in the accepted model, these variables did have important relationships with previous academic achievement, level of understanding, and academic self-concept. Furthermore, as illustrated in the subsequent section, the accepted model clarifies some of the opposing predictions derived from Harter’s and Weiner’s models.

Specific Relationships Within the Model

The accepted model delineates specific relationships among the self-related constructs and academic achievement and clarifies inconsistencies presented by Harter’s and Weiner’s theoretical models. The present section addresses the specific questions generated by the review of the theoretical and empirical literature. First, the issue of the “prime mover” is discussed followed by the issue of the relationships between perceptions of control and academic achievement and the intervening variables. Next, the question of the relative importance of expectation within the model is addressed. Finally, the relative strength of importance of the self-related constructs and prior academic achievement on subsequent academic achievement is examined.
The "Prime Mover" of Academic-Related Behavior

A fundamental issue in explaining academic achievement and its relationships with various self-related cognitions is the identification of the single variable that initiates the process leading to achievement-related behaviors. According to Harter's model (1978, 1981b), mastery motivation is identified as the "prime mover" or initiator of the process. In Weiner's model (1979, 1980, 1985), causal attributions are identified as the "prime movers." While both suppositions are plausible, the results of the present study supported Weiner's theorizing. Several findings converge leading towards this conclusion.

The hypothesized model which placed the causal attribution variables (level of understanding and relative internality) at the beginning of the processing chain was empirically validated. However, this is not to say that a different sequential arrangement of the variables would not also be accepted on empirical grounds. Nonetheless, it is unlikely that a model with mastery motivation as the "prime mover" would fit the data given the clear lack of effects found in the present study leading from mastery motivation to any of the other variables (with the single exception of autonomous judgment). As illustrated in model 1a (see Figure 1, Appendix A, page 152), including a path from mastery motivation to academic self-concept failed to yield an acceptable model.

Two modifications to the originally hypothesized model lend further support to the conclusion that mastery motivation could not be the "prime mover" of achievement-related behaviors. First, a positive direct relationship was found from prior academic achievement (GPA Fall) to mastery motivation. This additional path suggests that the greater one's past academic achievement, the more likely one is to
prefer academic challenge, show a curiosity and interest in academic work, and strive for independent mastery. Conversely, the poorer one’s past performance, the more likely one is to prefer relatively easy assignments, to do academic work to please the instructor and achieve good grades, and depend on the instructor’s assistance for completing assignments. This finding suggests that, rather than being a “prime mover,” mastery motivation is a consequence of academic achievement.

The second and more interesting finding was the absence of a path from mastery motivation to subsequent academic achievement (GPA Winter). According to Harter’s model, an individual’s motivational orientation should predict actual achievement objectively assessed. That is, intrinsic mastery motivation was expected to lead to relatively high levels of achievement while an extrinsic orientation would lead to relatively low levels of achievement. However, according to the accepted model, a picture emerges for college students suggesting that, although high academic achievement leads to high intrinsic motivational orientation toward academic tasks, motivational orientation, in turn, does not impact subsequent achievement as measured by grade point average. A similar lack of support for Harter’s model was found in the Harter and Connell (1984) study for both elementary and junior high school students. The finding that mastery motivation failed to impact on subsequent academic achievement, as observed in both the present and Harter and Connell’s (1984) studies, may be explained with different post hoc reasons.

In the Harter and Connell (1984) study, students’ academic achievement was measured a year prior to measuring mastery motivation. However, it is important to note that Harter’s model refers to causal priority of mastery motivation over the course of development rather than within particular achievement situations. Thus, one can
argue that it is hardly surprising that in their study, mastery motivation did not lead to academic achievement. The appropriate temporal sequence between mastery motivation and academic achievement which might have led to the hypothesized causal relationship was not built into the Harter and Connell study.

To amend this problem, academic achievement was assessed on two occasions in the present study: once approximately six weeks prior to, and the second, approximately six weeks after assessing mastery motivation. The lack of an observed effect despite the appropriate temporal sequence may suggest that the actual length of the time lag between these concepts may be a critical parameter. It is quite possible that six weeks is not a sufficient time period for this causal relationship to emerge.

Alternatively, the problem may be related to the actual measure of achievement. Perhaps, as predicted, mastery motivation does lead to academic achievement but only if achievement is measured in some way other than grade point average or standardized achievement tests. For example, an intrinsic orientation may lead to some form of qualitative or "creative" measure of achievement not reflected in grades. In any case, future research will need to address both the temporal nature of this predicted relationship and measures of academic achievement other than grade point average or standardized achievement tests.

Lastly, perhaps mastery motivation is more directly related to strategy use and degree of task involvement than academic achievement per se. Support for such a notion comes from a recent correlational study which examined relationships among motivational orientation, self-regulated learning, and academic performance of seventh grade children (Pintrich & DeGroot, 1990). In that study, those students who preferred challenging work and believed that their school work was interesting and
important used more cognitive strategies such as rehearsal, elaboration, and organization in trying to learn and comprehend the material. These students also engaged in more self-regulatory behaviors of a metacognitive (i.e., planning, skimming, and comprehension monitoring) and effort management nature (i.e., persistence and diligent work). Similar to the present study, intrinsic motivation was not found to relate to student performance. Rather, intrinsic motivation was found to be an important component of students' "choice" about becoming cognitively engaged in their classroom academic work.

Despite the lack of a direct link from mastery motivation to subsequent academic achievement in these studies, the results of Pintrich and DeGroot (1990) with children suggest that students' intrinsic motivation to learn is an important component to be considered in models of how students come to use different cognitive strategies and become self-regulating learners. This hypothesized relationship between mastery motivation and the use of cognitive strategies was not addressed in the present study and would be a fruitful direction for future research in the area of self-related cognitions and academic achievement with adults.

The issue of the "prime mover" has important implications. In the present study, level of understanding, a measure of causal attribution, was found to be the "prime mover" of achievement-related behaviors. The implication for educational practice is that it is important to increase students' awareness of the factors associated with their academic successes or failures. Such awareness on the students' part may lead to increased perceptions of competence, higher expectations for future academic performance, and ultimately higher actual achievement. In the case of past failures, such awareness of contributing factors may lead to the student implementing the relevant instrumental actions deemed necessary for subsequent success.
With regard to mastery motivation, although the data were not conclusive, the implication for educational practice is that it is important to foster students’ intrinsic motivation for academic work not because it will necessarily lead to higher grades or scores on academic assignments or standardized achievement tests directly, but because it may lead to more strategy use and self-regulated behaviors in the day-to-day work of the classroom.

**Perceptions of Control and Academic Achievement**

Another issue from the extant theory and research (Harter & Connell, 1984; Weiner, 1979, 1980, 1985) concerns the specification of the actual relationship of causal attributions or perceptions of control with academic achievement. Two aspects of this issue need to be addressed. First, are the effects of causal attributions on academic achievement direct or indirect? Second, if the effects are indirect, then what are the self-related cognitions that mediate the relationship between perceptions of control and academic achievement? Each of these questions will be discussed in turn in relation to the findings of the present study.

**Are the Effects Direct or Indirect?** Harter and Connell’s (1984) study with children found a direct effect of one of their measures of perceptions of control (level of understanding) on academic achievement. They concluded that level of understanding about the causes of success/failure in school “is most directly related to academic achievement” (p. 240). This finding is diametrically opposed to Weiner’s (1979, 1980, 1985) theoretical contention that causal attributions have only indirect effects on academic achievement. The results of the present study support Weiner’s theory. In the accepted model, both measures of perceptions of control--level of
understanding and relative internality--were found to have only indirect effects on academic achievement. Thus, for adult college students, perceptions of control did not influence academic achievement directly. These results are consistent with previous research with college students utilizing structural equation modeling techniques (Platt, 1988). Platt also found only indirect effects of causal attributions (ability, task ease, luck, and effort) on academic achievement (GPA).

One interpretation for the discrepancy between Harter and Connell's (1984) findings and those of Platt (1988) and the present study may be explained in terms of a developmental shift. Harter and Connell's (1984) subjects were elementary and junior high school students while the subjects in the latter two studies were college-level students. The model for adults assessed in the present study reflects an increase in the complexity of the interrelationships among the relevant constructs. Rather than having a simple direct effect from level of understanding to academic achievement, as found in Harter and Connell's models, level of understanding, in the present model had both direct links to academic self-concept and autonomous judgment and indirect links to mastery motivation, expectation, and subsequent academic achievement. This pattern of results suggests that adults may have more intertwined relationships among their thoughts, feelings, and behaviors than children. Adults are more psychologically complex than either elementary or junior high school age students. Such greater cognitive complexity would result in an increased number of paths among the variables in the model for adults. In support of such a developmental interpretation, Harter and Connell found a trend toward a pattern of greater complexity among the self-related cognitions and academic achievement from elementary to junior high school students.
A second explanation relates to the fact that expectation was not included in the network of variables assessed by Harter and Connell (1984). As Harter and Connell indicated, any good-fitting model can only maximize the functional relationship among the particular variables included. The addition of a new variable would therefore alter the pattern of relationships. Had expectation been included in Harter and Connell's study, causal attributions may not have had a direct impact on academic achievement, but rather only an indirect one via expectation, as observed in the present study. Platt's (1988) study lends support for this explanation. Platt's model included an expectancy construct similar to that used in the present study and found that the causal attribution "ability" impacted GPA indirectly through expectancy.

*What are the Intervening Variables?* In the Causal Attribution Theory (Weiner, 1979, 1980, 1985), the effects of causal attributions on academic achievement are postulated to be mediated by such intervening constructs as academic self-concept, expectations, and motivational indicators. The specific links between causal attributions and the mediating variables are believed to be a function of the causal dimensions of the attribution: locus (internal/external), stability (stable/unstable), and controllability (controllable/uncontrollable). Students' attributions of achievement-related outcomes to the locus dimension are expected to influence academic self-concept (Weiner et al., 1978, 1979). Attritions to relatively stable factors are expected to influence students' future achievement expectations (Feather & Simon, 1971; McMahan, 1973; Weiner, Nierenberg & Goldstein, 1976). Although there is considerable experimental support for the locus-affect and stability-expectation links, the possible linkages of the controllability dimension of attributions are less well
understood. However, evidence suggests that it may be an important influencing factor in both expectancy and affective reactions (Forsyth & McMillan, 1981).

Based on the above predictions, in the present model, it was hypothesized that "relative internality" (locus dimension) would link to academic self-concept. Given that the causal dimension of "level of understanding" was unknown, it was hypothesized to link to both expectations and academic self-concept. Level of understanding was also expected to link to autonomous judgment as it was found to do so in the Harter and Connell (1984) study for the junior high school students. These hypotheses were only partially supported by the results of the present investigation.

Contrary to predictions, "relative internality" (locus dimension) was found to link directly to expectation and not to academic self-concept. That is, the more internal one's perceived locus of control, the greater one's expectation for future academic performance. This finding stands in contrast to attributional theory and a wide range of research which suggest that the stability of causal attributions and not locus links to expectancy shifts (e.g., McEahan, 1973; Weiner, et al., 1976).

These discrepant findings may be due to a possible confounding of the locus and stability dimensions in the present study. It is also possible that irrespective of the specific internal attribution (ability or effort) subjects may perceive that their internal locus of control is also a stable characteristic. The items used to measure relative internality were not designed to differentiate between stability and locus dimensions, as there was no attempt to assess specific attributions such as ability, effort, or mood. Assessing specific aspects of attributions would have permitted the differentiation of the stability and locus dimensions (i.e., ability being both stable and internal with mood being unstable and internal). Future research will need to be more clear to
differentiate these dimensions when examining their direct outcomes on academic achievement and intervening variables.

In the present study, level of understanding was found to link directly to academic self-concept and autonomous judgment. However, it did not directly impact expectations. It is difficult to interpret these results in terms of the causal dimension underlying level of understanding. Since level of understanding did not link to expectation, it most likely did not represent the stability dimension, which is expected to link to expectation. Should level of understanding represent the controllability dimension, then the results suggest that controllability links to such affective reactions as academic self-concept and such motivational indicators as autonomous judgment, but not to expectations. However, these findings are contrary to those of Forsyth and McMillan (1981) who found that the controllability dimension linked to expectations and affective reactions other than self-concept or pride. Based on the Causal Attribution Theory (Weiner, 1979, 1980, 1985), the locus dimension is expected to link to academic self-concept. Thus, it seems most probable that level of understanding may reflect an internal locus of control. Nonetheless, the pattern of findings suggests that one’s sense of amount of “knowing” what causes one’s academic successes or failures directly impacts one’s perceptions of academic competence and one’s sense of autonomous judgment over academic situations.

Level of understanding was also found to influence motivational orientation indirectly through academic self-concept. Thus, if one understands why one succeeds or fails, feels competent, and is intrinsically motivated, one feels capable of making independent judgments. Failing to have such positive self-perceptions, one prefers, for example, to let the instructor make decisions in academic situations.
Level of understanding impacted academic achievement via academic self-concept to expectation. This sequence suggests that the more one claims to know about what controls one's successes or failures in the academic domain, the higher one's perceptions of academic self-concept which in turn increase one's expectation for future performance. This then leads to higher levels of achievement. More generally, the student who says "I feel academically competent because I know what causes my successes/failures on school tasks and I expect to do well in the future" actually outperforms the student who says "I don't know what causes my successes/failures so I must be stupid and therefore I do not expect to do well."

The finding that both academic self-concept and expectation are intervening variables between causal attributions and subsequent academic achievement has practical implications for professionals in post-secondary education. When students begin to explain things internally to themselves and begin to know more about the variables affecting their successes and failures, they begin to feel more academically competent, have higher expectations of themselves in future academic situations, and ultimately increase their actual academic performance. Thus, academic intervention programs should focus not only on increasing students' internal causal attributions after success but also on identifying the factors which account for one's successes and failures. Programs should also include aspects which foster an increased perception of academic competence. Perceptions of control and competence together seem to serve as precursors to positive expectations for future academic performance. The importance of such expectations is the topic of the next section.
The Importance of Expectation as an Intervening Variable

One important finding of the present study concerns the importance of a student's expectation for future academic performance. Although Harter speaks to the role of expectation as a factor leading to academic achievement, this variable was not included in the empirical test of her model (Harter & Connell, 1984). One's expectation for future academic performance is postulated as a critical determinant of academic achievement by attributional theorists (e.g., Stipek & Hoffman, 1980; Weiner, 1979, 1980, 1985), effort calculation theorists (e.g., Holahan & Kelly, 1978; Kukla, 1972; Motowidlo, 1981), and process oriented theorists (e.g., Bandura, 1977). For example, Weiner assigns considerable weight to expectation as a mediator between casual attributions and academic achievement.

The results of the present study lend support to the importance of expectation in a model of adults' academic achievement. First, expectation was the only self-related construct that directly impacted academic achievement. This finding is consistent with many empirical studies which have also found such a linear relationship between expectation and subsequent academic achievement (Bernstein, Stephen, & Davis, 1979; Holen & Newhouse, 1976; Keefer, 1969; Kimball & Gray, 1982; Kovenklioglu & Greenhaus, 1978; Malloch & Michael, 1981; Morrison, Thomas, & Weaver, 1973; Vollmer, 1984, 1986). Second, as predicted by Weiner, expectation served as a key mediating variable between the two causal attribution variables and academic achievement. Third, expectation served as a mediating variable between academic self-concept and academic achievement. The inclusion of expectation in the present study is clearly an improvement over the model presented by Harter and Connell (1984) in which an expectation variable was not included.
Researchers differ in their explanations of the determinants of expectation. According to attributional theorists, expectations depend on the stability dimension of the perceived causes of past performance outcomes together with the amount of personal control one can exercise in the situation (Weiner, 1979, 1980, 1985). According to effort calculation theorists (e.g., Holahan & Kelly, 1978; Kukla, 1972; Motowidlo, 1981), expectation on achievement-related tasks is determined by three variables: (1) task difficulty, (2) intended effort expenditures or past effort expenditures, and (3) perceived ability. Within the accepted model of the present study, expectation was derived from the perceptions of the causes of past performance (level of understanding and relative internality) and from the perceptions of academic competence, supporting both the attributional and effort calculation theorists.

There is considerable evidence that individuals' expectation for success at tasks affect their behavior in the task situations (Bandura, 1977; Battle, 1965; Crandall, Katkovsky, & Preston, 1962; Diggory, 1966). It is difficult to motivate oneself to persist at a task for which failure is believed to be inevitable. Without the positive expectation of achieving the goal, one would fail to engage in the appropriate strategy use. In other words, it is expectation which controls strategy use (Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989). At times, low expectation is unwarranted and students exert little effort or give up easily on a task which they are in fact capable of performing. Thus, performance expectation has important educational implications. However, because of the highly interrelated relationships of expectation with the other self-related constructs in the model, the implications of expectation will be discussed in the context of the other variables.
In general, the pattern of results presented in the accepted model (see Figure 6) suggests that adult students who feel that they are in personal control (relative internality) of their academic successes/failures expect to perform better academically (expectation) and actually do so (GPA Winter) than those who feel that powerful others control their academic outcomes. At the same time, those students who claim to know and control (level of understanding) what causes their successes/failures judge themselves to be more academically competent (academic self-concept) and thereby expect to do better in the future (expectation) than those who feel they do not know and do not control what causes their academic outcomes. Thus, both measures of perceptions of control (i.e., relative internality and level of understanding) lead to expectation, one more directly than the other.

The specific aspects of the model described here suggest an important practical message. According to the present model, college students' inferences regarding the reasons for their past successes/failures can influence their feelings about themselves as students, more specifically, their confidence or expectation for future performance -- factors that ultimately affect their performance as students. For example, an undesirable state of affairs would be a student who exclusively attributes success to a good instructor or failure to a bad instructor. Such a student would likely expect future successful performance only if he/she could find a "good instructor" and would likely expect not to do well in a course if he/she perceived the instructor to be "poor." Unfortunately, the direct path from expectation to subsequent academic achievement in the accepted model suggests that the student's expectation directly influences actual academic performance. It would seem that independent consideration of students' attributions of control is warranted. Further research is needed to develop effective
intervention strategies that can help students learn a healthy pattern of attributions for past success/failure. For example, as Forsyth and McMillan (1981) suggested, encouraging students to associate failure with factors that can be controlled may serve to avoid the debilitating consequences of failure. As well, fostering internal and controllable attributions may lead to more personally satisfying educational experiences and greater expectation for future academic performance.

**Importance of Prior Academic Achievement**

Although prior academic achievement was not included in the present model for the purpose of examining different aspects of Harter's and Weiner's models, this variable was found to have the largest total effect on subsequent academic achievement, expectation, mastery motivation, and academic self-concept.

It has been known that academic achievement is a relatively stable person characteristic (see Bloom, 1964; Byrne, 1986; Holen & Newhouse, 1976; Malloch & Michael, 1981; Maruyama, Rubin, & Kingsbury, 1981; Meece, Wigfield, & Eccles, 1990; Norwich, 1987; Vollmer, 1986). Moreover, various researchers (e.g., Bachman & O'Malley, 1977; Bereiter & Englemann, 1966; Calsyn & Kenny, 1977) have suggested that one's actual academic achievement has causal priority over self-related cognitions (e.g., self-esteem, perceptions of academic competence). Consistent with these notions, it is not surprising that the present study found such results. The significant contribution of the present study to this research is that it answers the question of how students achieve. Thus, notwithstanding the large magnitude of effects of prior academic achievement, the self-related constructs examined in the present study contribute to a more complete understanding of adult academic achievement. In
addition to the large direct effect of previous performance on subsequent grades, previous performance also had significant indirect effects mediated through students' academic self-concept and performance expectation.

The finding that previous academic achievement had the greatest impact on subsequent academic achievement implies that by increasing the adult student's current academic achievement, his/her future academic performance might be improved. However, the question still remains as to how one is to increase actual academic performance. The present findings suggest that self-related cognitions may play a significant role in increasing the adult student's current academic achievement. The finding that attributions of control, as measured by level of understanding and relative internality, do not directly impact academic achievement but do so indirectly through academic self-concept and expectation attests to the importance of incorporating not only measures of attributions but also perceptions of competence and expectation in models of adult academic achievement. This would also be true of programs designed to improve adult learning. Each of these self-related cognitions plays an important role in the total picture of adult academic achievement. Basically, of the self-related cognitions, expectation is the only variable which directly impacts actual achievement. However, the means by which one may increase expectation is through attributions of control and perceptions of competence.

In general, several aspects of the present study that represent certain advantages over the previous research were identified. First, the present study extends previous research by utilizing structural equation modeling techniques which consider relationships among all the variables in the model simultaneously. Second, by incorporating motivational orientation and expectation, the present study provides a
more comprehensive understanding of adult academic achievement than either Harter's Intrinsic Mastery Motivation Model or Weiner's Causal Attribution Model of Achievement. Furthermore, this study contributes to the current literature on models of adults' academic achievement in two ways. First, the results provide evidence to support the notion that adult self-related cognitions do play a critical role as determinants of academic achievement. Second, the study delineates specific direct and indirect relations among the self-related constructs and academic achievement and clarifies inconsistencies presented by Harter's and Weiner's theoretical models of achievement. In essence, the results of the present study contribute to the continuous process of refining a theory of adult academic achievement. Indeed, in a special issue of Journal of Educational Psychology. devoted to the topic of motivation and efficacy in education research, Schunk (1990) called for research that integrates constructs and findings to clarify relationships among self variables and academic achievement and to test opposing predictions from relevant theories. I believe that the present investigation exemplifies the potential fruitfulness of the research strategy recommended by Schunk.

Limitations of the Present Study and Recommendations for Future Research

Notwithstanding the positive aspects and the contributions of the present study to the existing literature, there are a number of limitations and cautionary notes that need to be addressed. Several useful directions for future research will also be considered in this section. With regard to the limitations of this investigation and recommendations for future research in the area of self-related cognitions and academic achievement, Harter and Connell (1984) suggested three directions: (a) the problem
with causal inferences and the need for longitudinal design; (b) the addition of other variables to the network; and (c) modeling attempts with other populations and in other domains. The discussion in the present section will follow this framework.

Use of Causal Inferences/Longitudinal Design. According to Harter and Connell, one of the problematic aspects of some causal modeling studies is the "static" nature of the measurement of the variables. Similarly, in the present study, the self-related cognitions were assessed at one point in time. Structural modeling procedures, such as the one employed here, are referred to as causal modeling techniques. This term may be a misnomer. The accepted model portrays a sequence of events, albeit unobservable, which is tested for its fit to a set of data which was collected essentially at three points in time (Time 1 - GPA Fall; Time 2 - self-related cognitions; Time 3 - GPA Winter). Although this represents a longitudinal design, it should be emphasized that the self-related cognitions data are "static" or collected at only one point in time.

The present description of the data reveals a postulated process model in which particular variables influence others in the network. However, the design is limited in its ability to directly test the causal or temporal aspects of the model as they relate to the self-related cognitions. Nonetheless, if the process model is correct, these static data can be expected to reflect this fact. The logic for this claim is as follows: If, at a given point in time, we were to measure adults on these constructs and if each of the adults had followed the paths in the model in terms of both the sequence and probabilistic statements included, the pattern of correlations among the constructs assessed at one point in time across different individuals should be adequately accounted for by the specified model.
At best, the accepted model represents a hypothesized chain of effects which must be tested using longitudinal procedures over an actual time frame. For example, the model gives considerable weight to cognitive attributions involving the adult's awareness of factors associated with academic outcomes. The model implies that these attributions are causally prior to perceptions of competence and expectation for future performance.

This inference in turn suggests that efforts to improve a learner's understanding of the events that control his or her successes may enhance perceptions of competence, expectation for future academic performance, and ultimately, actual achievement. However, given the static nature of the self-related measures, the present study cannot definitively attest to the validity of such an inference. We have yet to demonstrate that efforts to improve awareness of factors at Time 1 causally influence other related constructs at Time 2. Moreover, the temporal interval between self-related constructs at Time 1 and those at Time 2 must also be taken into account. The direct influence of one variable upon another may have a different time course, depending upon the particular variables in question (Harter & Connell, 1984). Thus, increasing an adult's competence evaluation may have a rather immediate impact on his/her expectation. However, the effect of an increase in competence evaluation on intrinsic mastery motivation may require a longer time course. The accepted model generates several interesting hypotheses which must, however, be tested longitudinally in order to demonstrate true causal primacy. In summary, although structural modeling does not provide a sufficient basis for inferring causation (cf. Baumrind, 1983), it does allow one to speak of the plausibility of a particular causal chain of events.
Use of Experimental Design. While Harter and Connell highlight the value of longitudinal designs in contributing to the literature, the use of experimental designs is no less important. Thus, the causal relationships among the relevant constructs observed in the accepted model must be confirmed or supported with experimental research designs. For example, once a plausible relationship has been established between perceptions of causal attribution and expectation, an experiment could be designed in which the specific causal attribution variable is manipulated and its causal effect on expectation for future performance determined. Only through the use of experimental designs, i.e., random assignment to groups with experimental manipulation of relevant variables, can causal relationships be established.

Addition of Variables to the Network. As Harter and Connell (1984) pointed out, the best-fitting model in any analysis can only maximize the functional relationships among the specific variables included in the network. The addition of a new variable may change the pattern of relationships. A promising variable, not included in the present model, which several researchers (e.g., Ames & Archer, 1988; Meece, Blumenfeld, & Hoyle, 1988; Pokay & Blumenfeld, 1990; Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989) have recently identified as an important mediating variable between motivation, expectations for future academic performance, and subsequent academic achievement, is strategy use. For example, future modeling efforts may include strategy use (e.g., rehearsal, elaboration, and organization) assessed through structured interviews (e.g., Zimmerman & Pons, 1986). As previously discussed, the finding in the present study that mastery motivation has no impact on subsequent achievement may simply reflect the importance of including strategy use within the model of adult academic achievement. Evidence exists to suggest that
mastery motivation may be related to strategy use which in turn may influence academic achievement (Pintrich & DeGroot, 1990).

Other variables that may be considered in future modeling attempts include such self-regulation variables as metacognition (e.g., planning, skimming, and comprehension monitoring) and effort management (e.g., persistence and working diligently). In a recent review and theoretical paper, McCombs (1986) advocated the need for causal models of learning which integrate self-system and self-regulation variables. Even good strategy users may not engage in strategy use. Self-system variables (e.g., motivational orientation, expectations, and perceptions of competence) may be critical determinants of effective strategy use and self-regulatory behaviors which may then ultimately influence academic achievement. How the existing pattern of relationships might change as a function of these additions would be an interesting empirical question with theoretical and educational implications.

Cross-Validation with other Populations and across Domains. As suggested by Harter and Connell (1984) for their model, another useful direction for future research would be the cross-validation of the present model with other populations. For example, one may look at special groups of adult learners such as students with "probationary status," who are encountering difficulties with their studies, advanced undergraduate students, or graduate students, in order to determine whether the relationships among the major constructs of interest are different across these groups.

Another emerging population of interest may be senior citizen students (i.e., over 65 years of age). Studies of this population assume that these students are studying mainly for the sake of acquiring new knowledge. With this population's greater intrinsic motivation, different patterns of results may emerge.
Lastly, the relationships described in the model in the present study are specific to the academic domain and cannot necessarily be extrapolated to other domains (e.g., interpersonal, occupational, social, and physical). The relationships among the self-related cognitions and achievement found here can be tested in different domains.

Assessment of Academic Achievement. One final cautionary note, not discussed by Harter and Connell but considered of primary importance, concerns the assessment of academic achievement. The measure of achievement used in the present study, discussed previously, may be problematic. Grade point average is only one of various measures of academic achievement, all of which may be used with equal validity. The relationships of self-related cognitions to other measures of academic achievement need to be explored. For example, while mastery motivation was not found to influence grade point average in the present study, it may impact other measures of achievement. Future assessments of the validity of the model should include multiple measures of achievement. This would allow for an examination of different components of achievement and their relationship to the self-related cognitions as proposed in the present model.

Summary

In summary, the results provide empirical evidence for the importance of considering self-related cognitions in models of academic achievement. Adult students' perceptions of control and competence are closely tied to their expectation for future academic performance and to their motivational orientation toward academic tasks. At the same time, these motivational beliefs, perceptions of competence, and perceptions of control are not sufficient for successful academic performance. Expectation seems
to be more directly implicated in performance. Thus, we need to integrate all of these concepts into our models of classroom learning.

In addition, there are other factors which may affect student academic performance. For example, students' strategy use may relate to student academic performance and potentially interact with self-related cognitions. Thus, we need to integrate such components into our models as well. More specifically, we need to examine the effects that motivational orientation, expectations, and strategy use have on each other in addition to their combined effects on achievement.

Structural equation modeling techniques as used in the present study are promising tools for theory construction and hypothesis testing. At the same time, we must keep in mind their limitations for making statements of causal inference. Longitudinal designs need to be considered and hypotheses must ultimately be tested using experimental methodologies.
References


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Appendix A

Review of the Literature
The following review is intended to point out the significance of self-related cognitions for adult academic achievement. Basically, the review aims to show that the role of the self-system in self-regulated learning is that of establishing and maintaining positive self-evaluations throughout the learning activity, thereby contributing to the motivation to engage in self-regulated learning strategies. The review includes the following sections. First, a review of selected theoretical positions on "the self" or "self-system" is presented which focuses on the general implications of these positions for the study of the relationships between self-related cognitions and cognitive activities. Next, a review of selected self-regulation theories will be considered with particular emphasis on the implications of the importance of self-related cognitions to self-regulated learning. The subsequent section will address developmental issues related to the self-system and self-regulated learning processes with the specific intent to highlight the need for further research in this area with adult populations. Next, four general classes of self-related constructs will be reviewed. Three of these constructs -- perceptions of competence, perceptions of control and intrinsic versus extrinsic motivational orientation -- emerged from Harter's (1978) model of the development of efficacy motivation. The fourth construct, expectations, emerged from attributional theory (i.e., Stipek & Hoffman, 1980; Weiner, 1979), effort calculation theory (i.e., Kukla, 1972; Motowidlo, 1981), and "process approaches" to learning (i.e., Bandura, 1977). The final section includes a presentation of four alternative structural models which are hypothesized to account for the observed relationships between self-related constructs and academic achievement. This section reviews Harter and Connell's (1984) study, which compares the four models using structural equation modeling techniques to determine which model best accounts for the observed data for elementary and junior high school students.
Self-System Theories

The self-system includes both cognitive and affective components and processes. Self-system constructs are thoughts, beliefs, attitudes, feelings, and theories one holds about the self. Self-system variables are both structural and functional in nature. From a structural standpoint, the self is described as a compound set of multifaceted, hierarchically organized cognitive structures or schemata. Positive and central traits or attributes are found at the core, linked to pertinent subschemata. Less positive characteristics are represented in the periphery (Connell & Ryan, 1984; Harter, 1986; Rogers, Kuiper, & Kirker, 1977). Over time, there is a gradually higher order integration of the multiple systems of self-identification. At the same time, the basic self-system processes are coordinated and integrated into the self-system structures (Connell & Ryan, 1984).

Self-system theorists describe the self-structure as the largest and most available structure or set of structures in memory (i.e., Markus & Sentis, 1982) and as the central and first structure through which all information flows (McCombs, 1986). Within this self-structure, the self can be viewed as both the subject and object of experience (Kinch & Falk, 1983; Lewis & Brooks, 1978) or cognitive construction (Harter, 1983; Harter & Connell, 1984). As the subject of experience the self is the causal agent. As object, we focus on how we perceive ourselves, our knowledge and feelings about ourselves (e.g., self-percepts). These self-related constructs or self-percepts are believed to be both global and domain specific (i.e., academic, social, and physical) (Byrne, 1984, 1986; Fleming & Courtney, 1984; Harter, 1983; Marsh, 1986).

From a functional standpoint, self-related constructs have been shown to exert considerable influence on attention, organization, and categorization of information,
recall, and judgments about others (Eccles, 1983; Maehr, 1985; Marsh, Parker, & Barnes, 1985; Paris & Cross, 1983; Pervin, 1985; Rogers et al., 1977; Shavelson & Bolus, 1982). The self is viewed as an extremely active and powerful agent in the construction of our reality and in helping us process personal data. In Bandura's (1977) self-efficacy theory, the self not only processes but also weighs and integrates a variety of information about one's capabilities and regulates choice behavior and effort expenditure accordingly. Each of these views of the self-system points to the role of self-perceives as cognitive mediators of performance.

In a similar vein, a number of functional processes operative in the self-system have been identified. The processes believed to be important to self-regulated learning arc: self-observation, self-evaluation and self-reward (Bandura, 1977, 1982b; Harter, 1982a). With regard to these processes, self-system theorists have postulated the self-serving bias. Simply stated, this self-serving bias refers to the functional role of self-system processes in establishing and maintaining a positive self-image and sense of self-worth. The self-serving bias is viewed as an inherent need to enhance and protect self-esteem (e.g., Harter, 1986; Mineka & Hendersen, 1985; Marsh, Cairns, Relich, Barnes, & DeBus, 1984; Tesser & Campbell, 1987), thereby serving to enhance motivation to participate in an activity. Once again, we see the mediating role of self-related cognitions.

In summary, the self can be seen as playing an active role in constructing, interpreting, selecting, and encoding information about ourselves and about reality. The self-referent nature of our information processing points to the "filtering" role of self-views and self-beliefs in cognitive activities. Thus, self-system structures and processes moderate our perceptions, expectations, judgments, self-statements, and other
cognitions (McCombs, 1986). The self-serving bias serves to enhance motivational level throughout the learning activity.

**Self-Regulated Learning Theories**

According to self-regulation theorists (e.g., Harter, 1982a; Scheier & Carver, 1983; McCombs, 1986), learning occurs in the following pattern. First, we compare what we bring to a task (perceptions of our skill and knowledge competencies) with what is required (standards or goals). Next we judge whether there are discrepancies between what we bring and what is required. Based on this information, we then make decisions about whether or not to engage in an activity and the degree of effort we will exert. Self-focus is believed "to engage a feedback loop which is the basic unit of cybernetic control" (McCombs, 1986, p. 320).

Thus, one can readily see that the foundation of self-regulation is self-awareness (Brown, Bransford, Ferrara, & Campione, 1983; Scheier & Carver, 1983). Here too, the mediating role of self-related cognitions is evident. As effective learners become aware of the functional relations between their patterns of thought and action (e.g., strategies) and their subsequent successes, their self-related perceptions of competence pertaining to academic achievement increase and they are more likely to engage in such activity in the future.

In addition, self-regulation theorists (e.g., McCombs, 1984, 1986; Schunk, 1984b; Stipek & Weisz, 1981) maintain that one's sense of personal control (a belief that one can exercise the personal control necessary for self-regulation) is a prerequisite for the ability to self-regulate events. Once again these positive self-perceptions are assumed to serve as the motivational basis for self-regulation during learning. Self-
percepts are assumed to affect students' decisions to use known self-regulated learning strategies (Zimmerman & Martinez-Pons, 1988), which in turn lead to academic achievement. Thus, both a self-focus and a positive self-identity are necessary and critical characteristics of the self-regulated learner. Each of the above theoretical notions points to the critical role of self-related cognitions as mediators of performance and persistence within the learning enterprise.

Within the academic domain, empirical literature also points to the importance of self-related constructs to achievement and self-regulated learning (see Bar-Tal & Bar-Zohar, 1977; Battle, 1965; Byrne, 1986; Findley & Cooper, 1983, Marsh, 1984; Marsh, Byrne, & Shavelson, 1988; Maruyama, Rubin, & Kingsbury, 1981; Schunk, 1984a, b). Academic self-percepts are beliefs or attitudes one maintains about the self in the context of the learning situation, for example, perceptions of one's academic competence, one's sense of personal control over one's own successes or failures, and expectations for success or failure in a given situation. Thus, we see a consensus among both self-regulation theorists and self-system researchers (see Bandura, 1982a, b; Duda, 1987; Harter, 1982a) that self-percepts are the critical mediators of performance and persistence. Further, the role of the self-evaluation process, (i.e., the process by which we examine our self-percepts and abilities), particularly as it relates to our judgments of personal control and competence, has been implicated as a crucial process operative in the self-system.

There is an apparent overlap between self-system processes and self-regulated learning processes. The research on metacognition bears considerable relevance to an understanding of the relationships between self-regulated learning processes and self-system processes. Metacognition may be defined as one's knowledge about cognition
and the self-regulation of one's thinking. McCombs (1984) maintains that metacognitive knowledge and skills provide the basic structures for the development of positive self-control and self-regulation. Brown and her colleagues (Brown, Bransford, Ferrara, & Campione, 1983) claim that self-awareness is the basis of self-regulation. The ability to employ metacognitive processes of self-monitoring, self-evaluation, and self-reinforcement requires a well-developed and stable self-identity in both a global and domain specific sense. Without this self-identity, self-awareness is missing (McCombs, 1986). Thus, the development of self-system structures and processes is a necessary prerequisite to the development of metacognitive capabilities which, in turn, are necessary to the development of self-regulation. In addition, the self is the active agent involved in coordinating the entire set of processes (metacognitive, cognitive, and affective) important to self-regulated learning.

In summary, the role of the self-system in self-regulated learning is that of establishing and maintaining positive self-evaluations throughout the learning activity. The positive self-evaluations then contribute to the motivation to utilize necessary self-regulated learning processes and activities. Without these positive self-percepts students would lack the motivation to acquire and use self-regulating learning processes that permit them to assume responsibility for their own learning.

*Developmental Issues of the Self-System's Role in Learning*

The intent of this section is to highlight the need for research within the self-system with an adult population. Assuming responsibility for one's own learning is of particular relevance to adult learners. Hiemstra (1980) suggests that adult learning is most effective when it is self-initiated and when the adult is an active participant in the learning process.
It has become apparent that within the realm of developmental psychology our approach has been relatively narrow in that we have given little attention to the study of the differential relationships between self-related cognitions and academic achievement as a function of development (Eccles Parsons, Midgley, & Adler, 1984). Little is known about the developmental course of a number of self-related constructs (Harter, 1978). We know very little about how self-system hierarchies may change with age. Little is known about how motivational and other self-percepts interact with each other in determining academic achievement of students as a function of age.

Developmental theorists (i.e., Harter, 1978) suggest that our self-system filters change with biological development, experience, and increased knowledge. As we develop and more complex cognitive structures and knowledge bases are established, the self-system plays an increasingly active and powerful role in monitoring and regulating all mental, emotional, and physical activity (McCombs, 1986).

One's judgments about the self are believed to be both global and domain specific (i.e., academic, social, and physical) (Byrne, 1984, 1986; Fleming & Courtney, 1984; Harter, 1983; Marsh, 1986; Marsh, Byrne, & Shavelson, 1988). This is of particular relevance from a developmental perspective. With age, specific facets or domains of self-concept become more and more differentiated (Shavelson, Hubner, & Stanton, 1976). Harter (1986) found the following five self-domains to be relevant in preadolescent and adolescent learners: scholastic competence, athletic competence, social competence, physical competence, and behavioral/conduct. In Harter's work with adults (see Neeman, 1986; Neeman & Harter, 1986), twelve self-domains and a global self-worth measure have been found to be relevant for college student learners. They are as follows: creativity, intellectual ability, scholastic competence, job
competence, athletic competence, appearance, romantic relationships, social
acceptance, class friendships, parent relationships, humor, and morality. Global self-
esteem or self-worth is operationalized and measured as the discrepancy between
domain-specific judgments and attitudes about the importance of success in each
domain. According to Harter (1983), a sense of global self-esteem does not emerge
until about the mental age of 8 years.

Self-regulation theorists point to the developmental nature of the self-regulation
processes, and the interdependence between the development of self-system and self-
regulation processes. For example, Connell and Ryan (1984) addressed the role of the
self-system in the development of self-regulation. They contend that for self-regulation
to occur, students must internalize or transform regulation by external sources into
regulation by internal forces. This internalization involves the process of assuming
regulation of behavior as one’s own, which receives its impetus from one’s needs for
competence and self-determination.

The following is the developmental progression of internalization. Initially, the
child’s regulation is extrinsic. He or she acts in response to the controls imposed by
others. During the introjected stage, the regulators are approving and disapproving
“voices in the child’s head.” During the identification stage, young adults act in
accordance with their own values and goals, and see themselves as a locus of causality.
The final stage of integration is not reached until mature adulthood. During this stage,
the adult synthesizes his or her multiple self-identities and is able to take part in a
reciprocal coordination and integration of fundamental self-system processes.
According to this view, then, self-regulation develops with the development of the self-
with the internalization of selected external standards and the development of self-
control and competence. Zimmerman's (1985) discussion of the development of self-regulation and self-efficacy is similar to this position. This development is said to be a gradual process of internalizing self-regulation, knowledge, and skills through observation, direct teaching, and feedback from others.

Considering the interdependent developmental nature of both self-system and self-regulation processes, it is probable that differential relationships may exist between self-system constructs and academic achievement at various ages (i.e., childhood, adolescence, and adulthood). For example, it has been suggested (Cross & Jones, 1972; Morstain & Smart, 1977) that it is critical to develop a better understanding of the characteristics, interests, views, and motivation of adult learners as they differ from children, if we are to serve them with success.

Adults are not "veteran children." They differ from children in numerous ways that affect their learning and performance. Adults have different body characteristics, different attitudes, beliefs, interests, motivations, and self-percepts. Thus, if we are to help adults learn we must be cognizant of these differences and adjust the task and the teaching accordingly.

Edward L. Thorndike's (Thorndike, Bregman, Tilton, & Woodyard, 1928) work was the first scientific study of adult learning. Thorndike found that his older students were not as fast as the younger students. He incorrectly interpreted his findings to mean that the ability to learn decreases with age.

However, research evidence is accumulating that shows that the basic ability to learn changes very little with age.

merely growing older does little to change his ability to learn or think. Growing older does bring different values, goals, responsibilities, and self-images (Zahn, 1967, p.69).
Perhaps such self-related cognitions together with slower speed of performance account for any decline in performance.

Consider, for example, the roles of perceived competence and expectations in motivation. Firstly, how we organize our perceptions as well as what we select to perceive are influenced by our expectations. If, as some theorists suggest, actual competence influences perceived competence which in turn affects one's participation choices (Griffin & Keogh, 1982; Harter, 1981a), one must assume some measure of accuracy in judging one's abilities. Harter (1981a), one of the few theorists to provide a developmental approach, suggests that the correlates to motivation and the relation among them change with experience. Perceptions of competence, and our expectations for future performance, depend on our past experience and our motives. A child has had so little experience that he/she has few ideas about what he/she can accomplish. In fact, very young children often feel omnipotent. They "are not only inaccurate, they are biased toward unrealistic optimism" (Stipek, 1984, p. 51). Stipek hypothesized that young children may be susceptible to the "wishful thinking illusion" postulated by Piaget (1925) wherein preschool-age children confuse their desires and their expectations. Successful mastery experiences maintain that high perception of ability. Unsuccessful attempts decrease positive self-perceptions and therefore decrease motivation to pursue that skill or task (Ulrich, 1987). Adults, on the other hand, have a vast reservoir of prior experience to shape their expectations. Their expectations may play a more important role in their choice of activity and performance outcome than in the case of the child. If so, their expectations in a learning situation need to be explored.
In addition, one's criteria for determining success or failure in a mastery attempt also changes with age. Success is inferred by a young child when a task is simply completed or a new task is learned (Ulrich, 1987). Older children and adults feel success if their performance is better than most of their peers (Nicholls, 1984) or at least equals their own expectations.

The preceding background review pointed to the importance of considering developmental and experiential factors that contribute to a learner's ability to use the necessary positive self-referent processes that enhance feelings of self-worth, which, in turn, allow for the development of personal responsibility and self-regulation. Moreover, the need for further research in this regard with adult learners was presented.

**Review of Self-Related Cognitions**

The global nature of "the self" construct has made any precise operational definition difficult. However, measurable components of the self, particularly as they apply to the domain of classroom learning, have been identified. Four general classes of self-related variables will be examined—perceptions of competence, perceptions of control, motivational orientation, and expectations. The first three constructs emerged from Harter's (1978) work on *efficacy motivation*, while the last one is derived from effort calculation, attribution, and process orientation theories (e.g., Kukla, 1972; Weiner, 1979; Bandura, 1977, respectively). Additional focus is achieved by reviewing the selected self-related constructs only within the academic domain.
Evaluation and Importance Dimensions of Perceived Competence

Self-concept has received considerable attention in the theoretical and applied literatures of psychology and education (Byrne, 1984). Comprehensive reviews of the literature exist with regard to major issues in self-concept theory (Purkey, 1970; Wylie, 1979; Zirkel, 1971), construct validation (Byrne, 1984), methodological concerns in self-concept research (Shavelson, Hubner, & Stanton, 1976; Shavelson & Stuart, 1981; Wylie, 1974), intervention programs with presumed self-concept change (Scheirer & Kraut, 1979), and the relationship between self and performance/achievement measures (Hansford & Hattie, 1982).

Given the volume and diversity of the literature, it is possible to find some support for basically any viewpoint regarding the relationship between self-concept and achievement. Some researchers contend that there are generally low correlations between self-concept and achievement (see Burns, 1979; Mintz & Mueller, 1977; Wylie, 1979). Others report the existence of ample evidence of a significant correlational relationship between general self-concept and achievement (e.g. Byrne, 1984; West, Fish, & Stevens, 1980). The mere presence of a correlation between any two variables does not in itself establish a causal relationship. However, Calsyn and Kenny (1977) point out that many educators and researchers are willing to accept that the relationship is at least reciprocal. Many educational researchers believe the self-concept/academic relationship is asymmetrical (Byrne, 1984). A controversy exists concerning the direction of this causal asymmetry. While there are those who maintain that self-concept influences academic achievement, there are others who argue that academic achievement determines self-concept. Studies whose findings support the argument that self-concept influences academic achievement at the college level are presented first.
Bailey (1971) sought to determine differences between achieving and underachieving students with below average college ability. His results led him to conclude that a student’s academic self-concept does play a crucial role in his or her level of academic achievement. Kubiniec (1970) investigated the relationship between self-perception and relative achievement success in the first year of college. She found general self-concept to be a good predictor of academic success in college. A subsequent study by Reynolds (1982), however, suggests contrary conclusions. Reynolds (1982) examined academic self-concept and general self-concept as noncognitive correlates of academic achievement in college students. His results revealed a strong relationship between academic self-concept and academic achievement. The relationship between general self-concept and academic achievement was minimal.

The general conclusion from these studies is that college students maintain certain attitudes about themselves and their abilities which have a strong impact on their academic performance. The contrasting view, that scholastic performance has a major influence on attitudes that students develop about themselves and their abilities, must also be considered. Roth (1959) investigated the relationship between self-concept and academic achievement among college students using outcomes in a reading improvement course as the measure for achievement. His results demonstrated that those college students whose reading ability improved showed much higher self-concepts than those who did not improve or those who dropped out of the course. Centi (1965) found a very strong pattern of low self-esteem among low achieving college students. Centi examined the self-reports of first-year students before courses commenced and subsequent to the receipt of first semester grades. Students who
received poor grades exhibited losses of self-esteem. In addition, those who continued
to be low achievers demonstrated diminishing levels of self-concept followed by
decreasing levels of academic achievement. In a review of published studies and
doctoral dissertations concerned with the impact of intervention programs on the self-
concept and academic achievement of school children, Scheirer and Kraut (1979) found
no evidence of a causal connection between self-concept and academic achievement.
Thus, they cautioned educators against the notion that improvement in students’ self-
concepts results in improvements in levels of academic achievement.

Many theorists argue that self-concept is a multi-dimensional construct (e.g.,
Byrne, 1984; Harter, 1982b; Marsh, Cairns, Relich, Barnes, & DeBus, 1984; Neeman &
Harter, 1986) with academic self-concept generally being considered one of the
dimensions of the construct. Many recent studies, in particular those of Marsh and his
colleagues (Marsh, 1986; Marsh, Byrne, & Shavelson, 1988; Marsh, Smith, Barnes, &
Butler, 1983) are providing increasing support for a hierarchical model of self-concept
with general self-concept at the apex followed by more domain specific self-concepts.
Perhaps some of the contradictory findings in the research are due to the differing
levels of self-concept utilized in various studies.

Two structural equation modeling studies (Byrne, 1982; Shavelson & Bolus,
1982) provide support for this notion. These studies found that the relationship
between general self-concept and academic self-concept is stronger than the
relationship between general self-concept and the external variable of academic
achievement but weaker than the relationship between academic self-concept and
academic achievement.
In her recent review, Byrne (1984) concluded that, to date, causal predominance between self-concept and academic achievement has not been fully confirmed. Nonetheless, she emphasized the need for further research as long as educators continue to show increasing concern for the SCs of less academically oriented students and continue to restructure curricula to meet this end, causal predominance between SC and AA must be determined in order to provide or deny justification of such practices (p.45).

In addition to the evaluation component of perceived competence the importance component has been viewed as essential to one's overall sense of self-worth. Several theorists maintain that it is the congruence or discrepancy between one's perceptions of competence and the importance attached to success in that domain that influences our decision to engage in that activity. For example, Eccles (1983) believes that the personal value learners attach to a task influences the use of self-regulated learning strategies. She points out that the importance of the task for some future goal contributes to the overall value of the task and whether the learner will choose to engage in the types of activities that foster task mastery. Similarly, McClelland (1985) maintains that it is not enough to merely believe that one will be successful at a task or activity. To participate in an activity, one must be motivated and interested to the extent that the activity is important to the individual. According to McClelland, the degree of importance of an activity is more strongly related to choices made than the actual outcomes of the activity.

Historically scholars of the self have postulated different theories concerning the determinants of global self-esteem or self-worth. According to James (1892), one's overall self-esteem represents the ratio of one's successes to one's pretensions. If one is successful in domains deemed important, then one will possess high self-esteem.
Conversely, if one is unsuccessful in areas where one aspires to be competent, the result will be low self-esteem. In Harter’s work with children (1986), James’s conceptual model has been translated into an empirical model that can be tested directly. James’s ratio is operationalized as a discrepancy between domain-specific competence evaluations and attitudes concerning the importance of success in each of these domains (Neeman & Harter, 1986). It was found that children age eight and older do consider these factors. They weigh and compare their competence and the importance of success in different domains. These appraisals appear to influence older children’s sense of self-worth (Harter, 1986).

However, a review of the literature suggests that this distinction between competence evaluation and importance has not been clearly articulated in treatments of self-evaluation, self-concept, and self-esteem (Messer & Harter, 1986). Thus, it follows that no theoretical or empirical consensus has been achieved as to the relative salience of the importance versus the evaluative/judgmental components of these self-related constructs. Future research should assess the importance of success for each domain in order to examine the discrepancy or congruence between one’s perceptions of competence and the importance the student attaches to success in each domain. These two dimensions of perceived competence are termed “competence evaluation” and “importance-competence discrepancy.” These two dimensions may differentially predict other constructs of interest.

**Expectancies**

One’s expectations for future performance is postulated as an important determinant of academic achievement by attributional theorists (i.e., Stipek &
Hoffman, 1980; Weiner, 1979), effort calculation theorists (e.g., Holahan & Kelly, 1978; Kukla, 1972; Motowidlo, 1981), and process oriented theorists (e.g., Bandura, 1977). Expectancy refers to a student's realistic estimate for future performance on a given task. It differs from self-efficacy or perceived competence. Perceived competence refers to self-appraisals of one's performance capabilities in a given situation. Performance expectancies refer to how one actually expects to perform in the future in a given situation. Schunk (1984b) also emphasized that expectancies about how one's performance will affect learning outcomes are differentiated from self-appraisals of what one can do.

A major source of difference involves how these self-judgments are derived. Judgments of self-efficacy are based on perceptions of prior successes or failures. Expectancies, on the other hand, are derived from alternate sources. According to attributional theorists (i.e., Stipek & Hoffman, 1980; Weiner, 1979), expectancies depend on perceptions of the causes (i.e., internal, external, unknown) of past performance outcomes together with predictions of the amount of personal control one can exercise in the situation. According to effort calculation theorists (e.g., Holahan & Kelly, 1978; Kukla, 1972; Motowidlo, 1981), expectancy on achievement related tasks is determined by three variables: (1) task difficulty, (2) intended effort expenditures or past effort expenditure, and (3) perceived ability. Thus, one's expectation judgments are not merely an isomorphic reflection of either past performance or perceptions of self-efficacy.

There is considerable evidence that individuals' expectations for success at tasks affect their behavior in the task situations (Bandura, 1977; Battle, 1965; Crandall, Katkovsky, & Preston, 1962; Diggory, 1966). It is difficult to motivate oneself to
persist at a task for which failure is believed to be inevitable. However, often low expectations are unwarranted, and students exert little effort or give up easily at a task that they are in fact able to do. Thus, performance expectations have important educational implications.

Many empirical studies have found a linear relationship between expectancy and subsequent academic achievement (Bernstein, Stephen, & Davis, 1979; Holen & Newhouse, 1976; Keefer, 1969; Kimball & Gray, 1982; Kovenklioglu & Greenhaus, 1978; Malloch & Michael, 1981; Morrison, Thomas, & Weaver, 1973; Vollmer, 1984, 1986). In light of such findings, it seems relevant to incorporate expectancies in any investigation of the relationships among self-related cognitions and academic achievement.

**Perceived Control**

Another important construct in the self-system is related to an individual’s sense of “what controls his/her life.” Such constructs have received considerable attention in the personality, social, and most recently, the developmental literature (Connell, 1981). The term “locus of control” introduced by Rotter (1954) refers to a person’s beliefs about control over life events. Since its introduction, over 1200 studies have been conducted utilizing various revisions of the construct (see Lefcourt, 1976, and Phares, 1976, for recent reviews). According to Rotter, whether or not an individual perceives himself/herself as being in control of particular reinforcements is an important mediator of his level of motivation to engage in that task. Rotter’s conceptualization of the locus of control construct was that of a dichotomous, unidimensional, global trait. Thus, individuals were considered to be either internal or
external across all situations and domains. Those people who feel personally responsible for the things that happen to them are referred to as “internals.”

“Externals” are people who feel that their outcomes in life are determined by forces beyond their control (i.e., fate, luck, chance, other people).

Within the education field, researchers have shown persistent interest in the topic of locus of control. The early work emphasized the locus of control construct’s relationship to achievement behavior (e.g., Crandall, Katkovsky, & Crandall, 1965). It was based on the premise that internals would show more effort and persistence in attempting to achieve than externals because the latter group would fail to make the connection between behaviors and outcomes. In a review of the literature, Bar-Tal and Bar-Zohar (1977) concluded that although studies, which used both children and adult subjects, often produced inconsistent results, a trend emerged indicating a positive relationship between perceptions of locus of control and academic achievement. However, other researchers (e.g., Levenson, 1981; Warehime, 1972) maintain that the evidence in this regard is equivocal.

Lefcourt (1976), Phares (1976), and Stipek and Weisz (1981) each suggested that age or grade level of the subjects may serve to qualify the relation between locus of control and achievement. Phares (1976) maintained that locus of control is more strongly related to academic achievement among children than among adults; Lefcourt (1976) simply noted the equivocalness of the findings; and Stipek and Weisz (1981) concluded that, in general, no consistent age differences had been found in the studies they reviewed. In a recent review of the literature, Findley and Cooper (1983) found some support for Phares’ conclusion. However, they suggested that the confusion may be due to the presence of a curvilinear relation such that the correlation among
adolescents was stronger than among children or adults. However, they suggested that research methodology, rather than social development, may be the cause for such findings. For example, studies assessing the relationship between locus of control and academic achievement across different age groups fail to use measures of equal reliability and construct validity. The relationship between locus of control and academic achievement of adults warrants further consideration with psychometrically sound instruments assessing similar constructs to those used with children and adolescents.

In this regard, Rotter's Internal-External (I-E) Scale (Rotter, 1966) is the instrument that has been most widely used with adults to measure their degree of internality versus externality (Bar-Tal & Bar-Zohar, 1977; Levenson, 1981). This scale is a global measure of causality. Stipek and Weisz (1981) questioned whether more specific locus of control scales would be more substantially related to achievement than locus of control scales that measured global perceptions. In support of this notion, Findley and Cooper (1983) found that there was a trend for specific measures to reveal stronger relations between locus of control and academic achievement. Many writers (e.g., Connell, 1985; Harter & Connell, 1984; Levenson, 1981; Paulhaus & Christie, 1981), including Rotter himself (1975), have called for the development of more specific locus of control scales than the robust but too general I-E Scale.

The strength of the relationship between locus of control and achievement has also been found to vary depending on the type of achievement measure used. Stipek and Weisz (1981) concluded that there is evidence that "locus of control questionnaire scores predict grades more strongly than they predict standardized achievement test scores" (p.107). Thus, future studies should include grades rather than standardized achievement test scores.
Another major development within the locus of control research is the movement toward viewing the construct as multidimensional. In addition to Internality, Levenson's (1981) multidimensional conceptualization differentiates between two types of external orientation: "belief in the basic unordered and random nature of the world" (p. 15) (i.e., luck, chance, fate) and "belief in the basic order and predictability of the world, coupled with the expectancy that powerful others are in control" (p. 15). Using Levenson's (1972) Internality, Powerful Others and Chance scales, Prociuk and Breen (1974) examined the relationship between control and study habits/attitudes and academic performance of college students. Their results, using correlational analyses, supported the prediction that study habits and academic performance are related positively to perceived internal control and negatively to chance control. Achievement and study habits were found to relate more to chance expectations than to powerful others orientations. Thus, the researchers concluded that their results support Levenson's differentiation of control into powerful others and chance dimensions.

In his work with children, Connell (1980; 1981; 1985) also conceptualized the locus of control construct as multidimensional. Connell's formulation postulates three dimensions: a) internal control -- the conception that one's own attributes bring about one's successes or failures, b) powerful others control -- the belief that other people's attributes bring about these outcomes, and c) unknown control -- not knowing why these outcomes occur.

Based on such research, Connell found it useful to recognize two conceptually independent components of children's perceptions of control within the cognitive domain. One component indicates the child's "level of understanding"; the other refers to the child's "content of understanding" or "relative internality."
Level of understanding is referred to as "unknown control" and is defined as the "amount of knowledge children have regarding the reasons for their successes and failures in school related activities." This component is assessed by items that tap the extent to which children say "they don’t understand why" they succeed or fail in school. The relative internality component is referred to as "internal-powerful others" and is similar to Rotter’s internal versus external locus of control. It is assessed by taking the difference between the child’s responses to items pertaining to perceptions of her own control (internal) and responses to items pertaining to perceptions of powerful others control. These two components of perceptions of control--level of understanding and relative internality--have not been examined with an adult population. Thus, no theoretical or empirical consensus has been achieved as to their existence and relative importance in adults’ academic achievement.

As with the self-competence-achievement issue, causality is an interesting question in the control-competence relationship. Does low self-competence engender external or unknown attributions or does the tendency to make external/unknown control attributions foster the development and maintenance of negative evaluations of self-competence? In theoretical work, Connell (1981; Harter & Connell, 1984) has speculated that knowing the sources of control operating in the classroom may be a necessary condition for competent performance and an intrinsic motivational orientation. On the other hand, not knowing the reasons for success and failure may inhibit competent performance and increase the need to focus on extrinsic sources of information and feedback to guide future achievement efforts. The results of Harter and Connell’s (1984) work examining causal relationships among self-related cognitions and academic achievement support the theoretical importance of the unknown control
variable. For both elementary and junior high school students, unknown control was the critical variable at the beginning of the predictive chain. Thus, for children between the ages of 8 and 13 years, the attributional component preceded perceived competence. The most powerful attributional variable in the model of self-related cognitions and academic achievement involved the extent to which children did not know or understand the contingencies governing their successes and failures. Children who were uncertain about these links had low feelings of competence, while children who "know" reported positive feelings of competence.

It should be noted that a high unknown score is believed to reflect a lack of experience or knowledge concerning the particular cause of an outcome as opposed to a history of experience in which behaviors and outcomes are viewed as non-contingent. One might, therefore, speculate that college freshman, making the transition from high school, with lack of experience in higher education, might also have temporarily elevated unknown scores. However, this remains an empirical question. To date, no one has extended this inquiry to adult learners, and thus we do not known whether the pattern of relationships that was found for children holds true for adults.

*Intrinsic versus Extrinsic Orientation*

Considerable experimental research has focused on understanding the development of intrinsic motivation and extrapolations of these results to education have been advanced (e.g., Pittman, Boggiano, & Ruble, 1983). However, the actual role of intrinsic motivation in schooling has received little attention (Gottfried, 1985). Although some research regarding intrinsic motivation in the school context has been conducted with children (Gottfried, 1985; Harter & Connell, 1984; Silon & Harter,
1985), the relation of academic intrinsic motivation to academic achievement and self-system factors remains to be thoroughly investigated (McCombs, 1984). Even less is known about this issue with adult learners.

It is important to distinguish between achievement motivation as it has been defined in the literature (cf Atkinson, 1964) and mastery motivation as it is being used in the present study. Achievement motivation refers to the level of one's motivation to pursue achievement behaviors based on the interaction of such factors as need for achievement, expectancy of success, and the incentive value of success (Harter & Connell, 1984). The motivational orientation construct in the present study refers to the type of motivational approach one assumes toward academic learning. In other words, to what degree is an adult's motivation for academic learning determined by her/his intrinsic interest in learning and mastery, curiosity, and preference for challenge as opposed to a more extrinsic orientation in which the student is motivated to obtain the professor's approval, grades, or skills to meet occupational demands. Does the adult learner prefer to learn independently, or is he/she dependent upon the instructor for guidance and direction? A related issue is whether the college student has internal criteria by which to judge her/his successes or failures or is dependent upon external feedback with regard to the outcome of her/his scholastic performances. In the present study, the focus is restricted to how motivational orientation relates to perceived competence, perceived control, performance expectations, and achievement within the scholastic domain.

Harter's (1978, 1980, 1981a,b,c) theoretical model of intrinsic motivation is derived from Robert White's (1959) model of "efficacy motivation." White proposed a motivational construct which impels the organism to engage in mastery attempts. He
proposed that this need to deal effectively with the environment is "intrinsic" as its gratification produces inherent pleasure.

Although the effectance motive construct had considerable heuristic appeal for Harter, she felt the global nature of the construct made it difficult to assess precisely. Thus, she focused her efforts on identifying measurable components of intrinsic mastery motivation within the domain of classroom learning, casting it within a developmental framework (see references cited above for a complete discussion of the model).

Harter (1981c) developed the Scale of Intrinsic Versus Extrinsic Orientation in the Classroom. She found it useful to define five separate components of a child's orientation to the classroom, each of which has an intrinsic and extrinsic pole. The first three subscales, referred to as the "intrinsic mastery motivation" cluster, measure the degree of a child's intrinsic or extrinsic motivational orientation, that is, what the child wants or likes to do in the classroom. These three subscales are (1) Preference for Challenge versus Preference for Easy work, (2) Curiosity or Intrinsic Interest versus Working to Please the Teacher and/or get good grades, and (3) Independent Mastery (liking to figure things out on one's own) versus Dependence on Teacher.

The two remaining subscales, referred to as the "autonomous judgment" cluster, tap more cognitive-informational structures, that is, the child's ability to make judgments about what to do in the classroom or about his or her performance. These scales are (4) Independent Judgment versus Reliance on Teacher's Judgment and (5) Internal Criteria for Success and Failure (one knows how well one has done without external feedback) versus External Criteria for Success and Failure (dependence on teacher feedback, grades, etc.).
Developmental Patterns. Harter (1981c) found some rather intriguing developmental trends across grades three through nine. The autonomous judgment cluster (i.e., cognitive-informational variable) shows striking linear trends across the grades. Scores for the third graders are relatively extrinsic, with a gradual increase into the intrinsic range by the junior high school grade. The intrinsic mastery motivation cluster produced the opposite linear trend. On this dimension, children begin with relatively intrinsic scores in the primary grades and move towards a more extrinsic orientation.

Harter (1981c) interpreted these trends to suggest the probability that with increasing grade level, students become more knowledgeable, more capable of making their own judgments and more able to determine whether or not they are successful. For the motivational subscales, the findings may reflect the possibility that, over the grade levels sampled, children’s intrinsic interest in learning dwindles or is suppressed, particularly with regard to preference for challenge, curiosity, and desire for independent mastery. Harter also suggested that it may reflect the tendency for children to adapt to the constraints of a school culture which fosters a relatively extrinsic orientation. More important, this writer concurs with Harter that further research is needed to determine whether the motivational and cognitive-informational constructs bear different relationships to other self-related constructs deemed important to academic achievement at different developmental levels.

In summary, four general classes of self-related constructs have been identified as determinants of adult academic achievement: perceptions of competence, expectancies, perceptions of control and motivational orientation. The review emphasized the multidimensional nature of these constructs and component variables
of each construct were identified. As well, the review established the hierarchical structure of these constructs and thus the need for future research to examine these constructs utilizing domain specific measures as opposed to more global general measures, for example, measures of academic self-concept as opposed to global self-concept.

Models of the Role of the Self-System in Academic Achievement

Although the validity of the role of the self-system in self-regulated learning has been accepted by theorists (e.g., Connell, 1981; Eccles, 1983; Harter, 1982a; McCombs, 1986; Paris & Cross, 1983; Zimmerman, 1986), little empirical evidence exists regarding the specific relationships among self-related cognitions and academic performance. In a recent study, Harter and Connell (1984) illustrated how the self-system can be used to predict academic achievement for elementary and junior high school students.

Harter and Connell wished to examine the relationship among these variables utilizing path analytic techniques which rely on structural equation procedures. The objective of such causal modeling approaches is to enable the researcher to go beyond simple correlational analysis and to make statements about the direction of influence of a specific variable upon others in the models. One such approach is to compare a number of possible models for their statistical fit to the observed relationships.

Harter and Connell (1984) examined four seemingly plausible models which could account for relationships among academic achievement and three self-related cognitions: (a) motivational orientation, (b) perceptions of control, and (c) perceptions of competence. Each of the models specifies a pattern of functional relationships or paths, implying the direction of influence of certain variables upon others in the
network. As suggested by Harter and Connell, the four models are in no way meant to be exhaustive, given the large number of possible models which could be generated from the relationships among the variables. However, the four models were chosen as plausible alternative conceptualizations which logically follow from existing formulations in the previously discussed theoretical and applied literature. Each of the models was designed to represent positions either explicitly or implicitly held by psychologists and educators in the field (Connell, 1981).

The four models are presented schematically in Figure 1. Each model contains an identical number of paths (six), an initial constraint required for the purposes of statistical comparison. In each model, one variable is surrounded by a box. This variable represents the hypothesized causal construct at the start of the predictive chain, the "prime mover" so to speak. The arrowheads indicate the hypothesized direction of influence of a given variable upon another. The minus signs (-) indicate a negative relationship between those variables. For example, in model 4, a high unknown control score is associated with a low level of achievement.

**Model 1 - Intrinsic Mastery Motivation**

The first model emphasizes the importance of one's motivational orientation (intrinsic versus extrinsic). It is extrapolated from Harter's (1978) and White's (1959) theoretical orientation. According to these theorists, intrinsic motivation gives the impetus to our mastery behaviors (represented in the model as achievement) and the ability and desire to make autonomous judgments. The outcomes of these achievement behaviors are believed to be predictive of one's perceptions of competence. Thus, high levels of achievement are expected to lead to a positive evaluation of one's competence. Conversely, low levels of achievement would lead to a negative competence evaluation.
Achievement is also expected to exert an influence on one's perceptions of control. High achievement would result in relatively low unknown perceptions of control and a more internal orientation relative to powerful others. Low achievement levels are expected to lead to unknown perceptions of control.

It should be noted that both White's and Harter's models are describing development processes which span years. Thus, it may be that at any given point in time the relationships among these constructs would not be reflective of the long-term causal processes proposed by these theorists (Connell, 1981).

Model 2 - Achievement-Behavior/Skill Development Model

This model, derived from the view of "traditional" educators who advocate skill development, assumes that achievement behavior is the prime mover influencing each of the other variables in the network. The emphasis is on how increases in one's achievement and/or actual skill level will lead to enhanced self-esteem or a more positive self-concept. This view is given some support by the work of Calsyn and Kenny (1977) and Bachman and O'Malley (1977). In this model, self-concept is thought to be a consequence rather than a cause of achievement. This position is typical of many back-to-basics and compensatory educational programs (e.g., Bereiter & Englemann, 1966).

Achievement is believed to be the all-important, singular, and direct factor accounting for all self-related cognitions and affects. Thus, achievement behavior is expected to influence perceptions of competence and affect. This model also assumes that high levels of achievement will lead to a relatively intrinsic motivational orientation. This is in contrast to the directionality specified in the Intrinsic Mastery
motivation model. According to that model, one's motivational orientation will influence one's achievement level.

The skill development model also postulates causal primacy to achievement with regard to its effect on the perceived control variables. High levels of achievement are also expected to influence autonomous judgment in that the higher one's achievement level, the more capable one is in making independent judgments in academic situations.

The general assumption here is that an individual's actual achievements directly affect his/her level of understanding, evaluations of and feelings about competence, level of autonomous judgment, relative internality, and mastery motivation.

**Model 3 - Self-Enhancement Theory**

Model Number 3 is consistent with those theorists who support a self-enhancement theory in which self-concept supposedly determines achievement (for reviews, see Purkey, 1970; Scheirer & Kraut, 1979). This model gives a fair hearing to those who advocate the importance of the individual's self-evaluation of competence for achievement behaviors and classroom motivation. This model reflects the view of those educational theorists and practitioners who have proposed that enhancing students' sense of self-esteem will lead to increments in their actual performance (e.g., Anderson & Evans, 1974; Purkey, 1970). Brookover, LePere, Hamachek, Thomas, and Erickson (1965), for example, argued that enhancing self-concept of ability, through changes in perceived evaluations of significant others, would influence the "functional limits" in learning and thereby improve students' achievement. Similarly, Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, and York (1966) supported the
notion that school desegregation would enhance minority children’s self-esteem and hence improve their academic achievement. Harter (1982b) has pointed out that a fair test of this position must be based on domain-specific measures of an individual’s self-related cognitions and affects—such measures as were employed in the Harter and Connell study.

Models 2 and 3 can be contrasted in light of the controversy concerning whether achievement causes self-concept (Model 2) or self-concept causes achievement (Model 3). The issue of causality has been a major one for educators, given its implications for remediation. The controversy between the skill development and self-enhancement theorists has continued unabated. See Harter (1983) for a further discussion of these issues.

This model represents the hypothesis that individuals’ reactions to their school achievements lead to their cognitive evaluation of their competence, then to their feelings about their competence and finally to their subsequent achievement, mastery motivation, and autonomous judgment. Perceptions of competence are also hypothesized to lead to individuals’ perceptions of control and the relative internality of their understanding of why they succeed and fail in school. Thus, the “message” is that individuals’ evaluations of their academic achievement and their affective reactions to those evaluations will impact their subsequent achievement, motivational orientation, and perceptions of control in the cognitive domain.

**Model 4 - Cognitive-Judgmental Processes**

The fourth model, which was hypothesized to best account for the relationships among the constructs, reflects Connell’s (1981, 1985) own emphasis on children’s
understanding of the reasons for their successes and failures. This model places perceived control at the beginning of the predictive chain. It is consistent with theorists who emphasize cognitive-attributional variables as determinants and mediators of behavior (e.g., Bar-Tal, 1978; Bar-Tal & Bar-Zohar, 1977; Covington & Omelich, 1979, 1984a; Marsh, 1984; Marsh, Cairns, Relich, Barnes, & Debus, 1984; Weiner, 1979). Current sequential models (see Bandura, 1978; Kanfer, 1980) also postulate that self-evaluations of competence and perceptions of control generate self-affects which in turn influence one's tendency to engage in a given behavior. Thus, a common thread which runs through many of these theorists' writings is the notion of a "process model" of the relationships among cognitive, affective, and motivational aspects of the self.

In this model, academic achievement is specified as the behavior dimension which leads to a competence evaluation, which in turn leads to competence affect. The affective reaction results in the individual becoming more or less intrinsically motivated to engage in the task.

This model departs from previous conceptualizations in the emphasis on the unknown control or "level of understanding" construct. The unknown control is identified as the most critical cognitive-attributional variable in the network (Connell, 1981). It is hypothesized to be a direct precursor to academic achievement, to relative internality, and to autonomous judgment.

This model hypothesizes that the individual's amount of knowledge about why he/she succeeds and fails will directly affect his level of academic achievement. Thus, the individual "who understands what makes him 'tick' in the domain of academics will do better in that domain than the child who doesn't" (Connell, 1981, p.22).
additionally, this model proposes that the higher the individual's level of understanding, the more of the "content" of this understanding will be internal. That is, that he/she is in control of his/her successes and failures. Conversely, if an individual does not know why he/she succeeds and fails, his perceptions of control will tend towards powerful others. This model also assumes that an individual's knowledge of the rules for achieving success and avoiding failure are precursors of his/her ability to make and preference for making independent judgments about school activities (e.g., you have to know the rules to play the game).

Harter and Connell’s study examined the best-fitting model for elementary and junior high school pupils using path-analytic techniques which rely on structural equation procedures. Seven grade levels were sampled in a cross-sectional study representing grades three through nine. Subjects completed three self-report scales assessing perceived competence, perceptions of control, and intrinsic versus extrinsic orientation. After data collection, a random subsampling procedure was used to obtain one sample for exploratory analytic purposes and one sample for purposes of confirming or replicating the initial effects obtained. The goals of their model-testing were fourfold: (a) to test relative goodness of fit of the four alternative models separately for elementary and junior high school pupils, using the exploratory subsamples; (b) to modify the best-fitting of these models in order to achieve an acceptable statistical fit using analytic criteria for goodness of fit; (c) to determine whether the best-fitting model for each group could be replicated using the confirmatory sample; and (d) to test for model differences between elementary and junior high school pupils.
The results suggested that for both groups of students Model Number 4, emphasizing cognitive-judgmental processes as a primary predictor, best fit the data. For both the elementary school and junior high school groups, additional paths were needed to improve the fit. A major difference between the junior high school and elementary school models was that at the junior high school level a greater number of paths were required to account for the observed relationships among the variables of interest. Certain constructs are more multiply determined. For example, competence affect (i.e., one's feeling about one's judgment of competence) plays a greater role at the high school level. It was found to have as great an impact on motivational orientation as competence evaluation. For the high school students -- unlike the elementary students -- a lack of understanding about who or what is responsible for successes and failures in the academic domain makes one feel relatively stupid. The general differences between the models of the two age groups is best depicted as a chain for the elementary school whereas the junior high school model depicts a more integrated network of constructs. The differences between the best-fitting models for junior high school pupils and the elementary school children were interpreted to reflect major developmental shifts between middle childhood and adolescence. For example, the adolescents' ability to think in terms of abstraction and to focus on their inner world of thoughts and feelings may account for their more psychologically complex patterns and more intimate links among their self-perceptions within the network.

To date, no one has examined the model which best fits the relationships among self-related cognitions and academic performance for an adult population. Existing developmental research and theory suggests that as one's cognitive abilities develop, one's self-system also becomes more differentiated and perhaps more complex.
(Harter, 1983). It seems quite probable, therefore, that developmental differences may exist with regard to the impact of self-related cognitions on each other and the impact of these variables upon actual performance.

**Summary and Concluding Remarks**

The relationship of self-related cognitions to academic achievement has been examined, drawing on literature from self-system and self-regulated learning theories and empirical research on selected self-related cognitions pertaining to achievement. Conclusions from each area will be addressed to summarize general findings, to address methodological issues, and to point out possible future research directions.

One purpose of the literature review was to establish the validity of the role of the self-system in self-regulated learning. The review points to the role of the self-system being that of establishing and maintaining positive self-evaluations throughout the learning activity. The consensus among self-system and self-regulated learning theorists is that self-percepts are the critical mediators of performance and persistence. That is, positive self-related cognitions contribute to the motivation to utilize necessary self-regulated learning processes and activities which in turn lead to academic achievement.

Having established the relevance of the self-system to the learning process, four general classes of self-related cognitions were identified as possible determinants of adult academic achievement. The literature suggests that these constructs are both hierarchical and multidimensional in nature, and the review emphasized the need to examine these constructs using domain specific measures.
One limitation of the research literature reviewed is that existing studies examining links between self-related constructs and academic achievement have been largely correlational in nature. The question of the causal primacy of achievement versus self-related constructs has been a highly controversial debate. However, the resolution of this debate has direct implications for remediation. For example, should remediation of "academic failure" be oriented more toward improving self-esteem or skill development? Certainly, more research is needed to study possible causal relationships among self-related constructs and academic achievement.

Future research should examine a network of self-related constructs and their relationship to each other and academic achievement. One such study (Harter & Connell, 1984) examining four alternative models with children and adolescents was reviewed. This study demonstrates how a network of self-related constructs can be used to predict academic achievement.

A second limitation of the existing literature is that studies examining the causal relationship among self-related constructs and adult academic achievement are sparse, despite the developmental nature of both self-system and self-regulated learning processes. For example, it is not now known which construct is the "prime mover" influencing the other self-related constructs and academic achievement for adults. It is not now known what the component variables of motivational orientation for classroom learning are for adult learners. Further research is needed to determine whether each of the self-related constructs bears different relationships to other constructs deemed important to academic achievement at different developmental levels, especially with adults.
In summary, the available data concerning the causal primacy of self-related cognitions versus academic achievement of adults are lacking. However, resolution of this debate has major implications for both remediation and theory development. Thus, further research concerning this issue seems warranted.
Appendix B

Scholastic Competence Subscale - Self Perception Profile
**WHAT I AM LIKE**

The following are statements which allow college students to describe themselves. There are no right or wrong answers since students differ markedly. Please read the entire sentence across. First decide which one of the two parts of each statement best describes you, then go to that side of the statement and check whether that is just sort of true for you or really true for you. You will just check ONE of the four boxes for each statement. Think about what you are like in the college environment as you read and answer each one.

<table>
<thead>
<tr>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Some students feel confident that they are mastering their coursework</td>
<td>BUT Other students do not feel so confident</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Some students do very well at their studies</td>
<td>BUT Other students don't do very well at their studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Some students have trouble figuring out homework assignments</td>
<td>BUT Other students rarely have trouble with their homework assignments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Some students sometimes do not feel intellectually competent at their studies</td>
<td>BUT Other students usually do feel intellectually competent at their studies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C

Scholastic Subscale - Importance Rating Scale
**IMPORTANCE RATINGS**

For these questions, think about how important these things are to how you feel about yourself as a person. These questions do not concern whether these things should be important, or whether it is a value one tries to live up to, or whether one appreciates these qualities in another person, or whether it is important to society. We want you to think whether these items really are important to you personally, and whether you behave as though they are important.

<table>
<thead>
<tr>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>BUT</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some students feel that doing well at their studies is important</td>
<td>Other students do not feel that doing well at their studies is all that important</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some students think that it is not that important to be good at their coursework</td>
<td>Other students feel that being good at their coursework is very important</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix D

Performance Expectation
PERFORMANCE EXPECTATIONS

Subject Number

1. Estimate, as realistically as possible, the letter grade you think you will get as your total grade point average this term. (Note - this is the average of all the courses in which you are currently enrolled) (Check one only)

<table>
<thead>
<tr>
<th>A+</th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>C+</th>
<th>C</th>
<th>D+</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>(93-92)</td>
<td>(87-86)</td>
<td>(80-79)</td>
<td>(75-74)</td>
<td>(70-69)</td>
<td>(65-64)</td>
<td>(60-59)</td>
<td>(55-54)</td>
<td>(50-49)</td>
<td>(under 50)</td>
</tr>
</tbody>
</table>

2. How important is it to you that you achieve your estimated grade point average? (check one only)

   | Very Important | Sort of Important | A little Important | Not at all Important |

3. On what factors do you base your expectation for your final grade point average? That is, how did you arrive with your specific prediction?

   ____________________________________________

   ____________________________________________

   ____________________________________________

   ____________________________________________
Appendix E

Academic/Cognitive Subscale - Measure of Perceptions of Control
WHY THINGS HAPPEN

INSTRUCTIONS TO THE STUDENT

As you can see from the top of your sheet where it says "Why Things Happen", we have some sentences here about a lot of things that happen to people your age. We would like to know how true you think these sentences are. This is not a test. There are no right or wrong answers. Since students are different from one another, each of you will be putting down different things.

What we want to know is what you think about these sentences. Please look at the following sample items:

<table>
<thead>
<tr>
<th>Very True</th>
<th>Sort of True</th>
<th>Not Very True</th>
<th>Not at All True</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. I like chocolate ice cream better than vanilla ice cream

b. Most people really like spinach

Beside sample a., we want you to check whether the sentence is very true for you, sort of true for you, not very true for you or not at all true for you. Only check one of these choices.

Beside sample b., do you think that this is very true, sort of true, not very true, or not at all true. Check the one that says how true you think it is that most people really like spinach.

These sentences were just for practice. Now you may proceed to the questionnaire. Remember, check the words that say how true you think each sentence is. Check only one for each sentence.
<table>
<thead>
<tr>
<th>Subject Number</th>
<th>Very True</th>
<th>Sort of True</th>
<th>Not Very True</th>
<th>Not at All True</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The best way for me to get good grades is to get the instructor to like me.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>2. When I do well in school, I usually can't figure out why.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>3. If I want to do well in school, it's up to me to do it.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>4. If I don't do well in school, it's my own fault.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>5. If I have a bad instructor, I won't do well in the course.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>6. If I get a bad grade in a course, I usually don't understand why I got it.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>7. When I do well in a course, it's because the instructor likes me.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>8. When I get a good grade in a course, I usually don't know why I did so well.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>9. If I want to get good grades in a course, it's up to me to do it.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>10. If I get bad grades, it's my own fault.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>11. If I don't have a good instructor, I won't do well in the course.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>12. When I don't do well in my courses, I usually can't figure out why.</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
</tbody>
</table>
Appendix F

Scale of Intrinsic Versus Extrinsic Orientation in the Classroom
We have some sentences here and, as you can see from the top of your sheet where it says "Approach to Course Work", we are interested in what kinds of things you prefer to do in your courses. This is not a test. There are no right or wrong answers. Since students are very different from one another, each of you will be putting down something different.

Let me explain how these questions work. First, read the following sample questions:

<table>
<thead>
<tr>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="false" alt="Box" /></td>
<td><img src="false" alt="Box" /></td>
<td><img src="true" alt="Box" /></td>
</tr>
<tr>
<td>Some students would rather be outdoors in their spare time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other students would rather watch T.V.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| (b)               |                     |                  |
| ![Box](false)     | ![Box](false)       | ![Box](true)     |
| Some students like hamburgers better than hot dogs |
| Other students like hot dogs better than hamburgers |

The first question, which is marked (a), talks about two kinds of students.

1. What I want you to decide first is whether you are more like the students on the left side who would rather spend time outdoors, or whether you are more like the students on the right side who would rather watch T.V. Don't mark anything down yet, but first decide which kind of student is most like you, and go to that side.

2. Now, the second thing I want you to think about, now that you have decided which kind of student is most like you, is to decide whether that is only sort of true for you, or really true. If it's only sort of true, then put an X in the box under sort of true; if it's really true for you, then put an X in that box, under really true.

3. For each sentence you only check one box. Sometimes it will be on one side of the page, and other times it will be on the other side of the page, but you can only check one box for each sentence.

4. Now try the second sample question, which is (b). Make sure you go through points 1, 2 and 3 above.

5. Those were just for practice. Now we have some more sentences. For each one, just check one box, the one that goes with what is true for you, what you are most like. Please proceed to the next page.
<table>
<thead>
<tr>
<th>Subject Number</th>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>BUT</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td>Some students like hard work because its a challenge</td>
<td>BUT</td>
<td>Other students prefer easy work that they are sure they can do</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>When some students don't understand something right away they want the instructor to tell them the answer</td>
<td>BUT</td>
<td>Other students would rather try and figure it out by themselves</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Some students work on problems to learn how to solve them</td>
<td>BUT</td>
<td>Other students work on problems because they are supposed to</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Some students almost always think that what the instructor says is true</td>
<td>BUT</td>
<td>Other students sometimes think their own ideas are better</td>
<td></td>
</tr>
</tbody>
</table>

Please turn page over
<table>
<thead>
<tr>
<th></th>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Some students know when they've made mistakes without checking with the instructor</td>
<td>BUT</td>
<td>Other students need to check with the instructor or to know if they've made a mistake</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Some students like difficult problems because they enjoy trying to figure them out</td>
<td>BUT</td>
<td>Other students don't like to figure out difficult problems</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Some students do their course assignments because the instructor tells them to</td>
<td>BUT</td>
<td>Other students do their course assignments to find out about a lot of things they've been wanting to know</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>When some students make a mistake they would rather figure out the right answer by themselves</td>
<td>BUT</td>
<td>Other students would rather ask the instructor how to get the right answer</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Some students know whether or not they're doing well in school without grades</td>
<td>BUT</td>
<td>Other students need to have grades to know how well they are doing in school</td>
<td></td>
</tr>
</tbody>
</table>

Please go on to next page
<table>
<thead>
<tr>
<th></th>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>Some students agree with the instructor because they think the instructor is right about most things</td>
<td>BUT</td>
<td>Other students don't agree with the instructor sometimes and stick to their own opinion</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Some students would rather just learn what they have to in school</td>
<td>BUT</td>
<td>Other students would rather learn about as much as they can</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Some students like to learn things on their own that interest them</td>
<td>BUT</td>
<td>Other students think it's better to do things that the instructor thinks they should be learning</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Some students read things because they are interested in the subject</td>
<td>BUT</td>
<td>Other students read things because the instructor wants them to</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Some students need to get their report cards to tell how they are doing in their courses</td>
<td>BUT</td>
<td>Other students know for themselves how they are doing even before they get their report cards</td>
<td></td>
</tr>
</tbody>
</table>

Please turn page over
<table>
<thead>
<tr>
<th>15. Really True for Me</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>If some students get stuck on an assignment BUT they ask the instructor for help</td>
<td>Other students keep trying to figure out the assignment on their own</td>
<td></td>
</tr>
<tr>
<td>16. Really True for Me</td>
<td>Sort of True for Me</td>
<td>Really True for Me</td>
</tr>
<tr>
<td>Some students like to go on to new work BUT that's at a more difficult level</td>
<td>Other students would rather stick to the assignments which are pretty easy to do</td>
<td></td>
</tr>
<tr>
<td>17. Really True for Me</td>
<td>Sort of True for Me</td>
<td>Really True for Me</td>
</tr>
<tr>
<td>Some students think that what the instructor thinks of their work is the most important thing</td>
<td>For other students what they think of their work is the most important thing</td>
<td></td>
</tr>
<tr>
<td>18. Really True for Me</td>
<td>Sort of True for Me</td>
<td>Really True for Me</td>
</tr>
<tr>
<td>Some students ask questions in class BUT because they want to learn new things</td>
<td>Other students ask questions because they want the instructor to notice them</td>
<td></td>
</tr>
<tr>
<td>19. Really True for Me</td>
<td>Sort of True for Me</td>
<td>Really True for Me</td>
</tr>
<tr>
<td>Some students aren't really sure if they've done well on a test until they get their papers back with a mark on it</td>
<td>Other students pretty much know how well they did even before they get their paper back</td>
<td></td>
</tr>
</tbody>
</table>

Please go on to next page
<table>
<thead>
<tr>
<th></th>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.</td>
<td>[ ]</td>
<td>Some students like the instructor to help them plan what to do next BUT Other students like to make their own plans for what to do next</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>[ ]</td>
<td>Some students think they should have a say in what work they do in their courses BUT Other students think that the instructor should decide what work they should do</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>[ ]</td>
<td>Some students like courses where it's pretty easy to just learn the answers BUT Other students like those courses that make them think pretty hard and figure things out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>[ ]</td>
<td>Some students aren't sure if their work is really good or not until the instructor tells them BUT Other students know if its good or not before the instructor tells them</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>[ ]</td>
<td>Some students like to try to figure out how BUT to do course assignments on their own BUT Other students would rather ask the instructor how it should be done</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please turn page over
<table>
<thead>
<tr>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>25. Some students do extra projects so they can get better grades</td>
<td><strong>BUT</strong> Other students do extra projects because they learn about things that interest them</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. Some students think its best if they decide when to work on each chapter of their text</td>
<td><strong>BUT</strong> Other students think that the best one to decide when to work on things</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. Some students know they didn't do their best on an assignment when they turn it in</td>
<td><strong>BUT</strong> Other students have to wait till the instructor grades it to know that they didn't do as well as they could have</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Some students don't like difficult course BUT work because they have to work too hard</td>
<td><strong>BUT</strong> Other students like difficult course work because they find it more interesting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please go on to next page
<table>
<thead>
<tr>
<th>Really True for Me</th>
<th>Sort of True for Me</th>
<th>Sort of True for Me</th>
<th>Really True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some students like to do their course work without help</td>
<td>BUT Other students like to have the instructor help them do their coursework</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some students work really hard to get good grades</td>
<td>BUT Other students work hard because they really like to learn things</td>
<td></td>
</tr>
</tbody>
</table>
Appendix G

Consent Form
CONSENT FORM

I __________________________ agree to participate in this study of University students' self-related cognitions and learning. I understand that all information related to me personally will be kept confidential so that only the experimenters will be able to identify any specific information to me. I understand that all information will be analyzed and reported as group data, and not on an individual basis.

I also understand that I have the right to request that any information relevant to me not be used and that I may withdraw from the study at any time.

I understand that for the purpose of this study it will be necessary for the experimenters to obtain my final grades for this current term together with my grade point average for the term immediately preceding in order to determine the relationship between self-related cognitions and academic achievement. My signature on this form shall serve as my permission and approval to the Registrar's Office for the release of such information to the experimenters named herein.

I also understand that I can obtain information about this study from the experimenters: Dr. Akira Kobasigawa and Jean Szkiba, who will be available through the Psychology department at the University of Windsor.

Date: ___________________________ Signature

Student Number

Subject Number
Appendix H

LISREL VI and Some Cautions
LISREL VI is a statistical tool for assessing how well sample data, in the form of a covariance or correlation matrix, fit predetermined systems of structural equations which describe causal models. A model seeks to account for variation and covariation in the endogenous or dependent variables by specifying their causal dependence both on other endogenous variables and on the exogenous or independent variables. LISREL's estimation of the model generally consists of two parts. The measurement model relates observed measures to latent variables, or "constructs." The structural model specifies the hypothesized relationships among the constructs. LISREL VI estimates both models simultaneously by fitting the observed variance-covariance matrix to each of the parameters in the specified structures. Indices are provided which indicate how well the data fit the hypothesized model. Introductory level descriptions of the LISREL VI analytic paradigm have been provided by Anderson (1987), Bentler (1980), Brynner and Romney (1985), Hayduk (1987), James, Mulaik, and Brett (1982), Kenny (1979), and Long (1983a, 1983b).

Notwithstanding the numerous capabilities of LISREL VI data analytic techniques, several cautions have been associated with its use. These will be briefly reviewed.

**Identification problems.** Failure to specify enough parameters a priori may lead to an inability for a function to be determined by solving for the remaining parameters (Mulaik, 1987). Underidentification can be caused by several factors such as too-low factor loadings or too-low or too-high correlations (Kenny, 1979). It can also result from model misspecification (e.g., omitted variables or factors, correlated errors, extra or omitted factor loadings or causal paths). Underidentification can lead to such undesirable results as failure to converge to a solution, negative unique or residual
variance estimates, parameters beyond reasonable limits, large standard errors of parameter estimates, or large correlations among parameter estimates (Rindskopf, 1984). Thus, along with the overall fit, the quality of the model must also be considered in the decision to reject or accept it.

Violation of assumptions. LISREL VI makes assumptions of linearity, additivity (no interaction effects), and multivariate normality (normal distributions of variables, with data from each subject containing only usual combinations of levels of measures considered collectively), and requires large sample sizes. In practice there is often a tendency to trade-off between sample size and quality of measures (Martin, 1987). Violations of assumptions are difficult to discover. As a matter of fact, assumptions of normality are not often met in social science data. Investigations concerning the robustness of findings using nonnormal data have only recently emerged (Huba & Bentler, 1983; Huba & Harlow, 1986; Tanaka & Huba, 1987). Basic assumptions should be considered when using LISREL VI to avoid poor results and wrong conclusions.

Interpretational problems. Several investigators (e.g., Biddle & Marlin, 1987; Cliff, 1983; Fornell, 1983; and Martin, 1987) caution about the potential abuses associated with causal modeling methods. Although these methods have increased the rigor with which one can analyze correlational data, and they solve some major statistical problems associated with such data, it must be borne in mind that they have not solved the typical interpretational problems (Cliff, 1983). Thus, these methods must be used with care. Hypotheses must be made a priori. Variables need to be carefully operationalized. Models are never confirmed by data, they gain support by failing to be disconfirmed (Anderson & Gerbing, 1988). Although a model may have
acceptable goodness of fit and cannot be disconfirmed, other models may exist which fit the data equally well. One should bear in mind that these techniques are not sufficient to determine causality. What they can be expected to do is test the plausibility of competing theoretical models, with the aim of eliminating some theories by demonstrating their inadequacies (Maruyama & McGarvey, 1980). Goodness of fit measures are all less than perfect. It is recommended that a mixture of statistical and subjective criteria be used (Cliff, 1983; Fornell, 1983; Hoelter, 1983; Joreskog & Sorbom, 1984; Marsh, Balla, & McDonald, 1988; Mulaik, James, Van Alstine, Bennett, Lind, & Stilwell, 1989). Ideally, one would want to split a sample using one half to develop a model and the other half to validate the solution derived from the first half. However, the necessity for large samples to meet the desirable asymptotic properties of maximum likelihood or generalized least squares estimates, often precludes such a practice (Anderson & Gerbing, 1988).
VITA AUCTORIS

P. Jean Szkiba-Day was born in Budapest, Hungary. As a young child, she immigrated to Canada with her parents and sister. She matriculated with first class honours from Barton Secondary School in Hamilton, Ontario. In June, 1979, she graduated on the Dean’s Honour Roll from the University of Western Ontario with a Bachelor of Arts (Honours) Degree in psychology. She remained at Western for graduate training and completed her Master of Arts Degree in Counselling/Educational psychology in November, 1982. In September, 1982, she enrolled in the Doctoral programme in Clinical (Child) Psychology at the University of Windsor. The Doctor of Philosophy Degree was completed in November, 1990. She is currently employed as the staff psychologist at Kinark Child and Family Services in Newmarket, Ontario.

P. Jean Szkiba-Day is married to David Day.