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LA THÈSE A ÉTÉ
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A Causal Modeling Approach to Construct Validation of
Self-concept
Using a Structural Equation Model

by

Barbara M. Byrne

A thesis
presented to University of Ottawa
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
in
Education

Ottawa, Ontario, 1982

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ABSTRACT

This study sought to validate the self-concept construct, by means of a LISREL structural equation model operating at two points in time. Specifically, the investigation examined the relationships among 'general self-concept' (GSC), 'academic self-concept' (ASC) and 'academic achievement' (AA); two measures of each construct were obtained at each time point.

Sample and Procedures

The sample comprised 929 high school students from grades 9 through 12. The instruments used to measure the three constructs were as follows:

General Self-concept

- Self-esteem Inventory---General Self subscale (Coopersmith, 1967).
- Self-esteem Scale (Rosenberg, 1965).

Academic Self-concept

- Self-esteem Inventory---School-Academic subscale (Coopersmith, 1967).
- Self-concept of Ability Scale (Brookover, 1962).

Academic Achievement

- Reading Comprehension: Cooperative English Tests (ETS, 1960).
- Mark Average

The data were collected in October and again in May, of the same school year.

Findings

Although the results of this investigation did not justify conclusions being drawn regarding causal predominance among the three constructs (GSC, ASC, AA), the study was nonetheless successful in its attempt to provide important theoretical and methodological contributions to self-concept research and its application in educational settings.

Theoretically, the study was able to clarify the following issues regarding the structural embodiment of the self-concept construct, within its nomological network.

1. AA, ASC and GSC are all very stable constructs; AA being the most stable, followed by ASC and GSC, respectively.
2. The correlation between GSC and AA, together with the correlation between ASC and AA, are very stable over time; the correlation between GSC and ASC is less stable.

3. The relationship between ASC and AA was found to be the strongest, followed by the relationship between GSC and ASC, and GSC and AA, respectively.
4. ASC, although correlated with GSC, can be distinguished from GSC; both ASC and GSC are distinct from AA.
5. Other important variables appear to influence the causal relationship among GSC, ASC and AA.

Methodologically, the study was able to provide guidance to investigators who may wish to examine the self-concept and academic achievement constructs, within a longitudinal framework. Additionally, the results were able to demonstrate that when multiple measures of a construct are specified, maximally dissimilar instrumentation should be used.

Finally, critically needed reliability and validity data were provided for the five standardized instruments of measurement used in the study.

ACKNOWLEDGEMENTS

I wish first to express sincere appreciation to my advisor, Dr. James E. Carlson, whose enthusiastic support, untiring patience and dedicated effort, have guided me to the completion of this thesis. Thanks are also due Dr. Marvin Boss and Dr. Jean-Paul Dionne, for their sustained interest and ready assistance whenever requested. I am also grateful to Dr. Gary Tushingham, without whose leadership and inspiration, I may never have embarked upon this endeavour. For permission to reproduce copies of their instruments of measurement, I would like to thank Dr. W.B. Brookover, Princeton University Press and Consulting Psychologists Press Inc. Finally, appreciation beyond words is due my husband Alex, for his continual understanding, encouragement and reinforcement, throughout the course of this study.

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INTRODUCTION

Over the past decade, education goals have become increasingly directed toward the enhancement of students' self-concepts. Implicit in this trend, is the notion that a child's perceptions about himself within the school environment, play a key role in his level of academic achievement. Thus, the development of basic academic skills of students, together with the amplification of their self-concepts, are viewed as two of the most important roles played by today's educators.

The relationship between these two tasks and the means of achieving them via the educational system, have received much attention from educational researchers. Indeed, a review of educational literature reveals a plethora of studies concerned with aspects of self-concept in a variety of educational settings and for a diversity of students: the physically disabled (Roshier and Howell, 1978); the trainable mentally retarded (Nash and McQuistan, 1975); the educable mentally retarded (Calhoun and Elliott, 1977); the learning disabled (Smith, 1979); the gifted (Winne, Woodlands and Wong, 1979); the disadvantaged (Soares and Soares, 1969). Clearly, self-concept is considered a critical variable in education and educational research.



Much of the research investigating the relationship between self-concept and academic achievement, has been presented in a form that suggests causality. Some researchers imply that self-concept is a fundamental determinant of academic achievement. Others in contrast, hold the opposing view, that academic achievement is a predominant determiner of self-concept. Thus, although a definite relationship between the two constructs has been empirically well-established, the direction of causality has not yet been determined.

An important prerequisite to the valid use of self-concept in educational research, however, is a thorough understanding of the construct itself. Formally, this corresponds to defining the nomological network, relating the differentiable facets of the self-concept construct to each other and relating the construct to other educational variables of significance, such as 'academic achievement'.

This present study seeks to validate the nomological network of the self-concept construct, using a causal modeling approach. Specifically, the research investigates the causal relationships among 'general self-concept', 'academic self-concept', and 'academic achievement', through the medium of a multiple-indicator structural equation model, operating at two points in time.

Chapter I

CONSTRUCT VALIDATION

1.1 DEFINITION OF A CONSTRUCT

According to Cronbach and Meehl (1955), a construct is "...some postulated attribute of people, assumed to be reflected in test performance" (p.283). That is to say, it is an abstraction which is inferred from observable phenomena (Theodorsen and Theodorsen, 1969). Measurements of a construct then, attempt to describe an individual, with respect to the degree to which he possesses the construct. Loevinger (1957), however, points out that traits exist in people, whereas constructs "...exist in the minds and magazines of psychologists" (p.642). More accurately then, measurements of a construct, attempt to describe an individual, with respect to the degree to which he possess the trait.

In an effort to further clarify the distinction between a trait and a construct, Loevinger (1957) draws an analogy with the familiar difference between a parameter and a statistic. She asserts that,

The parameter is what we aim to estimate; the corresponding statistic represents our best

estimate of it. Just so, the trait is what we aim to understand, and the corresponding construct represents our best understanding of it (p.642).

Construct validation refers to the procedures and evidence used in support of a construct interpretation of a measurement (Shavelson, Burstein and Keesling, 1977). As with all science, construct validation works by disconfirmation; a construct is projected forth and validation studies pose, and attempt to disconfirm counterinterpretations to the proposed construct interpretation. If these challenges are disconfirmed, support is gained for the proposed interpretation. Cronbach (1971) argues that the validity of a construct, should be challenged over and over again ; each time, accompanied by a new counterinterpretation and counterhypothesis.

Construct validation then, is an ongoing process, during which time, the definition of the construct, its measurement, or both, are revised. This modus operandi continues until a formal definition emerges, with concomitant empirical support.

The initial step in any construct validation process, is definition of the construct (Cronbach, 1971; Fiske, 1971; Kifer, 1977; Shavelson, Burstein and Keesling, 1977). Ultimately, a mature construct definition should be formal and explicit. That is to say, it should a) be defined in terms of its nomological network (Cronbach and Meehl, 1955) and b) relate the construct to observable properties or

quantities of the construct. Cronbach and Meehl (1955) emphasize that unless the nomological network of the construct actually includes observations, and exhibits explicit, public steps of influence, construct validation cannot be claimed.

The term 'nomological network', as introduced by Cronbach and Meehl (1955), refers to "...the interlocking system of laws which constitute a theory" (p.290); the construct is defined by proposing the laws which are thought to govern its occurrence. Within this framework, construct validation studies involve two basic types of investigations. The first of these includes studies which investigate the network of associations that relate the construct definition to observable properties or quantities of the construct. Shavelson, Hubner and Stanton (1976) claim these studies seek to examine the 'within-portion' of the construct definition (c.f. Loewinger's 'structural component', 1957; Kifer's 'facets/elements', 1977). For example, if the definition of the self-concept construct were hypothesized to comprise academic, physical and social facets (see eg. Shavelson et al., 1976, p.413), within-network studies would examine the relationships among these three components. Construct validation studies in this instance, would serve to establish the within-portion of the construct definition.

The second group of investigations includes studies which examine the relationship between the construct and other

constructs. This aspect of the definition, locates the construct in conceptual space and thus demonstrates its relationship to, or independence from, other constructs. Again, Shavelson et al. (1976) refer to this definition feature, as the 'between-portion' of the construct definition (c.f. Loevinger's 'external component', Kifer's 'differences from other constructs', 1977). These between-network studies would identify the relationships of the components of self-concept, with other variables such as 'academic achievement', or 'social adjustment'.

Clearly, within-network studies, which map the construct itself, must be prerequisites to valid between-network research (Wyllie, 1974; Shavelson et al., 1976). Marx and Winne (1978) posit further, that without sufficient knowledge from within-network studies, between-network research investigating the relationship of self-concept with some other construct, may be faulted for the uncertain interpretations affixed to the self-concept scores themselves. Soares and Soares (1980) note, however, that with respect to self-concept validation research, a substantially greater number of studies have investigated the between-network relationships, than have examined the within-portion of the construct. Within-network studies they suggest, are a relatively recent phenomenon.

Wells and Marwell (1976) posit that construct validation is the process of making a grounded argumentative link

between a particular construct like self-concept and its measurement; the latter being as indicators of the construct, in actual behavior. The measurement process, however, does not simply involve an isolated instrument and a corresponding construct; rather, there must be a congruence between the construct system (its nomological network) and the measurement system (sets of observed scores and events). In this regard, Fiske (1971) notes that in construct validation, the researcher validates not a construct or a measure, but rather, a construct-measure pairing. If validation fails, it may be that the measure is inappropriate, the explication of the construct is incorrect, or both.

Validation and/or measurement of a construct, however, must be made within the context of a particular interpretative scheme. As Cronbach (1971) points out, the researcher does not in fact validate tests, but rather, specific interpretations of tests.

1.2 TRADITIONAL METHODS OF CONSTRUCT VALIDATION

The validation of a construct involves the interplay of construct definition, instrument development and data collection; the construct definition, determining the boundaries for potential measurement techniques (Shavelson, Hubner and Stanton, 1976; Bentler, 1978). With the construct definition operating as a test plan, an instrument

is developed and the data collected. These data bear on the construct interpretation of the scores. As Cronbach (1971) notes,

To explain a test score, one must bring to bear, some sort of theory about the causes of the test performance and about its implications (p.443).

Interpretations of test scores may be considered hypotheses to be challenged repeatedly, with counterhypotheses (Cronbach and Meehl, 1955; Cronbach, 1971). Shavelson and his associates (1976) suggest that initial construct validation studies should examine the logical and empirical evidence in support of the within-portion of the nomological network; between-network studies can follow at a later date.

In the event that the empirical evidence is congruent with the construct definition, test scores are given construct interpretations. Conversely, should the data exhibit incongruence with the construct definition, the definition, the instrument, or both, require further investigation and/or revision. Shavelson et al. (1976) emphasize, however, that empirical evidence alone, does not have the power to veto the construct definition; rather, it reflects upon the measurement technique, which in turn, can reflect upon the construct definition. The ultimate goal in the process of construct validation then, is to build a logically and empirically sound theory and instrumentation.

Clearly, the interdependence of theory and measurement and, in particular, theory construction, measurement construction and validation, appears to be a circuitous relationship (Michael, Plass and Lee, 1973 ; Wells and Marwell, 1976; Bentler, 1978). Measurements of a construct are used to empirically test the theory, by means of the implications and predictions it suggests; yet the initial selection and testing of the measurements, are based on their ability to empirically satisfy the theory, since the theory specifies which empirical connections should occur.

Wells and Marwell (1976) therefore emphasize, that within this circularity, one cannot conduct independent validation tests of both the construct and its measurement; certain a priori assertions must be proposed, concerning one of the two phenomena. That is to say, if the researcher assumes valid measurements, he can test the theory; if he assumes an accurate theory, he can validate the measurements. This inevitable fact of validation research, leads Wells and Marwell (1976) to conclude that indeed, "...measurement and theory are inseparately wed" (p.183).

Traditionally, construct validation studies have fallen into three main categories (Cronbach, 1971); these are: logical analysis, correlational techniques and experimental techniques. Shavelson and Stuart (in press) contend that these same procedures have been employed for at least thirty years and of the three, correlational techniques have been

the most widely used. These methods are now briefly examined; construct validation studies of self-concept, are outlined in Chapter II.

1.2.1 Logical Analysis

Once the construct definition has been proposed, it can be examined logically, to identify counterhypotheses, with respect to the measurements taken. The basic function of a logical analysis then, is to generate counterhypotheses as to the construct interpretation of the test score. Cronbach (1971) considers careful scrutiny of an instrument by an expert, as providing one of the best procedures for formulating counterhypotheses. He argues that one who is familiar with the weaknesses of past tests, is better able to detect impurities, than the developer of the instrument. For example, the Self-esteem Inventory (Coopersmith, 1967) purports to provide separate assessments of general self, social self-peers, home-parents and school-academic aspects of self-concept. A logical analysis of this scale, would reveal whether in fact, each of these dimensions was worthy of measurement as separate identities. If it were found that indeed, the elements of 'social-peers' and 'home-parents' relate instead as a single trait, this would lead the investigator to propose a counterhypothesis in this regard. However, Cronbach (1971) posits that,

...the logical analysis of content cannot disprove a validity claim. The analysis puts forth a counterhypothesis whose pertinence can be verified only empirically (p.475).

It should be noted that since the major focus of this study is directed toward the refinement of self-concept theory rather than test validation, no further reference will be made to logical analysis, as a construct validation technique.

1.2.2 Correlational Techniques

From the definition of the construct and the logical analysis of the definition, predictions can be made concerning the empirical relationships among the facets of the construct (within-network studies) and between the construct and other constructs (between-network studies) (Shavelson, Burstein and Keesling, 1977). Additionally, Shavelson et al. (1977) note that correlational studies may be used to examine other features of the construct definition. Such considerations might include such variables as stability, developmental characteristics, hierarchical organization, and so forth.

The common criterion by which all correlational studies are evaluated for validation, is that of 'convergence'. That is to say, the propensity of different measurements, if purportedly related, should correlate to some degree, with each other; the stronger this relationship, the higher the correlation (Wells and Marwell, 1976). The criterion of convergence, however, cannot stand alone in the judgement of validity, since measures may converge for a variety of

reasons. Campbell and Fiske (1959) therefore, have proposed that a second criterion be employed, involving the discrimination between different measures. The lack of correlation between different measures then, can also provide useful and often desirable information. Campbell and Fiske (1959) posit that the combination of both convergent and discriminant criteria, provides a more powerful form of analysis. The essence of the validation strategy, is that a measure should correlate well with other measures that the theory predicts should be related; similarly, the measure should correlate negligibly, with measures that the theory suggests should be unrelated. Cronbach (1971), however, asserts that although indicators of the same construct are expected to converge, high correlations are not necessarily expected.

To date, five correlational techniques have been used by researchers, to examine relationships in the nomological network of the self-concept construct. The first of these techniques is termed 'Criterion Group Study' (Campbell and Stanley, 1963). This type of investigation attempts to demonstrate how individuals representing distinct populations, score on a particular measure. For example, the mean self-concept score of a sample of high school students might be compared with the mean self-concept score of a sample of retired men and women, all over 65 years of age. Such studies seek to determine whether the predicted

differences between the two populations are supported. This technique was used by Offer, Ostron and Howard (1977), in their validation of the Offer Self-image Questionnaire. The instrument was given to a randomly selected group of adolescents in each of four cultures--United States, Ireland, Australia and Israel. Additional studies of self-concept utilizing this type of correlational technique, are Piers and Harris (1964), Trowbridge (1972) and Zirkel (1972).

A second popular correlational technique, is that of 'Exploratory Factor Analysis'. In this procedure, item scores from an instrument are factor analysed in an attempt to identify those items which cluster together and also, to determine whether the clusters can be interpreted meaningfully. For example, if a test is measuring that which its design purports to measure, the scores from items expected to measure a specific construct (eg. academic self-concept), should cluster together. Furthermore, this cluster should be distinct from a group of item scores designed to measure some other independent construct (eg. social self-concept). Should unanticipated clusters be found in the test, some revision of the instrument and/or definition is required.

Of particular importance to construct validation, are those correlational techniques that fit the observed data to some model which embraces viable counterhypotheses to the proposed construct interpretation (Shavelson et al., 1976).

3
'Multitrait-multimethod Analysis', proposed by Campbell and Fiske (1959), is such a model. This technique examines patterns of intercorrelations among two or more traits (eg. academic, social and physical self-concepts), as measured by two or more different methods (eg. self-reports, observations, peer-reports). As a case in point, if factor analysis of the construct demonstrates that academic self-concept is indeed, independent of social self-concept, this fact should hold true, when different methods are used to measure the same traits.

Campbell and Fiske (1959) contend that a multitrait-multimethod matrix is constructed from correlations between a) scores on different traits obtained by the same measurement instrument, b) scores on the same trait, obtained by different measurement methods and c) scores on different traits, obtained by different measurement methods. With the multitrait-multimethod matrix then, reliability is the agreement between two efforts to measure the same trait, through maximally similar methods. Validity is represented in the agreement between two attempts to measure the same trait, through maximally different methods.

'Confirmatory Factor Analysis' is a second type of technique that can be used to test hypothesized relationships with empirical data. This paradigm can be developed specifically from a logical analysis of the construct definition (Shavelson et al., 1977). For example,

in a definition of self-concept wherein it is perceived as having academic, social and physical components, one would expect scores reflecting an individual's self-concept in a specific academic subject area, to be more highly correlated with the academic, than the social facet. Similarly, one would expect these various elements of the academic component, to have very low correlations, if in fact they are at all related, with the elements belonging to the other two factors--- social and physical self-concepts. Confirmatory factor analysis then, can be used to test such hypotheses. This technique fits the observed correlations to the proposed model and then tests the goodness-of-fit of the data, to the model.

1.2.3 Experimental Techniques

True experiments, as outlined by Campbell and Stanley (1963), can be used to test some portion of the nomological network, against counterhypotheses. These experimental tests are based on logical analysis. Shavelson, Hubner and Stanton (1976) note that although most self-concept experiments are not designed to test counterhypotheses as to the proposed self-concept^o interpretation of their measurements, the results often relate to construct validity. For example, where a construct definition distinguishes between academic, social and physical self-concept components, an experiment in which specific

treatments have been designed to change only one dimension of self-concept (eg. social self-concept), provides a test of the within-construct portion of the nomological network.

1.3 LIMITATIONS UNDERLYING TRADITIONAL CONSTRUCT VALIDATION TECHNIQUES

As outlined above, there are a variety of techniques that can be used to validate construct interpretations of self-concept. These methods may be classified into three main categories--- logical, correlational and experimental analyses. However, Shavelson and Stuart (in press) argue that although these methods of construct validation are as applicable today, as they were thirty years ago, they exhibit several limitations, within the context of present-day application.

One such limitation, is the time required for the evolutionary process of construct validation. The traditional approach is viewed as a gradual process of identifying constructs and laws, which may take place over many years. Shavelson and Stuart (in press, p.3) consequent to personal communication with Lee Cronbach, argue that such an approach "...reflects the 1950's philosophy of science". They point out that while a complete specification of a nomological network is a commendable, albeit unreachable goal, measurements which assure self-concept interpretations, are needed immediately, in many areas of social research. For example, in the study of self-concept

in educational research, it seems reasonable according to Shavelson and Stuart (in press), to expect researchers to provide evidence on the causal relationship between self-concept and academic achievement, since this interpretation is sometimes explicit, but more often implicit, in their work.

A second limitation of the traditional approach to construct validation as pointed out by Shavelson and Stuart (in press), is its reliance on statistical rigor in the concern for interpretation, with little consideration for the generalizability of the results to other persons or settings. They contend that in the examination of the causal relationship between self-concept and academic achievement for example, the most defensible technique would be a true experiment, wherein subjects are randomly assigned to treatments representing variations in achievement; following treatments then, the self-concepts would be measured. However, reality presents many obstacles to this approach. First, ideally the study would have to be conducted in a laboratory. Due to the moral and ethical issues involved, it is highly unlikely that educators would permit a situation whereby certain children were denied the opportunity to maximally achieve. Second, it is likely that the treatment would have to be contrived, in that students would randomly receive treatments in which they were more or less successful, in their achievement. Finally, even if the

study were conducted, educators would demand replication of the findings. These problems and the demand for replication, represent an important issue of external validity.

As a consequence of, the aforementioned limitations, Shavelson and Stuart (in press) supported by Cronbach (1975), postulate that the time has arrived when construct validation theory must be updated. In response to this call, the alternative technique of causal modeling is proposed (see Bentler, 1978; Kenny, 1979; Shavelson and Stuart, in press). This procedure utilizes correlational data in natural settings and albeit a different approach, appears to approximate the requirements of the true experiment. Rogosa (1979) warns, however, that the absence of experimental control, forces a heavier reliance on statistical methods, in the assessment of causal effects. Nevertheless, Rogosa (1979) supports the notion that the determination of causal effects from nonexperimental data, can be successfully accomplished through the use of causal modeling (see also, Linn and Werts, 1977; Kenny, 1979; Bentler, 1980). Indeed, Heise (1975) asserts that in social science research, where so many political, practical and ethical problems serve to diminish the implementation of the classical experiment, the plausibility of causal analysis and inference without manipulation, is crucially important.

1.4 CAUSAL MODELING AS AN APPROACH TO CONSTRUCT VALIDATION

Counterinterpretations of a proposed construct, might suggest that the projected causal ordering of the construct with other constructs, does not hold (eg. academic achievement influences self-concept). In such cases then, causality becomes the central issue. Further, since causal interpretation involves two or more variables, randomized experiments are often inappropriate. Thus, correlational data must be brought to bear on causal interpretations. Causal modeling provides a method for approaching this problem.

By means of this procedure, correlational data are inspected, to determine whether the data are consistent with a given theory, or whether, given the data, the theory is inadequate. In this regard, Bentler (1978) notes that, although there is no methodology for proving a theory to be correct and although many theories may describe the data equally well, an incorrect theory can be rejected, should the data logically (theoretically) provide a reasonable test of the theory.

According to Rogosa (1979), a causal model is,

...an explicit and quantitative statement of the postulated causal links between the variables of interest. Through the use of causal models, substantive hypotheses are recast in terms of the causal processes assumed to operate among the variables under consideration (p.266).

Stated in another way, causal modeling denotes the testing of hypotheses as part of the analysis of an entire system of

nonexperimental data (Bentler and Woodward, 1979). The term 'modeling' signifies that the data analysis must be guided by theoretical specification; the term 'causal', that such a specification is intended to explain, rather than describe, the data.

The use of causal models, Rogosa (1979) argues, forces the researcher to make explicit, all causal assumptions, in an internally consistent system (see also, Duncan, 1975; Cooley, 1978; Kenny, 1979). Thus, the validity of causal interpretations, rests on its theoretical underpinnings. This fact leads Shavelson and Stuart (in press) to posit that the use of causal models in the examination of test scores, implies that the pertinent aspects of the nomological network are defined. The results of the empirical estimation of the model, rest on the interpretation of the measurement, the nomological network, or both.

In addition to providing favourable statistical tools for the assessment of causal effects in nonexperimental data then, causal models hold the potential to span the gap between theory and research (Anderson and Evans, 1974). Bentler (1978) points out that causal modeling can provide the basis for quantifying and operationalizing well-known concepts of construct validity and nomological networks, as outlined by Cronbach and Meehl (1955). Furthermore, in areas of research, where the theory includes ambiguous and

vague concepts, whose postulated causal links are not clearly defined, causal models can serve to alleviate the problem, by recasting theoretical formulations as explicit propositions about the causal relations among the variables of interest (Rogosa, 1979).

In order to test a theory (i.e. validate a construct) via causal modeling, the researcher must meet the criterion of model specification. That is to say, he must be able to make a mathematical translation of the hypothesized causal relationships among a set of variables within a theoretical framework, into a set of structural regression equations. Furthermore, the investigator should decide which mathematical aspects of the model require resolution from the data (parameter estimation) and those recognized as being given in mathematical form by the theory (fixed, known parameters) (Bentler, 1978).

To recapitulate then, model specification involves the selection of variables for inclusion in a causal model and the postulation of their causal links within a theoretical framework, together with a translation of same, into a set of structural regression equations. Once a model has been specified, its unknown parameters are estimated and the model, empirically verified. That is to say, the data are analysed, in order to seek support for or against the existence of the specified relationships.

Mistakes in the specification of causal models, are termed 'specification errors'. Such errors might occur consequent to, for instance, the omission of an important causal variable, and/or the inclusion of an erroneous variable. In other words, the study has been designed around an inadequate or inappropriate model (Duncan, 1975; Cooley, 1978). Cooley (1978), however, has noted that there are no statistical methods for guarding against specification error; rather, the problem is related to the amount of knowledge held by the researcher, concerning the phenomena under investigation.

Although it has been argued that indeed, most models contain some degree of specification error (Duncan, 1975; Cooley, 1978; Kenny, 1979), such misspecification is often not easily sighted. However, with specific reference to educational research, Cooley (1978) has pointed out that only if researchers are guided by increasingly adequately specified models, can a cumulatively improved understanding of educational processes be attained; strong models (i.e. adequately specified models) of course, resulting from sufficient knowledge of one's subject matter.

It is important to note that of course, causal modeling procedures cannot prove causality (Campbell, 1963; Bentler, 1978; Cooley, 1978; Rogosa, 1979). Rather, they serve to assist the researcher in selecting from among several relevant causal hypotheses. By putting the theoretical

model to the test for goodness-of-fit, the investigator is able to rule out those paradigms not supported by empirical evidence. As Rogosa (1979) notes, "...when theories are expressed as causal models, they are subject to rejection, if contradicted by data" (p.268). Obviously then, causal modeling makes the improvement of theories possible, through the ability to compare alternatives (Bentler, 1978).

Causal modeling represents a fairly recent approach to construct validation. Thus, until a few months ago (see Shavelson and Bolus, in press), to the best of this author's knowledge, only two methods of causal modeling had been used in the examination of the self-concept construct; these are: Path Analysis (Wright, 1921) and Cross-lagged Panel Correlations (Campbell, 1963; Pelz and Andrews, 1964; Campbell and Stanley, 1963). These techniques test hypotheses concerning the validity of the causality claims and determine the extent to which the observed data fit the model. A review of studies which have employed causal modeling in the analysis of the self-concept construct, is presented in Chapter II.

1.5 LIMITATIONS UNDERLYING CAUSAL MODELING TECHNIQUES USED TO DATE

Inherent in both path analysis and cross-lagged panel correlation as construct validation techniques, are several limitations that can be detrimental to the validity of the empirical results; these are now discussed briefly, with respect to each method.

1.5.1 Path Analysis



Although path analysis incorporates many of the attractive features of causal modeling, the technique possesses major shortcomings as a statistical operation. The major problem associated with inferences based on path analysis, arise as a result of measurement error (Asher, 1976; Rogosa, 1979; Cook and Campbell, 1979). To achieve estimation of all the structural parameters contained in a causal model, the researcher must meet the identification criterion; that is to say, he must establish an overidentified model (the concept of identification is discussed in Chapter 3). One method of satisfying this requirement, is to incorporate into the model, multiple measures of the observed variables. Path analysis, however, is limited in its ability to take advantage of multiple indicators. Rather, standardized partial coefficients are determined for the causal paths linking the observed variables, specified in the model. Rogosa (1979) notes that indeed, in these instances, measurement errors can have severe and bewildering effects on the obtained estimates. He therefore cautions that the coefficients obtained by means of a path analysis model, are not sound evidence upon which to base causal attribution (see also, Magidson, 1977). Furthermore, Rogosa (1979) points out that should multiple indicators be included in the path analytic model, the inclusion only works to distort and possibly reduce the causal attribution made to each of the multiple measures.

That path analysis is limited in its ability to specify measurement error, leads to yet another problem with its statistical procedures. To date, most studies using path analysis, have employed the procedure of ordinary least squares (OLS) to estimate the multiple regression equations (Rogosa, 1979). However, Johnston (1972) notes that when complex models are being investigated, and in particular, when it cannot be assumed that the variables are measured without error, OLS may not only yield biased estimates, but may not be estimating parameters of the basic underlying constructs. Rather, a more sophisticated estimation technique such as full-information maximum likelihood (FIML) is required to obtain simultaneously, unbiased estimates of all the parameters of the model.

Finally, there are problems specific to the use of path analysis in longitudinal research. In longitudinal studies, path analytic models frequently incorporate lagged regression equations; OLS is not sufficient for estimating lagged regression models (Hannan and Young, 1977; Rogosa, 1979).

The above limitations lead Rogosa (1979) to view negatively, the use of path analysis in assessing the causal effects among variables. Similarly, Cook and Campbell (1979) assert that although the estimates of specific causal paths might occasionally be feasible and valid, the pressure to construct a model permitting their estimation, "...leads

to omissions which render most of the conclusions suspect" (p.308).

1.5.2 Cross-lagged Panel Correlation Analysis

The cross-lagged panel correlation procedure has been the subject of much criticism (Duncan, 1969; Heise, 1970; Goldberger, 1971; Rogosa, 1979; Cook and Campbell, 1979). Rogosa (1979) notes that the problems lie with a combination of the underlying logic, technical properties and implementation of the method.

The measure of cause in cross-lagged correlations, results from the comparison of correlation coefficients between measured variables (rather than latent or unmeasured variables). An attribution of predominant causal influence, is made only when the difference between the sample cross-lagged correlation coefficients is statistically significant. This ultimate goal of establishing a causal "winner" is ill-advised, according to Rogosa (1979). Rather, he argues that since most social and developmental processes are reciprocal (indeed, this appears to be the case with the self-concept/ academic achievement relationship), that measures of strength and duration of the reciprocal relationship, and of the individual causal effects, are more informative and more directly interpretable.

Additionally, the difference of the cross-lagged correlations, does not guarantee unequivocal evidence regarding the predominance of causal direction. In fact, as Rogosa (1979) notes, in many instances, the predominance of causality is indeed, opposite to that of the causal structure built into the data. Also, it is possible to obtain a zero difference when important causal influences, both balanced and unbalanced, are present.

Another weakness with the technique, is the fact that it fails to determine the causal influence of a variable on itself, over time, thus rendering itself insensitive to changes in variability.

Cross-lagged panel correlations also suffer from the effects of both measurement and specification errors. With respect to the former, it was noted earlier, that in order to identify the model so that all causal parameters may be estimated from the data, multiple measures of each observed variable at each time point, are necessary. However, in the case of cross-lagged correlations, the use of single observable measures or multiple indicators, is quite complex. With one observable measure of each variable, the procedure employs a complicated correction procedure designed to disattenuate the cross-lagged correlations and to control for changes in reliability over time. Rogosa (1979) argues that regardless of the correction technique used, it is doubtful if any amount of correction would

render the cross-lagged correlation method even as good as estimation of an underidentified structural equation model. When multiple indicators of each variable are employed, the determination of causal influences becomes even more complex. Since no procedure exists for utilizing the data from all of the indicators simultaneously, each measure must be considered separately, in making the cross-lagged comparisons; measurement error is thus treated without the advantage of additional information from other indicators. With respect to specification error, claims are often made that cross-lagged correlations are not affected by omitted causal variables or by other forms of specification error (see Kenny, 1975). Rogosa (1980b) regards such claims as specious, contending that indeed, cross-lagged correlations are not immune to errors of specification. He argues that it is critical that complete specification of a model be satisfied, through the inclusion of all important causal variables.

Finally, in addition to the difficulties encountered in the relations among population parameters when cross-lagged panel correlation is used, Rogosa (1980b) notes two major problems with the application and interpretation of statistical inference procedures. First, he points out that too often, rejection of the null hypothesis of equal cross-lagged correlations is interpreted, with little regard for the power of the statistical test. On the one hand, researchers using cross-lagged correlation, are advised to

use large samples; with large enough samples, however, trivial deviations from the null hypothesis can lead to rejection. On the other hand, many investigators totally ignore sampling variation; with small sample sizes, differences between the sample cross-lagged correlations, are interpreted as if these sample estimates were population values. Rogosa (1980b) suggests that the use of interval estimates would be an improvement in this regard.

The second problem associated with statistical inference, is that significant differences between the cross-lagged correlations, are too often interpreted without regard for the assumptions underlying cross-lagged correlation. Rogosa (1980b) points out that the complete null hypothesis should be that the cross-lagged correlations are equal, conditional on stationarity. However, he notes that to date, no exact statistical test is available for this conditional test. Although Rogosa (1980b) suggests that methods such as covariance structure analysis (Joreskog and Sorbom, 1979), could be used to form a large-sample normal-theory test, he is quick to conclude that,

...of course, no improvement in the use of statistical inference procedures, can offset the basic deficiencies of cross-lagged panel correlation (p.257).

Clearly then, the validity of causal statements resulting from cross-lagged panel correlation analysis, are open to question. From the results of his most recent overview of the topic, Rogosa (1980b) concludes there is no

justification for the use of cross-lagged correlations. He argues that in cross-lagged correlation, both determinations of spuriousness and attributions of causal predominance, are ill-founded. In another recent review of this technique, Cook and Campbell (1979), making reference to their skeptical advocacy in earlier publications, stress their feelings of even stronger skepticism and even less advocacy today. Rogosa (1979, 1980a) goes as far as to suggest that in fact, cross-lagged correlation techniques are an unsound practice and should never be used.

Construct validation studies, with specific reference to self-concept, are now reviewed in Chapter II.

Chapter II

CONSTRUCT VALIDATION OF SELF-CONCEPT

A review of the literature regarding self-concept, reveals a profusion of imprecise and diverse definitions. Despite such imprecision and diversity, many self-concept definitions overlap in a number of ways. Shavelson et al. (1976) point out that in order to provide a working definition that is congruent with current research and can be used as a basis for integrating empirical evidence on the validity of self-concept interpretations, it is necessary to combine features common to each of the definitions. An attempt is now made to meet this requirement.

2.1 DEFINITION OF SELF-CONCEPT

In general terms, self-concept is a person's total perception of himself; in specific terms, it is his attitudes, feelings and knowledge about his abilities, skills, appearance and social acceptability (West and Fish, 1973; Labenne and Greene, 1969; Jersild, 1965). These perceptions which an individual holds about himself, are derived from his social environment and believed to provide the culminating force in directing his behavior; this

behavior in turn, influencing the ways in which he perceives himself.

Self-concept per se, does not exist as a separate entity; rather, it is inferred from observable behavior (Wells and Marwell, 1976; Labenne and Greene, 1969). These inferences of one's 'self' may be perceived by the individual himself, or by someone else. However, Shavelson et al. (1976) note that most educational studies of self-concept make a distinction between the terms 'self-concept' and 'inferred self-concept'. Use of the term 'self-concept' is restricted to an individual's perception of himself. The term 'inferred self-concept' has come to mean attributions of an individual's self-concept, as perceived by someone else. This study maintains the distinction between the two terms and focusses on the former.

Regardless of the perceptual source, however, self-concept is an inference which is derived from observable behavior. For the individual, such behavior is usually described in the self-report. Combs and Soper (1957) point out that like any other act, the self-report is a behavior which reveals in some degree, what is going on inside an individual i.e. how he perceives himself. It can be concluded then, that self-concept is a psychological construct (Soares and Soares, 1979; Labenne and Greene, 1969; Combs and Soper, 1957).

In their extensive review of the literature, Shavelson and his colleagues (1976) concluded that seven characteristics can be attributed to self-concept; these features being crucial to its construct definition. Accordingly, self-concept can be described as: organized, multidimensional, hierarchical, stable, developmental, evaluative and differential. Each of these characteristics is now addressed.

A primary feature of self-concept is that it is organized (see Purkey, 1970 for a more extensive explanation). An individual's perception of himself is based on a composite of all his experiences as a consequence of his social environment. Bruner (1965) claims that in order to reduce the complexity of these experiences, a person recodes them into simpler categories. Most of these categories are learned on the basis of experience and socialization within a particular culture. The organization of one's experiences into categories, is an attempt to make them meaningful to the individual.

A second characteristic of self-concept is that it is multidimensional. Indeed, most researchers it would appear, agree with this aspect of the construct definition (see eg. Piers and Harris, 1964; Coopersmith, 1967; Campbell, 1967; West and Fish, 1973; Michael, Plass and Lee, 1973; Shavelson, Hubner and Stanton, 1976; Scheirer and Kraut, 1979). In their attempt to amalgamate the operational

definitions gleaned from many studies, Shavelson et al. (1976) concluded that indeed, most definitions include an academic component. Additionally, they claim that the literature also supports the inclusion of social, physical and emotional components. According to Shavelson et al. (1976), one's general self-concept may be perceived as being subdivided into four major dimensions, one of which is academic (associated with academic phenomena) and the others, non-academic (associated with social, physical and emotional phenomena).

One exception to the viewpoint of multidimensionality, however, is that taken by Winne, Marx and Taylor (1977); they in contrast, perceive self-concept as a unitary construct, rather than one that is divided into sub-parts or facets in the nomological network. In their investigation of the within-portion of self-concept, as it is used in three widely used instruments--The Gordon 'How I See Myself' Scale (Gordon, 1968); The Piers-Harris Children's Self-concept Scale (Piers, 1969); The Sears Self-concept Inventory (Sears, 1964), Winne, Marx and Taylor (1977) found that although there was consistent evidence favouring the convergent validity of the academic, social and physical facets, little support could be demonstrated for discriminant validity for any of these components. Subsequent to a replication of this study (Marx and Winne, 1978), identical conclusions were drawn.

Thus, in the light of their research findings, Winne, Marx and Taylor (1977) suggest that the self-concept construct be conceptualized as resembling the structure of a daisy. They conclude that much of the construct is shared and relatively undifferentiable (the centre); concomitantly, each of the facets (petals) may be more or less relevant, when the self-concept is related to other constructs, such as academic achievement, social well-being, and so on.

Shavelson and Bolus (in press) have recently challenged the stand taken by Winne et al. (1977), with respect to the dimensionality of the self-concept construct. They have criticized the methodology of the Winne et al. (1977) study and point out three major limitations of the multitrait-multimethod (MTMM) design used. First, despite caveats (see Shavelson et al., 1976) regarding the interpretability of the instruments' original subscales, Winne et al. (1977) subjectively categorized the subscales pertinent to each instrument, as belonging to one of three facets---academic, social or physical. Second, the three instruments used in the study did not employ maximally dissimilar methods in eliciting responses; a necessary requirement for the MTMM design. Third, although Winne et al. (1977) performed correction for attenuation, the basic assumption of parallel tests, was not met.

In an attempt to clarify the theory with respect to the dimensionality aspect of self-concept, Shavelson and Bolus

(in press) rectified the methodological problems inherent in the Winne et al. (1977) study and subsequently reanalysed their data, using the same MTMM design. The results of this reanalysis, provide strong support for the notion that self-concept is indeed, a multifaceted construct.

A third feature of self-concept is that it is hierarchically structured with perceptions of behavior at the base, moving from inferences about oneself in specific subareas (eg. academic self-concept in science), to general subareas (eg. academic self-concept) and finally, to general self-concept at the apex.

Marx and Winne (1980) note that although nearly all self-concept inventories support the hierarchical model proposed by Shavelson and his associates (in press; 1976), their research does not offer the same support. Rather, their data indicate bipolar relations among the various facets of the construct. Thus facets may be inversely related, rather than proportionally so, as predicted by the hierarchical model. On the basis of their research, Marx and Winne (1980) suggest that the within-network relations of self-concept comprise compensatory components. That is to say, lower status on one component might be compensated by higher status on another component.

It is interesting to note that in their most recent empirical work, Shavelson and Bolus (in press) were also unable to show full empirical support for their proposed

hierarchical model; two aspects remain unconfirmed. First, their data did not support the assumption that facets of self-concept become increasingly stable toward the apex of the hierarchy; rather, they were shown to be equally stable. Second, support was not provided for the interpretation that changes in self-concept operate from the base of the hierarchy, upward.

Despite past support for the hierarchical character of self-concept, it appears that more sophisticated methodological approaches to construct validation research, are beginning to cast doubt on this particular feature.

A fourth characteristic of self-concept is that general self-concept is stable. Combs and Soper (1957) note that it is this degree of stability and consistency, which makes the individual and his behavior, fairly predictable. Shavelson et al. (1976) point out, further, however, that as one descends the hierarchy, self-concept gradually decreases in stability, while concomitantly increasing in dependency on specific situations. As mentioned in the discussion of the last feature (hierarchical structure), recent studies (Shavelson and Bolus, in press; Marx and Winne, 1980) have produced data which now challenge earlier beliefs regarding the stability of self-concept.

A fifth feature of self-concept is its developmental quality. Self-concept becomes increasingly differentiated as an individual develops from infancy through to

adolescence; each developmental period providing new learnings to his growing store of experiences. That self-concept becomes increasingly differentiated and stable with age, has been empirically demonstrated with: preadolescents (Fu, 1979; Yamamoto, Thomas and Karns, 1969; Long, Henderson and Ziller, 1967); adolescents (Rubin, Dorle and Sandidge, 1977; Long, Ziller and Henderson, 1968; Egge, 1959) ; comparison of both groups (Rubin, 1978; Drummond, McIntire and Ryan, 1977).

A sixth feature of self-concept is its evaluative aspect. According to Shavelson et al. (1976), an individual can both describe himself in a particular situation (eg. I do well in science) and evaluate himself (eg. I do better in science, than most of my friends). Further, this evaluative dimension of self-concept appears to vary in importance, for different individuals and within different situations (see eg. Marx and Winne, 1980). To date, however, there is still no clear distinction between the descriptive and evaluative aspects of self-concept (see Winne and Marx, 1981; Shepard, 1979).

Finally, a seventh feature of self-concept is that it is differentiable from other constructs with which it is theoretically linked (see Shavelson and Bolus, in press). This aspect of self-concept is reviewed more extensively later in the chapter, under the rubric of between-network studies.

In summary then, self-concept can be conceptualized as a construct which is inferred by an individual, through observation of his own behavior; the individual's attitudes, feelings and cognitive processes, forming the major components of his self-concept. The self-concept is developed through accumulated experiences in social interaction with others and becomes increasingly differentiated as one progresses from infancy through adolescence. Additionally, self-concept is characterized as being organized, multidimensional, hierarchical, stable, evaluative and differentiable.

2.2 CONSTRUCT VALIDATION STUDIES OF SELF-CONCEPT

As noted in Chapter I, in order to validate a construct, it is necessary to gather empirical evidence pertaining to both the within and between-portions of the nomological network. Both kinds of theoretical relations in turn, determine the operationalization of the construct in subsequent empirical work and influence interpretations of relations among its facets and between the construct and other variables. Empirical studies which examine the within and between-network relations of self-concept specific to academic achievement, are now reviewed.

2.2.1 Within-network Studies

Within-network studies investigate the relations among the proposed facets of a construct (eg. academic, social and physical measures of self-concept) and/or whether the facets are differentiable from one another. Additionally, within-network studies may examine other features of the construct definition such as its stability, developmental character or hierarchical structure. It should be noted that all within-network studies examined by this investigator, also included one or more external constructs.

2.2.1.1 Correlational Studies

Exploratory factor analysis was used by Gleser, Winget and Rauh (1977) in their validation study of a new 40-item behavioral checklist, The Adolescent Life Checklist. Other investigations that have employed exploratory factor analysis to validate self-concept interpretations of subtest scores, are those conducted by Fernandes (1978), Gordon (1968) and Piers and Harris (1964).

Multitrait-multimethod matrix analysis has been used by Dyer (1963), in the validation of the Self-esteem Inventory developed by Coopersmith (1967). Shavelson, Hubner and Stanton (1976) also used this technique, in their attempt to validate the construct of self-concept through their review of five major self-concept instruments. Recent studies by Lakey (1977) and Shepard (1979), have employed the

multitrait-multimethod matrix. to validate measures of student self-concept, together with attitudes towards school and self-acceptance, respectively. Winne, Marx and Taylor (1977) conducted a multitrait-multimethod matrix study, in which the facets of self-concept, as defined by subscale labels in three self-concept instrument manuals, were compared. In a followup investigation, Marx and Winne (1978), replicated their former study in a different geographical location, using an entirely different sample of individuals. Finally, Soares and Soares (1980) sought to test the diverse perspectives of self, as determined by distinct situations and individual perspectives, within a multitrait-multimethod matrix framework.

Confirmatory factor analysis was employed by Kokenes (1974) in her construct validation study of the Coopersmith (1967) Self-esteem Inventory. Comparisons were made between the items which loaded into the factors in her study, with those items included in the subscales by Coopersmith (1967), as measuring self-esteem derived from self, peers, parents and school. This technique was also employed by Torshen (1969, cited in Shavelson et al., 1976) in her investigation of classroom evaluation, as it relates to students' self-concepts and their mental health.

2.2.1.2 Experimental Studies

One example of the experimental technique used to validate the self-concept construct, is provided through examination of a study conducted by Ludwig and Maehr (1967). They attempted to determine the effects of success and failure in athletic tasks, on physical and general self-concepts, among junior high school boys. Subjects were randomly assigned to one of the following groups: positive feedback, negative feedback or control. In the two experimental groups, feedback was either consistent or inconsistent with the student's ability.

Unfortunately, as noted by Shavelson, Burstein and Keesling (1977), studies which test counterhypotheses experimentally, are not often found in the self-concept literature. Bentler (1978), however, points out that in the area of social science research, true experimentation is difficult, if not, impossible to execute (see also, Calsyn and Kenny, 1977; Kenny, 1979). This fact, no doubt, is a consequence of the moral and ethical considerations that must be respected when working with human subjects. In this regard, Gordon (1969) points out the caveats issued by governmental agencies and universities, that researchers respect the privacy and well-being of their subjects. With specific reference to self-concept and academic achievement, Calsyn and Kenny (1977) note that being subject variables, they cannot be manipulated easily in a true experiment.

Therefore, self-concept researchers in education, have relied almost exclusively on correlational data.

2.2.1.3 Causal Modeling Studies

To the writer's knowledge, only two studies to date have attempted to validate the within-network of the self-concept construct, via a causal modeling technique. The first study employed path analysis; the second, a structural equation model.

Using a subset of data from a larger investigation of the achievement processes of youth, Rosher and Howell (1978) utilized path analytic techniques in their examination of disabled and nondisabled 10th grade students, with respect to certain socio-demographic variables---curriculum track assignment, self-concept dimensions and educational and occupational aspirations. The findings revealed that the measures of social self-concept and physical self-concept, regressed on curriculum track and social origin variables separately, tended not to be appreciably influenced by disability status; academic self-concept, however, was greatly influenced. Additionally, academic self-concept was shown to have an impact on the aspiration variables. Rosher and Howell (1978) suggest that the significance of the impact of disability status on the academic self-concept, might be best explained as an overcompensation in one particular field, where there is a weakness in another (c.f. Marx and Winne, 1980; Winne and Marx, 1981).

Using a structural equation model, Shavelson and Bolus (in press) sought to accomplish two tasks: 1) to test the structural underpinning of the self-concept definition with respect to its multidimensionality, hierarchical structure with increasing stability in the direction of the global perspective and differentiation from academic achievement and 2) to examine the causal predominance between self-concept and academic achievement. Specifically, the study was designed to measure the following: general self-concept, academic self-concept, subject matter specific self-concepts in English, mathematics and science, academic achievement in English, mathematics and science.

The original sample for the Shavelson and Bolus (in press) study comprised 130 7th and 8th grade junior high school students. A battery of six self-concept instruments were administered to the students during one 50-minute class period in February, 1980. The following day, the students were given a standardized test. This initial data collection occurred two weeks after the students had received their first semester grades. Data collection replicating the procedures in February, was conducted again in June, 1980, one week prior to the end of school. Due to the mortality of cases for a variety of reasons, the final sample consisted of 99 students; 50 males and 49 females.

Two measures of each self-concept and academic achievement construct were obtained. General self-concept was measured using the 'How I Feel About Myself' 4 scale

(Piers and Harris, 1964) and the Tennessee Self-concept Scale (Fitts, 1965). The Self-concept of Ability Scale (Brookover, 1962) was divided into two parallel tests and used as measures of academic self-concept. Subject matter self-concept was measured using Form B of the Brookover (1962) instrument. Items on Form B are identical to those on Form A, with the exception that the former elicits responses relative to a specific subject matter area (eg. how do you rate your ability in English, compared with your close friends?). The subject matter self-concept scales were each divided into two parallel tests which were used as measures of self-concept in English, mathematics and science. Finally, academic achievement was measured using first and second semester grades in English, mathematics and science; these were obtained from students' files and converted to a 13-point numeric scale (A+ = 13, A = 12, ---, F = 1).

Consequent to their study, Shavelson and Bolus (in press) have drawn the following conclusions with respect to the self-concept construct:

1. Self-concept is a multidimensional construct. General self-concept can be interpreted as distinct from, although correlated with academic self-concept. Additionally, subject matter specific facets of self-concept can be interpreted as distinct from, but correlated with one another and with academic and general self-concept.

2. Self-concept is a hierarchical construct with general self-concept at the apex and situation-specific self-concepts at the base. However, the data were unable to support the assumption that facets of self-concept become increasingly stable toward the apex of the hierarchy. Rather, the facets were found to be equally stable.
3. Self-concept can be distinguished from academic achievement. The relationship between grades and subject matter self-concept was found to be stronger than the relationship between grades and academic self-concept.
4. Causal predominance between self-concept and academic achievement was unable to be determined.

2.2.2 Between-network Studies

Between-network validation studies examine the relationship between a construct or its facets, with some other construct. The review of empirical studies here, will include only those which examine the relationship between self-concept and/or its academic component (academic self-concept) and academic achievement.

A review of studies that have investigated the relationship between self-concept and academic achievement since 1960, is evidence that the relationship holds true, regardless of grade level, race, ethnicity, age, sex, socio-

economic status and physical or mental disability. A brief overview of a few of these studies is now presented.

2.2.2.1 Correlational Studies

Although most studies which examine the relationship between self-concept and academic achievement are of a correlational nature, they may be categorized into two groups; studies concerned only with determining an associational relationship between the constructs and those which focus on determining causal direction. Studies designed to examine a relationship only, are reviewed first.

In an effort to determine whether a positive association between self-concept and academic achievement was evident in very young children, Lamy (1965) investigated the relationship between children's self-perceptions while in kindergarten and their subsequent reading achievement in grade one. She concluded that a child's perceptions of himself, is indeed, related to his academic performance in school. In their investigation of the correlates of self-concept in children, Piers and Harris (1964) collected data from students in grades 3, 6 and 10. They found the correlation between self-concept and academic achievement to be positive, but low. The relationship appeared to be strongest at the grade 6 level (0.32). This value is comparable to the correlation of 0.36 reported by Coopersmith (1967) in his study of students in grades 5 and

6. Butcher (1968) and Mintz and Muller (1977) also examined the relationship between these variables with respect to elementary school students (grades 3-6 inclusive and grades 4 and 6 respectively). Their results concurred with previous findings in demonstrating a positive but low correlation between self-concept and academic achievement. Mintz and Muller (1977), however, suggested that the selection of inappropriate instruments may have led to spuriously low correlations, while Butcher (1968) intimated that the instruments used in his study, were not totally adequate for the task.

In an extensive research study which comprised three separate projects spanning a 6-year investigation, Brookover and his associates (1962, 1965, 1967) tracked students in one grade 7 class, through to the 12th grade, in an effort to determine the relationship of students' self-concepts to their academic achievement. They reported that self-concept of ability (i.e. academic self-concept) is significantly and positively related to academic achievement among both boys and girls. Furthermore, this relationship is substantial, even when IQ is controlled. In a more recent study at the secondary school level, Mitchell (1979) investigated the extent to which high school students attribute the grades they receive in school, to four perceived causes: ability, effort, task difficulty and luck. He found that both causal attribution and self-assessment variables exhibited

significant relationships with academic achievement; the self-assessment variables figuring more importantly as independent variables, than those of causal attribution. At the college level, Bailey (1971) in determining differences in self-perceptions between achieving and under-achieving students, concluded that indeed, a student's academic self-concept plays a crucial role in his level of academic achievement.

In a study of black students, Caplin (1966, cited in Purkey, 1970) found that children who demonstrated more positive self-concepts, tended to attain higher degrees of academic achievement. In a later study (1969), Caplin studied 60 black and white children from intermediate grades of two elementary schools. Again, he found a significant positive relationship between self-concept and academic achievement. Additionally, he found no significant differences between the sexes; Piers and Harris (1964) reported similar findings for elementary school children. It appears therefore, that the relationship between self-concept and academic achievement may be the same in both black and white American children at the elementary school level. Similarly, with respect to ethnicity, Evans and Anderson (1973) in their investigation of 102 Anglo-American and Mexican-American junior high school students, found a positive correlation between self-concept and academic achievement.

In response to the American government's concern for equality of educational opportunity for the disadvantaged, Coleman's (1966) extensive study of public schools in the United States, revealed that indeed, attitudinal variables accounted for more variation in academic achievement, than any other set of variables, including all family background and school variables. That self-concept is closely related to academic achievement, is deemed reasonable by Coleman (1966), since it represents an individual's own estimate of his ability. Additionally, Coleman (1966) found no significant difference among the socio-economic strata, with respect to the self-concept/academic achievement relationship. Soares and Soares (1969) and Trowbridge (1972), in studies involving disadvantaged students in both elementary and secondary schools, drew similar conclusions.

A growing body of research concerning the disabled, indicates that the relationship between self-concept and academic achievement parallels that associated with the non-disabled. In 1969, Joiner and his associates replicated Brookover's (1967) study, in an attempt to generalize the findings to the acoustically-impaired. The sample for the Joiner et al. (1969) investigation, included two groups of acoustically-impaired adolescents from separate educational institutions.. Not only did these researchers find the relationship between academic self-concept and academic achievement to be positive, but additionally, that a

student's perception of his academic ability is more highly related to academic performance than is IQ. Similarly, Smith (1979); in his investigation of school-verified learning-disabled children ranging from 7 through 12, concluded that a child's self-concept is definitely related to his academic achievement. Finally, Park (1980) confirmed the same results, with respect to the moderately mentally retarded. His findings, following a study of 50 individuals of ages 9 through 21, demonstrated that the relationship between self-concept and academic achievement for moderately mentally retarded individuals, is indeed, consistent with that reported for the non-retarded. That is to say, there is a significant and positive relationship between self-concept and school performance.

Judging from this brief overview of studies with findings generalized to different populations, there appears to be unquestionably, a persistent relationship between one's self-concept and his/her academic achievement. The presence of a correlation between two variables, of course, does not in itself, establish a causal relationship (Lavin, 1965; Glass and Stanley, 1970). However, as Calsyn and Kenny (1977) point out in their investigation of causal predominance between self-concept and academic achievement, most educators and researchers are willing to concede that the relationship is at least, reciprocal.



Nevertheless, there are many educational researchers who believe the self-concept/academic achievement relationship is asymmetrical. Judging from the preponderance of studies over the past fifteen years, considerable disagreement exists concerning the direction of this causal asymmetry. There are researchers who posit that self-concept influences academic achievement. Conversely, there are others who argue with equal conviction, that academic achievement determines self-concept.

Many of these studies are now reviewed. An attempt has been made to examine studies applicable to four levels of the educational process; these are, preschool, elementary school, secondary school and college.

Self-concept Influences Academic Achievement

There appears to be little argument with the notion that one's self-perception plays a major role in influencing one's behavior. With this rationale as a base, many researchers have concluded that self-concept stands in a causal relationship with academic achievement.

In an investigation to determine the antecedent phenomenon in the relationship between poor self-concept and reading disability, Wattenberg and Clifford (1964) obtained measures of mental ability and self-concept for children in their first semester of kindergarten. Two and one-half years later, measures were obtained of their progress in reading, and the self-concept measures repeated. The

results showed the measures of self-concept to be antecedent to and predictive of, reading achievement in the second grade. Wattenberg and Clifford (1964) concluded that self-concept measures of kindergarten children are significantly predictive of their later achievement levels in reading ability. A study conducted one year later by Lamy (1965), demonstrated similar results. Her findings led her to suggest that the perceptions of a young child about himself, are not only related to, but may in fact, be causal factors in his subsequent reading achievement.

At the elementary school level, Campbell (1967) examined the relationship between self-concept and academic achievement of 4th, 5th and 6th grade students. He reported support for the hypothesis of a positive relationship between self-concept and academic achievement. Subsequent to his own study, in addition to a review of six doctoral dissertations and other research conducted in the 1950's and early 1960's, Campbell (1967) concluded that although findings appeared to conflict somewhat, the weight of the evidence suggested that self-concept does make a difference, in its influence on academic achievement. Similarly, Brookover and his associates (1962, 1964, 1965, 1967) concluded from their studies, that changes in the self-concept of ability of students, were associated with parallel changes in academic achievement.

Pugh (1976) examined data from a sample of 5,236 senior high school students from 13 Connecticut schools. Using path analysis, he attempted to estimate reciprocal relationships between student self-concept and academic achievement. Pugh (1976) found that among white students, both self-concept and educational aspirations were significant determinants of academic achievement; for black students, the impact was very weak. A more recent study by Moyer (1980), tested the causal associations between self-concept (SC), locus of control (LC) and academic achievement (AA), at the secondary school level; the sample comprised 6,198 high school students. Each relationship (SC/AA; SC/LC; LC/AA) was tested using both cross-lagged panel analysis and path analysis. Both analytic techniques found general support for the causal impact of self-concept on academic achievement. This relationship was shown to be much stronger, however, using cross-lagged panel analysis. Although the cross-lagged panel analysis also identified a causal relationship from academic achievement to self-concept, this association was much weaker than the self-concept to academic achievement causal direction. In their study of Anglo-American and Mexican-American junior high school students, Evans and Anderson (1973) found that regardless of the amount of English spoken in the home, Mexican-American students exhibited lower self-concepts of ability, than their Anglo-American peers; concomitantly,

they attained lower levels of academic achievement. In the explication of their findings, Evans and Anderson (1973) suggested that the low achievement levels of the Mexican-American students were the result of their low self-concepts of ability; these in turn, being a function of socialization factors associated with the culture of poverty.

At the college level, Bailey (1971) sought to determine differences between achieving and under-achieving students with below average college ability. His results led him to conclude that indeed, a student's self-concept of ability plays a crucial role in his level of academic achievement. Kubiniec (1970) investigated the relationship between self-perception and relative achievement success in the freshman year in college. The sample comprised 468 incoming freshmen; this represented 20% of the total freshman class (N=2281). The findings of this study supported the predictive value of self-theory. More specifically, academic success in college can be predicted by the measurement of global perceptions of oneself and one's environment.

The overall conclusion from a review of the above studies is apparent; a student holds certain attitudes about himself and his abilities, which ultimately, have a strong impact on his academic performance in school. In contrast, however, it cannot be denied that scholastic performance has a heavy influence on attitudes that a student develops about himself

and his abilities. Studies in support of the latter view, are now reviewed:

Academic Achievement Influences Self-concept

Bridgeman and Shipman (1978) conducted a longitudinal study on 404 children from predominantly low-income areas. They sought to determine the relationship of preschool, kindergarten and first grade measures of self-esteem and achievement motivation to reading, mathematics and problem-solving performance in the third grade. Bridgeman and Shipman (1978) found that whereas self-esteem scores tended to be generally high in the preschool years and the first grade, there was much greater variance among the scores in the third grade. Additionally, self-esteem scores in grade 3, were more strongly related to concurrent achievement measures. These results led Bridgeman and Shipman (1978) to conclude that a student's self-concept of his ability in school, develops as a reaction to, rather than as a cause of, his achievement level in school.

There appears to be general agreement among researchers who have examined the effects of success and failure on an individual's self-evaluation, that those who under-achieve scholastically or who do not meet their own academic expectations, suffer significant losses in their self-esteem (Purkey, 1970). One such study of grade 5 students, was that conducted by Ames (1978). She probed the question of how children, high and low in self-concept, react to success

and failure achievement outcomes. The results of this study showed that for children with high self-concepts, experiences of success, served to further heighten their self-esteem; conversely, experience of failure, had negative effects on their self-esteem. The findings, with respect to the low self-concept children, were reported as confused and thus no definite conclusions were drawn. Another study of the effects of success and failure on the self-concepts of elementary school children, was conducted earlier by Gibby and Gibby (1967). Using a sample of 60 students, the investigators explored the effects of stress induced by academic failure, on 7th grade students. Their findings indicated that under the stress of a failure situation, students not only performed less effectively, but also tended to regard themselves less highly.

Kifer (1975), however, argues that success/failure, of and by itself, is not sufficient. Rather, he contends that it is the pattern of success/failure and the accumulation of experiences, which affect an individual's self-concept. His longitudinal study of students from grades 2 through 8, queried how school achievement performance and personality characteristics including self-concept, are related over time and over a series of tasks. Kifer's (1975) findings revealed that successful achievement is antecedent to a positive self-concept. Furthermore, he found that the relationship became stronger and more powerful, as

success/failure became prolonged and as a consistent pattern of accomplishments emerged.

From his investigation of 147 school-verified learning-disabled children, Smith (1979) concluded that learning-disabled children utilize knowledge of their relative academic performance capabilities, in forming and maintaining their self-concepts. He noted that although all students had experienced academic difficulty in the regular classroom, they tended to compare their own performance with that of only those students with comparable deficiencies (see Rosenberg, 1968, for a more extensive discussion of reference groups).

Calsyn and Kenny (1977) attempted to determine the direction of causal predominance among self-concept of ability, perceived evaluations of others and academic achievement, for 556 adolescents. Their study was a reanalysis of the Brookover et al. (1962, 1965, 1967) data, over a five-year period, using a cross-lagged panel design. The results of the Calsyn and Kenny (1977) study revealed two major findings. First, academic achievement was found to be causally predominant over self-concept of ability. This factor appeared stronger in females than in males, although less pronounced with the high socio-economic group. Second, contrary to the Brookover et al. (1962, 1965, 1967) findings, both self-concept of ability and academic achievement were found to be causally predominant over perceived evaluations of others.

In a comparison study of educable mentally retarded children in special classes, with non-retarded youngsters 8 through 16 years of age, Hayes and Prinz (1976) found that students in both IQ groups, attributed a positive effect to themselves, following success. Subsequent to a failure situation, however, the educable mentally retarded children tended to be less negative in their feelings towards themselves, than were the non-retarded children.

Using a reading improvement course as the vehicle for achievement, Roth (1959) sought to investigate the relationship between self-concept and academic achievement, among college students. His results demonstrated that those college students whose reading ability improved as a consequence of the course, showed much higher self-concepts than those who did not improve, or who dropped out of the course. In another study of college students, Centi (1965) found a very strong pattern of low self-esteem among low achievers. He examined the self-reports of college freshmen, before courses formally commenced and subsequent to the receipt of first semester grades. Centi's (1965) findings revealed that students who received poor grades, did exhibit losses of self-esteem. Those students who continued to be low achievers, tended to pursue a self-defeating pattern. Following initial rationalization of their academic performance, these students developed hostility and dissatisfaction towards the course, the

professor, their classmates and finally, school itself. Ultimately, they avoided study, thus precipitating further decline in their academic achievement.

Finally, in an extensive survey of the literature, Scheirer and Kraut (1979) reviewed eight published studies of intervention programs, designed specifically to increase the self-concepts of students, with a view to increasing their academic achievement. This review included studies of various groups of children at different school grade levels. Additionally, Scheirer and Kraut (1979) examined the results from eighteen unpublished doctoral dissertations since 1971, which reported research on attempts to increase academic achievement linked with self-concept change. Following their review, Scheirer and Kraut (1979) concluded that the only studies that indicated some possibility that self-concept intervention might succeed, were those conducted by Brookover and his associates (1962, 1965, 1967). However, as noted earlier, reanalysis by Calsyn and Kenny (1977), revealed academic achievement as causally stronger than self-concept and therefore supports Scheirer and Kraut's (1979) general conclusion that self-concept is an outcome variable, rather than a causal variable. Similarly, corresponding findings from his landmark study, led Coleman (1966) to posit that the relation of self-concept to achievement, "is probably more a consequence than a cause of scholastic achievement" (p.320).

With reference to the common belief of many educators and that which underlies most intervention programs, that improved self-concept leads to greater academic achievement, Rubin, Dorle and Sandidge (1977) have noted that nowhere has this fact been convincingly demonstrated (see also, West and Fish, 1973). Finally, given the postulated hierarchical structure of self-concept (Shavelson et al., 1976), Shavelson and Stuart (in press) conclude that while causation is probably reciprocal, academic achievement is causally predominant.

2.2.2.2 Experimental Studies

Gibby and Gibby (1967) employed an experimental design in their investigation of the effects of stress, induced by academic failure, on 7th grade students. Two classes established for academically superior children, provided the sample for the study; none of the children had ever experienced failure. Both classes were given three tests. Immediately prior to the last test, however, the students in the experimental group were each given pieces of paper stating that they had failed the previous test. The results from this study showed that under the stress of a failure situation, the children's self-concepts diminished.

As noted earlier, experimental studies are not often found in self-concept research. The writer was only able to find the one study above, which used the experimental

technique to investigate the between-portion of the self-concept nomological network.

2.2.2.3 Causal Modeling Studies

As noted in Chapter I, with the exception of the Shavelson and Bolus (in press) study, only two types of causal modeling have been used in construct validation studies of self-concept; these are path analysis and cross-lagged panel correlation. Studies which investigated the between-portion of the self-concept network are now reviewed.

Pugh (1976) used path analysis to estimate reciprocal relationships between student self-concept and academic achievement among high school students. He concluded that among white students, self-concept and educational aspirations were significant determinants of academic achievement; among blacks, the impact was minimal. In a longitudinal study spanning eight years, Bachman and O'Malley (1977) employed path analysis to investigate the relationships among self-esteem, educational and occupational attainment, for 1600 young men, between the time they were in grade 10, through to seven years later. These findings revealed that the correlation between self-concept and academic achievement, is much stronger in the early high school years and gradually becomes weaker, during the senior years and following graduation from high school.

The investigators (Bachman and O'Malley, 1977) postulated that perhaps academic achievement becomes less dominant in its influence on the self-concept, during the later school years.

Other between-network studies have employed the cross-lagged correlational technique to validate aspects of the self-concept construct. One such study conducted by Calsyn and Kenny (1977), used cross-lagged panel correlations to reanalyse five years of data originally collected by Brookover and his associates (1965, 1967), to provide information pertinent to the controversy at issue between the self-enhancement theorists and skill-development theorists, concerning the causal relationship between self-concept and academic achievement. Contrary to the Brookover (1965, 1967) findings, Calsyn and Kenny's (1977) results fully supported the skill development model of education. In other words, Calsyn and Kenny (1977) found that academic achievement influences self-concept (the reverse of the Brookover findings).

In a similar study, Crano and Mellon (1978) used cross-lagged panel correlations to investigate the causal interplay of teachers' expectations and children's academic performances. This research project was conducted over a period of four years and involved 4,300 British beginning elementary school children. The results of the Crano and Mellon (1978) study showed teachers' expectations and evaluations of children's social development, to have

greater impact on later academic performance, than those expectations concerned solely with academic status.

Finally, Moyer (1980) employed both path analysis and cross-lagged panel correlations to test the causal associations between self-concept, locus of control and academic achievement. Although both methods of causal modeling found general support for the causal impact of self-concept on academic achievement, the relationship using cross-lagged panel correlations, was found to be slightly stronger than that which resulted from the use of path analysis. The cross-lagged panel correlation method also identified a causal association from academic achievement to self-concept; this link being weaker than the former (self-concept to academic achievement). Generally speaking, however, the cross-lagged correlations were low ($r < 0.20$), indicating only a slight causal relationship between the constructs. Moyer (1980) concluded that the demonstration of weak causal relations among the variables, makes it appear unlikely that a change in one construct would have an immediate and significant effect on the other. Thus, he suggests these results may explain why programs designed to increase academic achievement by enhancing the self-concept, have met with only limited success.

2.3 INTERPRETATION OF THE EMPIRICAL FINDINGS

The existence of a relationship between self-concept and academic achievement, across a variety of populations, appears to be well-established. In fact, this author was able to discover only one study (Williams, 1973) which failed to find any significant link between these variables. On the other hand, it is clear from this review of cross-sectional and longitudinal studies, that a causal direction, if any, has not yet been determined. This conclusion supports the findings from other reviews of the literature (Purkey, 1970; Zirkel, 1971; West and Fish, 1973; Shavelson, Hubner and Stanton, 1976; Scheirer and Kraut, 1979). In fact, the findings from a very recent study investigating the direction of causality between self-concept and academic achievement, have led Shavelson and Bolus (in press) to suggest that causal predominance probably cannot be ascertained.

While the profusion of self-concept studies conducted over the years has been impressive, many researchers (Zirkel, 1971; West and Fish, 1973; Shavelson, Hubner and Stanton, 1976; Scheirer and Kraut, 1979; Wylie, 1979) have expressed concern, bewilderment and utter dismay, with the degree to which inconsistency and indeterminacy pervade the research findings. Wylie (1979) expresses very aptly, the apparent consensus of opinion among reviewers of the literature, concerning the state-of-the-art, when she asserts,

It is fascinating that hundreds of thousands of research hours have been devoted to studying self-concept variables, especially overall self-regard, and that both lay persons and professional individuals from many disciplines evidently continue to be impressed with the importance of the topic, despite the paucity of definitive findings and indeed, despite numerous resounding failures to obtain support for some of their most strongly held hypotheses (p.685).

As a body of research, however, self-concept studies have been subjected to a plethora of criticism. In the early 1960's, Crowne and Stephens (1961) and Wylie (1961) questioned the validity of interpretations of self-concept measurements (see also Dyer, 1963; Diggory, 1966; Wylie, 1968; Bilby, Brookover and Erickson, 1972; Wylie, 1974; Wells and Marwell, 1976; Lakey, 1977; Mintz and Muller, 1977; Scheirer and Kraut, 1979). Today, almost twenty years later, Wylie (1979) still contends that the weaknesses of the findings may be attributable in part, to shortcomings in the theory, measurement and/or research methods.

That self-concept research continues to be plagued with problems of measurement then, also appears well-founded. These problems are now addressed.

2.4 PROBLEMS OF MEASUREMENT IN SELF-CONCEPT RESEARCH

One of the major problems associated with the interpretations of self-concept measurements, is the blatant lack of any clear, concise and universally accepted definition of self-concept. In her classic review of self-concept measurements, (Wylie, 1974) reported that

theoretical statements with reference to self-concept, have not exhibited sufficient clarity, as to lead researchers to agree on any particular operational definition for the construct. In this regard also, La Benne and Greene (1969) have argued that indeed, the term 'self-concept', has been virtually all that most research studies have had in common. In fact, Shavelson, Hubner and Stanton (1976) actually distinguished seventeen different conceptual dimensions on which the multiplicity of self-concept definitions could be classified. Similarly, Zirkel (1971), in his review of the literature with respect to the disadvantaged, counted fifteen definitions of self-concept that were explicitly cited; additionally, he found several other definitions that were implicit in the selected instruments and designs of various studies.

With reference to the research concerned only with the relationship between self-concept and academic achievement, the degree of specificity associated with the self-concept construct, poses a constant obstacle to any attempts to establish equivalencies among research findings. Many researchers, albeit that they use a variety of terms, imply a global notion of 'self-concept.' A sample of these terms include, 'self-concept' (Ames, 1978); 'self-esteem' (Bridgeman and Shipman, 1978); 'self-perception' (Centi, 1965); 'self-assessment' (Mitchell, 1979); 'self-evaluation' (Borislow, 1962) (see Wells and Marwell, 1976, for a more

extensive coverage of 'global terms'). Other researchers award the construct a more specific orientation, by use of terms such as: 'self-concept of ability' (Brookover et al., 1962, 1964, 1965, 1967, 1975); 'academic self-concept' (Vitale, 1980); 'ability self-concept' (Almaguer and Daniel, 1981).

Given the definitional imprecision of the term 'self-concept' then, it becomes extremely difficult, if not impossible, to specify: a) the population of items from which a representative sample would be drawn for an instrument and b) the population of subjects for which the measurement techniques and interpretations, would be appropriate (Shavelson et al., 1976).

A second problem in the interpretation of self-concept measures, arises consequent to the lack of equivalence among the diverse instruments used by researchers. Indeed, for many studies, investigators have developed their own instruments, to accommodate a specific population and to serve the purposes of their own particular problem (Wylie, 1974; Wells and Marwell, 1976; Lakey, 1977). This fact led Shavelson et al. (1976) to speculate that "...the number of different measurement techniques is increasing almost as rapidly as the number of self-concept studies" (p.409). Similarly, Wells and Marwell (1976) have noted that the most striking aspect of the updates of earlier reviews of self-concept measurement by Crandall (1973) and Wylie (1974), is

their findings that the qualitative state-of-the-art had not changed much since 1961, except for the addition of many new instruments (see Mitchell, Reynold and Elliott, 1980, for recent growth figures regarding personality instruments in general). In addition to being infrequently tested for reliability and validity, such instruments are often poorly described and difficult to locate; thus the opportunity for replication is denied (LaBenne and Greene, 1969).

In other studies, researchers have employed standardized instruments, but have used them to measure aspects of self-concept for which the instrument was not specifically designed. That is to say, they have attempted to measure a specific dimension of self-concept such as 'academic self-concept'; with an instrument that was originally constructed to measure 'general self-concept', and vice versa (see eg. Butcher, 1968). In this regard, Kubiniec (1970), commenting on the fact that the lack of precision in self-concept definition has been reflected in the absence of effective instrumentation, has pointed out, "...the same instruments are employed to measure different self constructs and the same constructs are measured by different instruments" (p.321). Additionally, some investigators have elected to alter certain test items to better suit the purposes of their own study (see eg. Bachman and O'Malley, 1977; Winne and Marx, 1981).

Thus, given both the imprecision and diversity of self-concept definitions, together with the non-equivalence of measurement instruments, it has become virtually impossible to generalize across studies for a specific instrument and/or population. Consequently, the external validity of all self-concept studies to date, is brought into question.

A third difficulty in measuring self-concept, is that many of the instruments used, either lack entirely, any evidence of reliability or validity, or else the investigations being conducted to test various instruments, are of very poor quality (Wylie, 1974). Lakey (1977) has noted that, of more than two hundred self-concept measures that have been reported in the literature, most have not been validated against the independent measures on theoretical constructs of self-concept. Wylie (1974) asserts that although there are many self-concept instruments available,

...the problem of any kind of validity is often bypassed entirely, being replaced by assumptions of face validity or reliance on the reader to infer what he will, from whatever statement of operations is given (p.124).

Thus despite agreement among most self-concept researchers, that this type of research and data are crucial to self-concept literature, very few studies have attended to this problem.

A final obstacle to self-concept measurement, is the fact that data are not available to test rival interpretations.

Shavelson et al. (1976) have drawn attention to the fact that self-concept interpretations, as with any self-report measure of a personality variable, may be challenged on the grounds that students may a) select responses they know to be socially desirable, rather than self-descriptive or b) be unable or unwilling to report their personal self-concept (see LaBenne and Greene, 1969, for a more extensive discussion). A third consideration in this regard, is a student's inability to distinguish between self-descriptive and self-evaluative responses (Shavelson et al., 1976; Shepard, 1979; Winne and Marx, 1981).

In summary then, it seems apparent that self-concept research has addressed itself to substantive problems, before the difficulties of definition, measurement and interpretation, have been resolved. Spears and Deese (1973) it appears, lend full support to this assertion when they point out that indeed,

The difficulty in validating SC theory appears due, at least in part, to an inadequate logical analysis of the concept and to an incomplete if not inappropriate translation of the construct into methodology (p.144).

Until these problems have been managed in a manner made possible by advances in construct validation methodology, the generalizability of self-concept findings will continue to be severely limited. Furthermore, data on students' self-concepts, in relation to their academic achievement, will persist in yielding ambiguous results.

That there is a need to validate self-concept interpretations of measurements, has been clearly demonstrated (Crowne and Stephens, 1961; Dyer, 1963; Wylie, 1974; Shavelson et al., 1976; Wells and Marwell, 1976; Lakey, 1977; Scheirer and Kraut, 1979).

2.5 THE PROBLEM

To date, studies which have investigated the relationship between self-concept and academic achievement, have produced a multiplicity of confused and contradictory findings. It would appear that the problems underlying the research are three-fold. Each of these problems is now addressed.

2.5.1 The Need for Further Construct Validation

That further construct validation is needed, with respect to self-concept, has been well-established (West and Fish, 1973; Shavelson, Hubner and Stanton, 1976; Wells and Marwell, 1976; Winne, Marx and Taylor, 1977; Scheirer and Kraut, 1979; Soares and Soares, 1980; Winne and Marx, 1981; Shavelson and Bolus, in press). This requirement is consequent to the fact that a greater number of studies have examined the between-portion of the nomological network, than have assessed the within-portion (Soares and Soares, 1980; Wells and Marwell, 1976; Winne, Marx and Taylor, 1977). Yet Wylie (1974) has stressed that indeed, within-network studies which define and clarify the self-concept

construct, should precede inter-variable research (see also, Shavelson et al., 1976). Thus, between-network studies, having been designed around an ill-defined construct, have been at a disadvantage and have ultimately produced conflicting and indeterminate research findings (Soares and Soares, 1980). The magnitude of such results, have prompted Winne, Marx and Taylor (1977) to plea for future research, designed to sharpen aspects of the within-portion of the nomological network of the self-concept construct, before proceeding with additional investigations of the between-network portion.

As Wells and Marwell (1976) further point out, "...confusion at the conceptual level necessarily manifests itself in equal or greater confusion at the methodological level" (p.9). The extensive use of a potpourri of self-concept terms and instruments, have rendered interpretations of measurements on a comparative basis, exceedingly tedious, if not impossible. For example, many studies have examined the relationship between academic self-concept and academic achievement; others have investigated the association between general self-concept and academic achievement.

That the global conception of self-concept is independent from the more specific component of academic self-concept, is supported by Brookover and his associates (1964). Additionally, agreement with this conceptual understanding of independence, is implicit in the structure of many self-

concept instruments (eg. Piers and Harris, 1964; Coopersmith, 1967; Sears, 1964).

Furthermore, Shavelson and Stuart (in press) and more recently, Shavelson and Bolus (in press) have questioned whether academic self-concept in fact, differs from academic achievement. Pugh (1976), subsequent to his study of senior high school students, raised the same query. Shavelson and Stuart (in press) propose that indeed, academic self-concept may merely represent the student's own report of his academic achievement.

These counterinterpretations then, bear serious examination in terms of both within and between-network portions of the nomological network. As Wylie (1979) notes, these ideas can be adequately tested only,

...by approaching one's inquiry with the sophistication of thought and method appropriate to the subtlety and complexity of these constructs, their hypothetical relationships among themselves, and their hypothetical relationships with other variables (p.701).

Soares and Soares (1979) point to the need for a paradigm to aid more effective explanation of the interrelationships bound within the nomological framework. Indeed, by incorporating the constructs of 'general self-concept', 'academic self-concept' and 'academic achievement', into one paradigm, the aforementioned counterinterpretations to the proposed self-concept interpretations, can be tested and hopefully, untangled.

This study addresses the need for further clarification of the self-concept construct. Specifically, the research attempts to determine the status of the constructs, 'general self-concept', 'academic self-concept' and 'academic achievement', as they relate to one another in the nomological network. By incorporating both 'general self-concept' and 'academic self-concept' into the model, the study is able to examine the within-portion of the nomological network; examination of the relationship between both 'general self-concept' and 'academic self-concept' respectively, with 'academic achievement', constitutes between-network analysis. To this author's knowledge, only one very recent empirical endeavour has attempted to include these three constructs into a single investigation (see Shavelson and Bolus, in press); the findings not being in print at the commencement of this current study.

2.5.2 The Need for an Updated Methodological Approach to Construct Validation

As noted earlier, Shavelson and Stuart (in press), supported by Cronbach (1975), have called for an updated approach to construct validation; particularly with application to the self-concept construct. Scheirer and Kraut (1979) have pointed out that/ indeed, empirical evidence validating the causal roles of both self-concept and academic achievement, has lagged behind its incorporation into theory and educational practice. Yet the

assumption of causality is evidenced by the interpretations of research findings and the application of same, in educational settings (Shavelson and Stuart, in press). This study has proposed the use of causal modeling, as a fresh approach to construct validation.

Additionally, Marx and Winne (1975) argue that educational research should address the complexities of school and changes in students, within a causal framework. With specific reference to the relationship between self-concept and academic achievement, Marx (and Winne (1975) contend that by so doing, an attempt is made to map the variables which give meaning to the construct, thereby providing a vehicle for construct validation.

This review of the literature has cited the few studies that have utilized causal analysis, in attempts to glean further understanding of the self-concept construct and its relationship to academic achievement. It was noted that until recently, only two methods of causal analysis have been employed; that of path analysis and cross-lagged panel correlation. Both of these techniques, however, possess limitations which can be detrimental to the empirical results. These limitations were detailed in chapter I.

In contrast to the methodological approaches to construct validation offered by the use of path analysis and cross-lagged panel correlation analysis, the present study employed a multiple-indicator structural equation model, to

examine the causal relationships existing among the variables, 'general self-concept', 'academic self-concept' and 'academic achievement'. Magidson (1977) notes that indeed, the structural equation model has recently captured the interest of a large number of disciplines, particularly those constituting the realm of the social science researcher. More specifically, the structural equation model is viewed by Rogosa (1979) as by far, the most superior strategy for detecting causal relations. In fact, because of their wide applicability to areas of nonexperimental research, Bentler and Weeks (1980) express the hope that structural equation models will become routinely utilized by researchers, when they need to test causal models with quantitative indicators of hypothesized latent constructs.

Unlike the models of path analysis and cross-lagged panel correlation, the model specified in this study, bears no underlying assumption that the observed variables are measured without error. In contrast, the model allows for the analysis of measurement error in determining the degree to which each indicator variable contributes to its respective construct. This error factor then, is congruent with Heise's (1970) contention that if a causal model is to have any value, it must yield information in the presence of some measurement error (see also, Duncan, 1975). Additionally, the multiple-indicator model allows the

researcher to postulate correlated errors between the indicators (Rogosa, 1979; Joreskog, 1979); most models assume the error terms to be uncorrelated.

It is important to note, however, that although the allowance for measurement error is generally viewed as a highly desirable feature of structural equation models, one can never assume to have accounted for pure measurement error. The researcher must be cognizant of the possibility that some error might be the consequence of residual error associated with latent variables that may not have been incorporated into the model. Of course, the presence of such error, is always a possibility and its full determination never known with certainty, by the investigator.

The entire structural equation model can be decomposed into both structural and measurement submodels. The structural model declares the relationship among the constructs; the measurement model, those expressing linkages between the constructs and their indicator variables. This distinction between the structural and measurement models, is viewed by Joreskog (1973) and Wiley (1973) as an improvement in that it strengthens the idea that theoretical relations should be cleanly distinguished from empirical relations. Concomitantly, it satisfies earlier contentions by Cronbach and Meehl (1955), regarding the importance of separating the nomological network of theoretical

relationships of constructs, from the operational definitions of observable variables and their relations to the latent constructs, through measurement operations.

The use of multiple indicators with structural equation models, is important on both methodological and theoretical grounds. Methodologically, this procedure satisfies the technical requirement of model identification; the presence of more than one measure of each construct, permits all the unknown parameters to be uniquely estimated from the data. Theoretically, multiple-indicator models are congruent with meta-theoretical arguments which suggest the need for multiple measures of all theoretical concepts; increasing numbers of observed variables, lead to heightened content validity of the unobserved constructs (Baltes and Nesselroade, 1973; Wheaton, Muthen, Alwin and Summers, 1977; Rogosa, 1979).

Clearly, this approach appears to answer Wylie's (1968) plea for more systematic and analytical research designs, capable of unravelling the apparent overlap of variables expected to measure the self-concept construct. Indeed, Shavelson and Stuart (in press) posit that the employment of a multiple-indicator structural equation model to test important counterinterpretations to the proposed self-concept construct, should lead to greater accuracy and to a more complete understanding of the relationship of self-concept to academic achievement, and of self-concept interpretations of measurements, in general.

As noted earlier, only one study to date, has used structural equation modeling in an attempt to validate the self-concept construct (see Shavelson and Bolus, in press). The current study, however, differs from the Shavelson and Bolus study with respect to the following: sample, instrumentation, time lag between first and second data collections and the specificity of self-concept constructs under study.

With respect to sample, the investigation differed from the Shavelson and Bolus study in terms of size and population sampled. Whereas the latter study had a final sample size of 99, this study was successful in obtaining a final sample size of 929. The Shavelson and Bolus sample comprised grades 7 and 8 students in junior high school; this study collected data from students in grades 9-12 high school.

Although the two studies were identical in their collection of two measures for each construct, only the Self-concept of Ability Scale (Brookover, 1962) was utilized in both studies. Whereas Shavelson and Bolus divided the Brookover (1962) scale into two parallel composites in order to obtain two measures of academic self-concept, this study employed two independent instruments. Additionally, the use of first and second semester marks as measures of academic achievement, differed in the two studies. Shavelson and Bolus converted letter grades to a 13-point numeric scale; this study used the raw numeric mark averages.

Another difference between the two studies involved the temporal lag between testing periods. Whereas Shavelson and Bolus engaged a 5-month span (February, 1980 to June, 1980), this study spanned 6 months (October, 1980 to May, 1981).

Finally, the Shavelson and Bolus study incorporated measures of subject matter self-concept specific to English, mathematics and science. This study did not incorporate those constructs into its research design.

The author believes that this study exhibits an improvement over the Shavelson and Bolus (in press) study in at least four ways. First, the larger sample size should reduce the size of the standard errors and thus render a more valid value. Second, the use of two independent measures of academic self-concept should reduce the amount of uniqueness resulting from correlated errors which can occur when two measures are component parts of the same instrument. Third, the use of raw mark averages ranging from 1 to 100, should provide a more accurate measure of academic achievement, than the conversion of letter grades to a numeric scale ranging from 1 to 13; the latter providing a much cruder scale of student achievement. Finally, the author believes that the longer time span in her study, should serve to reduce the degree of uniqueness due to correlated errors common to test-retest situations.

2.5.3 The Need for Longitudinal Research

Many investigators (eg. Gordon, 1969; Kimball, 1973; Kifer, 1975; Wells and Marwell, 1976; Bachman and O'Malley, 1977; Rubin, 1978; Fu, 1979), have called for more longitudinal data with respect to self-concept research. According to Rogosa (1979), longitudinal research holds the potential for disentangling the complex effects of reciprocal causal influences. Given the magnitude of studies that have shown a reciprocal relationship between self-concept and academic achievement, this requisite certainly appears long overdue in self-concept research.

Additionally, only from longitudinal data, can estimates of strength, balance and duration of the reciprocal causes be determined (Rogosa, 1979). Cronbach and Meehl (1955) have asserted that indeed, measures over time, are considered both relevant and necessary to construct validation.

With respect to causal modeling as a means to construct validation, Bentler (1978) posits that although the technique represents a potentially fruitful approach for a variety of empirical data, it is particularly relevant to the understanding of repeated measurements data, found in longitudinal research. Consequent to the fact that repeated measurements automatically generate correlational data, methods for drawing causal inferences from correlational data, immediately become pertinent to longitudinal research.

Thus, the causal modeling approach to construct validation, using a longitudinal design, allows the entire system to be analysed simultaneously, in the context of theory (Bentler, 1978).

The present study proposes a longitudinal approach to validation of the self-concept construct. The data were collected for the three constructs, 'general self-concept', 'academic self-concept' and 'academic achievement', at two time points.

2.6 STATEMENT OF THE PROBLEM

A review of self-concept research and in particular, the relationship between self-concept and academic achievement, has revealed three important problems:

1. The need for further construct validation.
2. The need for an updated methodological approach to construct validation.
3. The need for longitudinal research.

The present study addresses these problems, by attempting to validate the self-concept construct, through the medium of a multiple-indicator structural equation model, operating at two points in time.

2.7 THE HYPOTHESES

2.7.1 Hypothesis I

The first hypothesis addresses the question of whether academic achievement is stronger as a predictor of general self-concept than general self-concept is, as a predictor of academic achievement.

The empirical works of Roth (1959), Centi (1963), Coleman (1966), Gibby and Gibby (1967), Marx and Winne (1975), Hayes and Prinz (1976), Bachman and O'Malley (1977), Ames (1978) and Smith (1979), have produced findings that lead one to conclude that academic achievement is causally predominant over general self-concept. Similarly, Scheirer and Kraut (1979), in their recent extensive review of the literature, concluded that indeed, there is no sound evidence to support the notion that one's self-concept influences his academic achievement. Finally, Moyer (1980), using two methods of causal analysis, identified a causal relationship with direction from academic achievement to general self-concept; additionally, however, he found general self-concept to be causally predominant over academic achievement, the latter relationship being stronger than the former.

In contrast to these studies, other investigators (Wattenberg and Clifford, 1964; Lamy, 1965; Coopersmith, 1967; Kubinieć, 1970; Pugh, 1976; Moyer, 1980), support the notion that general self-concept is causally stronger than academic achievement.

On the basis of the magnitude of empirical evidence supporting directional cause of influence from academic achievement to general self-concept, this investigator hypothesizes that academic achievement is causally predominant over general self-concept.

2.7.2 Hypothesis II

The second hypothesis addresses the question of whether academic achievement is a stronger predictor of academic self-concept than academic self-concept is, as a predictor of academic achievement.

Recent investigations by Kifer (1975), Calsyn and Kenny (1977) and Bridgeman and Shipman (1978), support the argument that academic achievement is causally predominant over academic self-concept. In contrast, Brookover and his associates (1962, 1964, 1965, 1967, 1975), Joiner et al. (1969), Bailey (1971) and Evans and Anderson (1973), on the basis of their research, postulate that academic self-concept is causally stronger than academic achievement.

On the basis that a) the relationship between general self-concept and academic self-concept has not been clarified to date, with respect to validation of the self-concept construct, and b) the bulk of recent reviews of the self-concept literature have concluded that academic achievement is causally stronger than general self-concept, this investigator hypothesizes that academic achievement is causally predominant over academic self-concept.

2.7.3 Hypothesis III

The third hypothesis addresses the question of whether academic self-concept is causally stronger than academic achievement, as a predictor of general self-concept.

In their review of self-concept research and subsequent formulation of a definition of the construct, Shavelson and his associates (1976) argue that because self-concept is hierarchical in nature, general self-concept is influenced by behavior and assessments in specific situations. That is to say, the more closely self-concept is linked with specific experience, the stronger the relationship between self-concept and behavior in those particular situations.

In the present study, this means that while self-concept and academic achievement share reciprocal effects upon one another, the predominant direction of causality should flow from academic achievement to academic self-concept, to general self-concept. This notion is also supported by Ames (1978), Wylie (1979) and Lambert (1980).

On the basis of these theoretical and empirical data, this investigator hypothesizes that academic self-concept is causally predominant over academic achievement, as a predictor of general self-concept.

2.7.4 Hypothesis IV

The fourth hypothesis addresses the question of whether academic achievement is a stronger predictor of academic self-concept than academic achievement is, as a predictor of general self-concept.

West and Fish (1973), subsequent to their review of the literature, conclude that clearly, the interdependence of academic self-concept and academic achievement, is much greater than the relationship between general self-concept and academic achievement. Similarly, Brookover et al. (1962, 1964, 1965, 1967), Joiner et al. (1969), Caplin (1969) and Kifer (1975), have postulated that academic self-concept is more highly related to academic achievement, than is general self-concept. More recently, in a study of grades 7 and 8 students, Shavelson and Bolus (in press) found that their results not only concurred with those of the aforementioned studies, but in particular, that the relationship between academic achievement and academic self-concept, with respect to a specific subject area, was stronger than the same relationship with no consideration given to differentiation among specific subject areas.

These empirical data lead this investigator to hypothesize that the causal relationship between academic self-concept and academic achievement, is stronger than the relationship between general self-concept and academic achievement.

In summary, this study tests 4 hypotheses; they are restated below.

Hypothesis I

Academic achievement (AA) is stronger as a predictor of general self-concept (GSC), than general self-concept (GSC) is, as a predictor of academic achievement (AA).

Hypothesis II

Academic achievement (AA) is a stronger predictor of academic self-concept (ASC), than academic self-concept (ASC) is, as a predictor of academic achievement (AA).

Hypothesis III

Academic self-concept (ASC) is causally stronger than academic achievement (AA), as a predictor of general self-concept (GSC).

Hypothesis IV

Academic achievement (AA) is a stronger predictor of academic self-concept (ASC), than academic achievement (AA) is, as a predictor of general self-concept (GSC).

Details regarding the research design are now presented in Chapter III.

Chapter III

RESEARCH DESIGN

3.1 OPERATIONAL DEFINITIONS

Based on the instruments of measurement used in this study, the constructs of 'general self-concept' (GSC), 'academic self-concept' (ASC) and 'academic achievement' (AA) are defined below.

General Self-concept

An individual's total appraisal of himself with respect to his abilities, attitudes, feelings and social acceptability.

Academic Self-concept

An individual's appraisal of himself with respect to his academic ability and academic performance in school.

Academic Achievement

A student's scholastic standing in school.

3.2 SAMPLE AND PROCEDURES

The original sample at time 1 (October, 1980), comprised 1018 students from two secondary schools located within one mile of each other, in a middle/upper-middle class suburban area of Ottawa, Ontario; both schools were under the jurisdiction of the same school board. Assuming that the social structure of this Ottawa suburban community is representative of those elsewhere in southern Ontario and the fact that the Ministry of Education curriculum guidelines are the same province-wide, it is believed that the findings of this study may be generalized to all students attending suburban high schools in southern Ontario.

Given the complexities of individual student time-tabling, random selection of students, albeit desirable, was both unrealistic and impossible to achieve. Alternatively, classes of students were selected from each of grades 9, 10, 11 and 12. For technical reasons, however, the data of the study were not analysed for each grade level. Since it is known that a high school student may take courses at any grade level, his subject registration at a particular grade level may not necessarily be congruent with his overall registration at a specific grade level. Thus, analysis of data based on grade level, appears meaningless.

In an effort to obtain a sample which truly represented the target population, the following procedures were followed:

1. The total number of classes in each school, was divided approximately equally among the four grade levels. The resultant number of students tested was as follows: grade 9 (N=276), grade 10 (N=251), grade 11 (N=239), grade 12 (N=252).
2. At each grade level, the proportion of 'general level' classes to 'academic level' classes, was selected in accordance with the overall number of 'general' and 'academic' level students in each school.
3. Although the class selection procedure differed in each of the two schools, the underlying rationale of representativeness remained common to both. In school A, all classes were selected from within the English department. Since English is now deemed a core subject by the Ministry of Education in Ontario, it was believed that a representative sample of students would be obtained. In school B, classes were selected from four subject disciplines: grade 9 (Geography); grade 10 (History), grade 11 (English), grade 12 (Mathematics). This interdisciplinary approach to selection of students, was perceived as also satisfying the need for a representative sample.

This sample of students at time 1 (October), represented approximately 91% of the potential number of students scheduled for participation in this study. The differential

was the result of absenteeism at the time of testing. Due to the time frame of class periods at school A (50 minutes), collection of data on all five instruments, necessitated the use of a partial additional period; the self-concept instruments were administered the first day (partial period), while the standardized achievement test was administered the second day (full period). This necessity for two testing times alone, accounted for a mortality of 87 students (i.e. students who completed the self-concept instruments, but were absent for the standardized achievement test). The situation, however, was corrected for the final testing; all five tests were completed in an extended 60-minute period. In school B, all five instruments were administered within one 60-minute period.

The initial testing of students took place approximately one week following the issuance of the October report cards; the final testing, two weeks following the issuance of the April report cards. At both testing times therefore, students were fully cognizant of their academic achievement, prior to their completion of the tests for this study.

The final sample comprised 929 students (i.e. students who completed all tests in both October and May). The number of students per grade level, was as follows: grade 9 (N=264), grade 10 (N=228), grade 11 (N=213), grade 12 (N=224). Although this represents an 8% mortality rate among subjects, it is considerably less than that of the

similar investigation by Shavelson and Bolus (in press); they experienced a 30% decrease in sample size, from their testing at time 1, to testing at time 2. However, the causative factors underlying the sample shrinkage, remained the same for both studies. Specific to this investigation, the reasons for the mortality together with the number of students involved, are as follows: absence for final testing (N=53), withdrawal from school (N=30), refusal to write at final testing (N=6).

3.3 INSTRUMENTS OF MEASUREMENT

For the purpose of this present study, the following five standardized instruments were employed: Self-esteem Inventory--General Self and School-Academic subscales (Coopersmith, 1967), Self-esteem Scale (Rosenberg, 1965), Self-concept of Ability Scale (Brookover, 1962), Reading Comprehension: Cooperative English Tests (ETS, 1960). Mark averages for each student, were obtained from the school records.

Each instrument was selected on the basis of five major criteria; these are as follows:

1. Applicability to a high school student population.
2. Adequate reliability and validity indices.
3. Magnitude of empirical data available.
4. Recommendations by other researchers, concerning their employment with a high school population.

5. Brevity and ease of administration.

Each instrument is described below, in the light of the construct it is purported to measure.

3.3.1 General Self-concept

3.3.1.1 Self-esteem Inventory (SEI)--General Self Subscale (Coopersmith, 1967)

Description

The SEI is composed of 58 items--- 8 lie-scale items and 50 scaled items. This instrument provides a general assessment of self-esteem, which may also be decomposed into component subscales. The test is designed to measure 5 aspects of self-concept: general self, social self-peers, home-parents, school-academic, lie scale. Only the General Self subscale was used to measure the construct of general self-concept. The General Self subscale contains 26 items that are simple, self-descriptive statements. Each item requires one of two response alternatives ("like me"; "unlike me").

Normative Sample

The original normative sample included between 80 and 140 students in grades 5 and 6. This scale has subsequently been administered to over 40,000 children and adults, ranging across the entire socio-economic spectrum, together with many ethnic and subcultural groups (Self-esteem Institute, 1975).

Reliability

In the study of 3rd, 5th, 7th, 9th and 11th grade students, Dyer (1963) found internal consistency reliability coefficients of the four subscales, ranging from 0.28 to 0.82. In a similar study, Spatz and Johnson (1973) found internal consistency coefficients of 0.81 for 5th graders, 0.86 for 9th graders and 0.80 for 12th graders. Additionally, Kimball (1973), in a study of 7600 elementary school students, has reported Kuder-Richardson (KR-20) reliability coefficients as follows: grade 4 (0.92), grade 5 (0.87), grade 6 (0.88), grade 7 (0.89), grade 8 (0.90).

With respect to test-retest reliability, Coopersmith (1967) has reported a total score test-retest reliability coefficient of 0.88, over a 5-week interval, with a sample of 30 5th grade students and a coefficient of 0.80, over a 3-year period, with a different sample of 56 elementary school children; the grade level of the latter group has not been specified. Fullerton (1973), in a study of 104 mentally gifted (IQ=130+) boys and girls in grades 5 and 6, found a test-retest reliability of 0.64, over a 12-month period. In an investigation of two groups of subjects (9-12 and 12-15 years of age), drawn from participants in the Educational Follow-up Study

(1978), Rubin (1978) found the test-retest reliability coefficient over a 3-year period to be 0.31 and 0.55 for each group respectively. Finally, Drummond et al. (1977), investigated the stability of the SEI over a 6-month period, for students in grades 2 through 12. With respect to high school students, their findings revealed test-retest coefficients for the General Self subscale, as follows: grade 9 (0.58), grade 10 (0.54), grade 11 (0.60), grade 12 (0.52).

Split-half reliabilities based on the entire 58 items, have been found to be 0.87 (Fullerton, 1973) and 0.90 (Taylor and Reitz, 1968, cited in Self-esteem Institute, 1975).

Validity

With respect to convergent validity, Getsinger, Miller and Weinberg (1972) have reported a correlation of 0.63 between the SEI (Coopersmith, 1967) and the Self-perception Inventory (Soares and Soares, 1975); a 0.60 correlation between the SEI and a Derived Picture Test. Taylor and Reitz (cited in Crandall, 1973) found a correlation of 0.45 between the CPI Self-acceptance Scale and the SEI and correlations of 0.42 to 0.66 with other scales. Ziller et al. (1969) have reported separate correlations between the SEI and three other scales, for both males and females. Their findings revealed correlations for males of 0.16 with

the Bill's Scale, 0.37 with the Cutnick Scale and 0.02 with the Ziller Scale; for females, the correlations were 0.17, 0.23 and 0.04 respectively.

Using the multitrait-multimethod procedure, Fullerton (1973) found substantial evidence to support both convergent and discriminant validity for self-concept, as measured by the SEI.

In a factor analytic study to investigate the construct validity of the SEI subscales, Kokenes (1974) administered the instrument to approximately 7600 public school children (grades 4 through 8). She found two items assigned by Coopersmith to the General Self subscale, that failed to load into any factor in her study.

Empirical Research

In addition to the empirical research mentioned earlier with respect to specific instrument data, the following studies have used the General Self subscale of the SEI: Campbell (1967), Trowbridge (1972), Williams (1974), Kifer (1975), Rubin et al. (1977), Stebbins et al. (1977).

Comments

Crandall (1973) notes that with slight wording changes, the Coopersmith (1967) Self-esteem Inventory can be used with all age groups. However, Rubin (1978), in a study of children 9-15 years of age, has

reported that scores on the General Self subscale, appear more stable from ages 12 to 15. Additionally, she found the General Self and School-Academic subscales to be the most reliable of all the SEI subscales. Finally, House et al. (1978) in a critique of the Follow Through evaluation, suggest that the rationale underlying selection of the SEI for the evaluation study, probably lay with its easy use and widespread acceptability.

3:3.1.2 Self-esteem Scale (Rosenberg, 1965)

Description

This scale was originally designed as a unidimensional measure of general self-concept for use with high school students. The instrument is constructed as a Guttman scale and consists of 10 items, based on a 4-point likert scaling format, ranging from strongly agree to strongly disagree. For clarity of interpretation in this study, the scoring procedure was altered slightly, such that a score of 4, was indicative of high self-concept and a score of 1, equivalent to a low self-concept. Of necessity, the scores for five of the items (numbers 1,2,4,6,7) were reversed, to satisfy congruency with the scoring format.



Normative Sample

The original normative sample reported by Rosenberg (1965) included a total of 5,024 high school students from 10 randomly selected schools in New York state.

Reliability

Rosenberg (1965) reported a coefficient of reproducibility of 0.92 with his original sample of high school students and one slightly higher, with 560 British adolescents. Wylie (1974) asserts that this coefficient is acceptable as an index of reliability. Silber and Tippet (1965) found a test-retest reliability coefficient of 0.85 for 28 college students, over a 2-week period.

Validity

With regard to convergent validity, Silber and Tippet (1965), using a multitrait-multimethod matrix analysis, correlated scores from the Self-esteem Scale (Rosenberg, 1965), against three other measures of self-esteem; they reported correlations of 0.67, 0.83 and 0.56. In scoring the Rosenberg (1965) instrument for Guttman scalability, Crandall (1973) found a correlation of 0.59 with Coopersmith's (1967) Self-esteem Inventory. Wylie (1974) comments that these convergent validities are among the highest observed, in cross-instrument validations.

Tests for discriminant validity by Silber and Tippet (1965), have shown correlations with measures of self-stability, of 0.40, 0.34 and 0.21. However, both Wylie (1974) and Wells and Marwell (1976), criticize this research with the claims that indeed, the two constructs (self-esteem and self-stability) are not completely independent of one another (see Campbell and Fiske, 1959). Wylie (1974) concludes that at best, the evidence supporting discriminant validity, may be conservative.

Empirical Research

In addition to the empirical findings cited above, the following studies have also employed the Self-esteem Scale (Rosenberg, 1965): Pugh (1976), Bachman and O'Malley (1977), O'Malley and Bachman (1979).

Comments

Crandall (1973) notes that although brief, the Self-esteem Scale (Rosenberg, 1965) is very thorough in its measurement of general self-concept. Wylie (1974) views the high reliability relationships supporting its construct validity, as most impressive for such a short scale. In fact, she posits that the instrument, deserves more research and application. Finally, Gordon (1969) asserts that Rosenberg's (1965) Self-esteem Scale is representative of some of the best empirical work in the area of self-concept research.

3.3.2 Academic Self-concept

3.3.2.1 Self-esteem Inventory (SEI)--School-Academic Subscale (Coopersmith, 1967)

Description

The general data regarding this instrument, have been summarized in connection with the General Self subscale. The School-Academic subscale is composed of 8 items.

Reliability

Lakey (1977) has reported a test-retest reliability coefficient of 0.88 over a 6-week period, with a sample of 110 2nd and 3rd grade children. In her study of two groups of children (9-12 and 12-15 years of age), Rubin (1978) has reported a test-retest reliability coefficient over a 3-year period, of 0.36 and 0.55 respectively. Finally, Drummond et al. (1977), in their investigation of the stability of the SEI over a 6-month period, found test-retest coefficients as follows: grade 9 (0.70), grade 10 (0.68), grade 11 (0.52), grade 12 (0.29).

Validity

The results of a multitrait-multimethod matrix analysis in the Lakey (1977) study, indicated that the SEI--School-Academic subscale met the criteria for convergent and discriminant validity.

Empirical Research

Additional studies that have employed the School-Academic subscale of the SEI, are as follows: Dyer (1963), Campbell (1967), Trowbridge (1972), Kimball (1973), Spatz and Johnson (1973), Williams (1974), Kifer (1975), Rubin et al. (1977), Stebbins et al. (1977).

Comments

The author was able to find only one study (Lakey, 1977) in which the SEI---School-Academic subscale was used as an independent measure. However, Lakey (1977), in her investigation of students in grades 2 and 3, has suggested that academic self-concept can be measured satisfactorily by means of the School-Academic subscale. In her study of children 9-15 years of age, Rubin (1978) has reported that scores on the School-Academic subscale appear more stable from ages 12 to 15. Having used all of the subscales in the SEI, Rubin (1978) found the General Self and School-Academic subscales, to be the most reliable. All general comments regarding the SEI, were presented with the General Self subscale review.

3.3.2.2 Self-concept of Ability Scale (SCA) (Brookover, 1962)

Description

This instrument consists of 8 items that are structured on a 5-point likert-type scale. Five of the items ask the students to rate their present school ability, as compared with their classmates. The remaining three items ask students to rate their future academic ability (i.e. ability to complete college).

Normative Sample

The original normative sample included 1050 grade 7 students. Developed specifically for use in a longitudinal study (Brookover et al., 1962, 1965, 1967), this instrument was subsequently employed with students registered in grades 7-12.

Reliability

Using Hoyt's Analysis of Variance method of determining internal consistency, Brookover and his associates (1967) found reliability coefficients ranging from 0.82-0.88 for males and from 0.77-0.85, for females.

With respect to test-retest reliability, Brookover et al. (1967) found correlations over a 1-year time span, as follows: grade 9 (0.72), grade 10 (0.71), grade 11 (0.73), grade 12 (0.69). In an analysis of sex differences, Paterson (1967) has reported

stability coefficients over a 12-month period, of 0.75 for males and 0.77 for females.

Validity

In her study of the SCA Scale (Brookover, 1962), Paterson (1967) found evidence to support the notion that scores from this scale, are not reducible to IQ scores, past or present achievement, or student attitudes towards the importance of securing good grades. She posits that the SCA Scale is able to discriminate general self-attitudes towards ability to achieve, from self-attitudes towards ability to achieve in specific school subjects. Additionally, Paterson (1967) argues that the SCA Scale is content valid by virtue of the fact that the method of item selection, ensured a comprehensive sample of the construct under consideration. Finally, Paterson (1967) has reported that the performance of Guttman scalogram analysis and individual item analysis, have all affirmed the basic unidimensionality of the SCA Scale with respect to content, and ultimately, its measurement of self-concept of academic ability.

With respect to convergent validity, Burns (1979) cites an unpublished study by Reid (1976), using 118 primary school students to compare four academic self-concept instruments. A correlation of 0.70 between the SCA Scale (Brookover, 1962) and the Academic Self-

image Scale (Barker Lunn, 1970), was found to exhibit the highest degree of convergent validity.

Empirical Research

In addition to the empirical findings previously cited, the SCA Scale (Brookover, 1962) has been employed in the following studies: Brookover et al. (1962, 1964, 1965, 1967), Bakan (1971), Kifer (1975), Calsyn and Kenny (1977), Almaguer and Daniel (1981), Shavelson and Bolus (in press).

3.3.3 Academic Achievement

3.3.3.1 Reading Comprehension: Cooperative English Tests, Grades 9-12 (ETS, 1960)

Description

This instrument provides scores for four areas of reading comprehension: vocabulary, speed of comprehension, level of comprehension and total score.

Normative Sample

The normative sample included students registered in grades 9 through 12, from 95 secondary schools in the United States. The schools were selected randomly from a list prepared by the U.S. Office of Education (ETS, 1960a, p.9).

Reliability

Clemans (1972) notes that test-retest reliability coefficients reported on the Reading Comprehension: Cooperative English Test (ETS, 1960), are very similar

for each of the three alternate forms. Typical, are the values reported for Form 1C, based on 12th grade students: Vocabulary (0.88), Speed (0.83), Level (0.77), Total (0.92).

Validity

ETS (1960a) points out that since the Cooperative English Tests are designed primarily as measures of developed abilities in reading and language usage, content validity is of utmost importance. Clemans (1972) posits that on the basis of the group of qualified persons selected to construct the Reading Comprehension: Cooperative English Test, claims for content validity, are well-founded.

Comments

Nunnally (1970) asserts that extensive research has shown this instrument to be a good predictor of academic achievement. In fact, ETS (1960b, p.12) makes a further claim that total reading comprehension ability, is often the best predictor of academic performance in any school course. Finally, Wolfe and Robertshaw (1981), in their recent analysis of a data subset from a national longitudinal study of high school students, found reading subtests to be one of the two most reliable indicators of academic ability.

3.3.3.2 Mark Average

The mark average was calculated on the basis of all the courses in which each student was enrolled, during the year of testing (1980-81) and for which he/she was expected to receive secondary school creditation.

3.4 METHOD

3.4.1 Design

This study employed a 3-variable, 2-wave, 2-indicator (3V2W2I) panel design. The study proposed to measure 3 constructs: general self-concept (GSC), academic self-concept (ASC) and academic achievement (AA). In the terminology of causal analysis, these constructs are known as latent (unobserved, unmeasured) variables. These theoretical constructs, however, have implications for determining the relationship between themselves and their respective indicator (observed, measured, manifest) variables. Causal models therefore, provide the tools for relating the theory and hypotheses expressed in the latent variables, to the indicator variables.

Two observed variables were used as indicator measures for each of the 3 constructs listed above. These are as follows:

General Self-concept was measured by means of the Self-esteem Inventory --General Self subscale (Coopersmith, 1967) (GSCC) and the Self-esteem Scale (Rosenberg, 1965) (GSCR).

Academic Self-concept was measured by means of the Self-esteem Inventory--School-Academic subscale (Coopersmith, 1967) (ASCC) and the Self-concept of Ability Scale (Brookover, 1962) (ASCB).

Academic Achievement was measured using the Reading Comprehension: Cooperative English Tests (ETS, 1960) (AAET) and the students' Mark Average (AAMA).

It should be noted that the selection of more than two indicator measures per latent variable is considered in principle, to produce a better model. However, unless the investigator is fairly confident that the additional indicators are reliable and valid measures of the underlying construct, model specification will not be improved. As Bentler (1980) points out, in practice, poor choice of, and/or too many indicators can make it difficult if not impossible to fit the model to the data.

The measures were taken at two points in time. The first set of data were collected in October, the second, in May of the same school year. These time points were selected on the basis of the issuance of report cards at that time; students thus, were informed of their academic achievement.

Shavelson and Bolus (in press) have pointed out that in order to examine the causal predominance of self-concept over academic achievement or vice versa, three conditions must be fulfilled. First, a statistical relationship between self-concept and academic achievement must be

established. In this study, two measures of academic achievement were correlated with each of two measures of general self-concept and academic self-concept, in order to establish a statistical relationship. Second, a time precedence must be established. The self-concept and academic achievement measurements were taken at two points in time (October, 1980 and May, 1981) so as to establish time precedence. Third, a model of the causal relationship must be specified. The model used to investigate causal predominance in this study, was developed in large part, by Shavelson and Stuart (in press) and meets the necessary requirements for model testing (i.e. it is both specified and identified, statistically speaking) (see Bentler, 1980).

3.4.2 The Model

Analysis of the model specified in this study, χ^2 was accomplished by means of the LISREL IV computer program (Joreskog and Sorbom, 1978); LISREL being an acronym for linear structural relationships. LISREL IV not only provides optimal maximum likelihood estimates and standard errors for each parameter, but simultaneously solves for all parameters in the model and produces information about the overall goodness-of-fit, through the generation of a χ^2 statistic. Additionally, the program yields the following information: a matrix of $S - \Sigma$ residuals, first-order derivatives of the function of F, tables describing the

iterative procedure, T-values (critical ratios of parameter estimates) and a standardized solution.

3.4.2.1 Specification

Figure 1 is a schematic representation of the full causal model used in this study; it serves to summarize the data collected, together with the relationships hypothesized, and to provide a basis for data analysis. The structural model expresses the assumed relationships among the constructs (GSC, ASC, AA); the measurement model provides the links between these constructs and their indicators (GSCC, GSCR, ASCC, ASCB, AAET, AAMA).

In Figure 1, the circles represent the constructs (latent, unobserved, unmeasured) variables; the boxes represent the indicators (observed, measured, manifest) variables. At each of two points of time, there are two measures of: general self-concept (GSCC1&2; GSCR1&2), academic self-concept (ASCC1&2; ASCB1&2) and academic achievement (AAET1&2; AAMA1&2). The parameters $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 are regression coefficients which represent the lagged causal effects of GSCI, ASCI and AAI, on GSCII, ASCII and AAII respectively; these are of central importance in this investigation, since they reflect the strength of each causal path. The parameters γ_1, γ_2 and γ_3 represent the causal influence of each construct on itself, over time; these reflect the temporal stability of the construct.

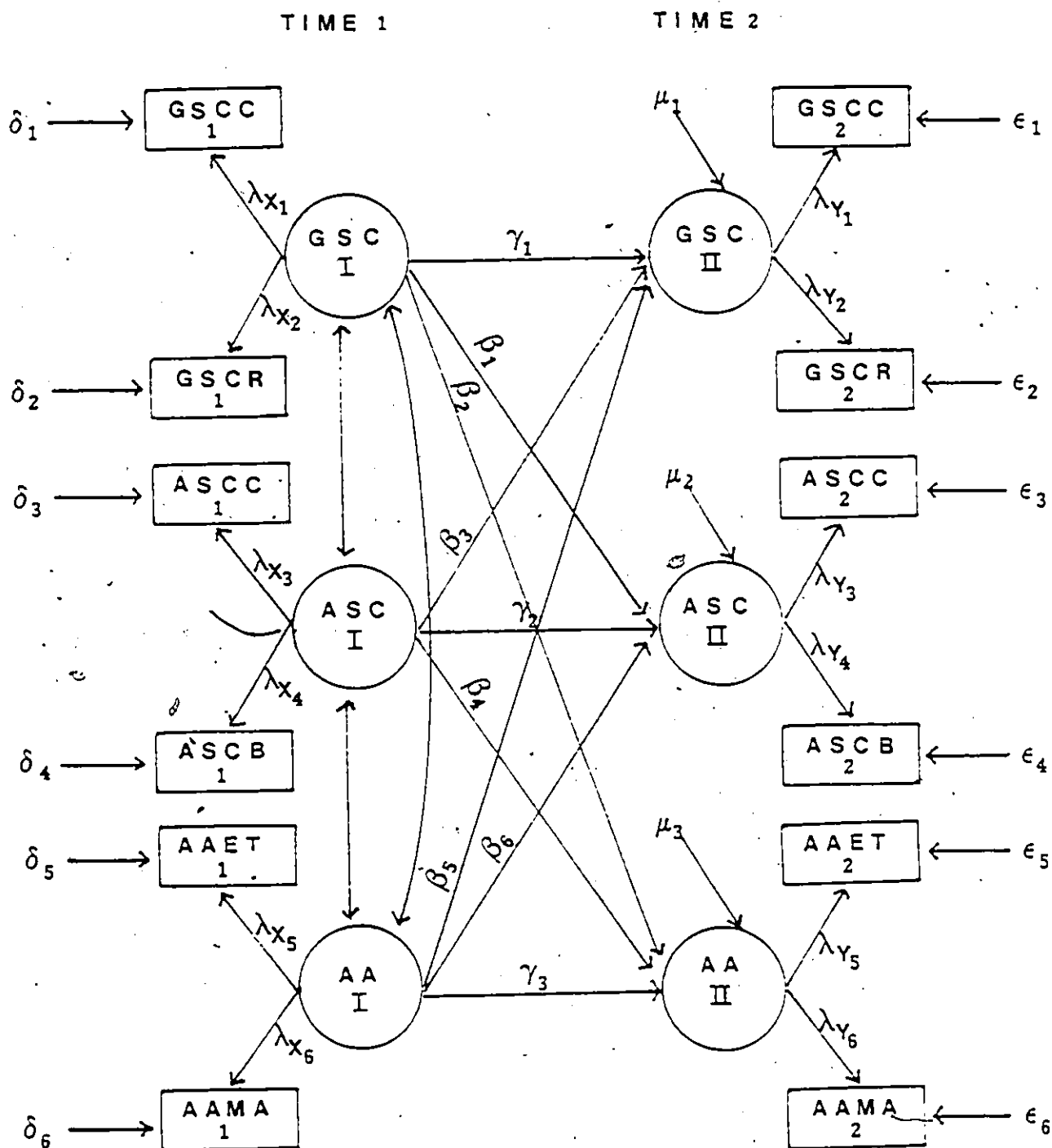


Figure 1: Proposed Causal Model of the Relationship Between Self-concept and Academic Achievement

The paths between the indicators and the constructs, represent the relationship between each construct and its observed variables. The coefficients associated with these paths, are synonymous with factor loadings in factor analysis. The degree to which the constructs have been measured by the indicator variables, can be determined by analysis of these coefficients (factor loadings) and the error terms.

In the model depicted in Figure 1, the number of variances and covariances total 78, while the number of estimable parameters is 39. The parameters to be estimated from the data, are as follows: 6 causal coefficients $\beta_1 - \beta_6$; 3 stability coefficients $\gamma_1 - \gamma_3$; 12 coefficients between the constructs and their indicators $\lambda_{x_1} - \lambda_{x_6}$ and $\lambda_{y_1} - \lambda_{y_6}$; 12 uniqueness variances (variances of $\delta_1 - \delta_6$ and $\epsilon_1 - \epsilon_6$); 3 structural error variances (variances of $\mu_1 - \mu_3$); 3 variances of the constructs at time 1 ($\xi_1 - \xi_3$). The term 'uniqueness' as it is used in this study, refers not only to measurement error, but also, to factors not held in common by the two indicator variables measuring the same latent variable.

As noted in Chapter II, once the causal model is constructed, the set of causal relationships among the variables, is written as a series of structural regression equations. These equations express both the latent and indicator variables, in terms of all other variables in the

model, together with their respective error terms. Based on the complete causal model shown in Figure 1, the equations are as follows:

The Structural Model

$$GSC_{II} = \gamma_1 GSC_I + \beta_3 ASC_I + \beta_5 AA_I + \mu_1$$

$$ASC_{II} = \gamma_2 ASC_I + \beta_1 GSC_I + \beta_6 AA_I + \mu_2$$

$$AA_{II} = \gamma_3 AA_I + \beta_4 ASC_I + \beta_2 GSC_I + \mu_3$$

The Measurement Model

$$GSCC1 = \lambda_{x1} GSC_I + \delta_1$$

$$GSCR1 = \lambda_{x2} GSC_I + \delta_2$$

$$ASCC1 = \lambda_{x3} ASC_I + \delta_3$$

$$ASCB1 = \lambda_{x4} ASC_I + \delta_4$$

$$AAET1 = \lambda_{x5} AA_I + \delta_5$$

$$AAMA1 = \lambda_{x6} AA_I + \delta_6$$

$$GSCC2 = \lambda_{y1} GSC_{II} + \epsilon_1$$

$$GSCR2 = \lambda_{y2} GSC_{II} + \epsilon_2$$

$$ASCC2 = \lambda_{y3} ASC_{II} + \epsilon_3$$

$$ASCB2 = \lambda_{y4} ASC_{II} + \epsilon_4$$

$$AAET2 = \lambda_{y5} AA_{II} + \epsilon_5$$

$$AAMA2 = \lambda_{y6} AA_{II} + \epsilon_6$$

The structural equation model specified in this study, uses the Joreskog-Keesling-Wiley (JKW) model (Joreskog, 1977; Wiley, 1973) (see Bentler, 1980), with analysis by means of the LISREL IV computer program (Joreskog and Sorbom, 1978). The specified model is hereafter referred

to, as a LISREL model. An important point should be presented at this juncture, with regard to usage of the term 'LISREL model'. Bentler and Weeks (1980) point out, and correctly so, that the name LISREL is a commercially registered trademark of National Educational Resources Inc.; it therefore should not be used generically, to describe the system of equations or the covariance structure that it generates. However, despite these admonitions by Bentler and Weeks (1980), a review of the literature reveals the common practice among researchers, of referring to JKW models that use the LISREL programs, simply as 'LISREL models'. For the sake of consistency with the bulk of the literature then, this study employs the term 'LISREL model'. The full causal model shown in Figure 1, is now translated into the lexicon of the LISREL model.

Figure 2 replicates the specified model of this study, using the appropriate LISREL symbols. An explanation of the LISREL notation and the specified model, is now presented.

η and ξ represent (mx1) and (nx1) vectors of the latent dependent and independent variables, respectively.

ζ represents a (mx1) vector of errors in equations.

B and Γ represent (mxm) and (mxn) coefficient matrices for the latent dependent and independent variables, respectively.

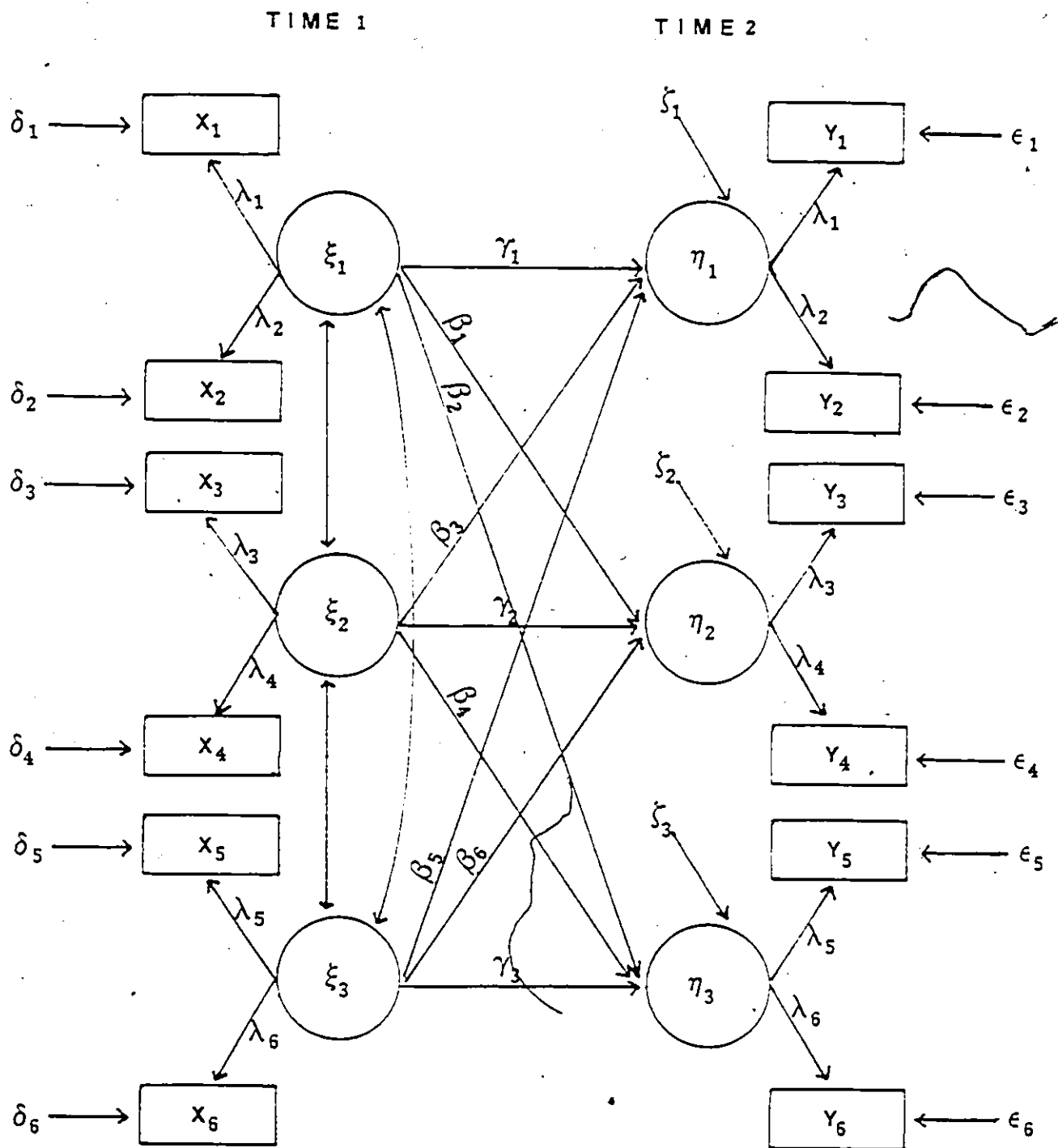


Figure 2: LISREL Model of the Relationship Between Self-concept and Academic Achievement

Y and x represent $(px1)$ and $(qx1)$ vectors of observed dependent and independent variables, respectively.

Λ_Y and Λ_x represent (pxm) and (qxm) regression matrices of Y on η and x on ξ , respectively.

ϵ and δ represent $(px1)$ and $(qx1)$ vectors of uniquenesses for the observed dependent and independent variables, respectively.

Φ and Ψ represent the covariance matrices for ξ and ζ , respectively.

Θ_ϵ and Θ_δ represent the covariance matrices for ϵ and δ , respectively.

The above parameters can be of three forms:

1. Fixed parameters i.e. they have been assigned given values.
2. Constrained parameters i.e. they are unknown, but have been made equal to one or more of the other parameters.
3. Free parameters i.e. they are unknown and free to assume any value.

With respect to the model in Figure 2, the boxes on the left and right, are indicator (observed) variables; the X 's are the independent variables and the Y 's are the dependent variables. The circles represent the latent or unobserved

constructs, each of which are measured by two indicator variables. The single-headed arrows denote causal influences (eg. $\xi_1 \longrightarrow X_1$, is interpreted to mean "a change in ξ_1 , produces a change in X_1 ").

The measurement model represents how the latent variables (unobserved constructs) are measured in terms of the observed variables. Its parameters Λ_Y , Λ_X , Θ_ϵ , Θ_δ , are used to describe the measurement properties of the observed variables (Joreskog and Sorbom, 1977). In this model, the X's are postulated to be caused by the 3 latent variables (ξ'_s) and by the error variates (δ'_s).

The structural model specifies the causal relationships among the latent variables. Its parameters B , Γ , Φ and Ψ describe the causal effects and the amount of unexplained variance (Joreskog and Sorbom, 1977). In this study, it is hypothesized that η_1 is caused by ξ_1 , ξ_2 and ξ_3 ; similarly, for η_2 and η_3 . In a longitudinal study, no influence from η to ξ is assumed, since η is measured at a later occasion than ξ (Olsson and Bergman, 1977). On the independent variable side of the model, the latent constructs (ξ'_s) are correlated as specified by empirical research and as represented by the double arrows. The errors in the structural model (ζ'_s) are referred to as errors in equations, to distinguish them from the uniquenesses δ and ϵ . They also influence the η'_s but each is independent of all other constructs.

The data of the study consist of the variances of the X's and Y's and all possible covariances. The two-headed arrows representing correlations among the measured variables, are not drawn into the diagram, since they are assumed to result from the variables measuring the same correlated constructs.

As illustrated with the model depicted in Figure 1, the specified LISREL model in Figure 2, is now translated into a system of equations. The model assumes that all parameters are related by a system of linear structural equations. These equations, together with their underlying assumptions, are now presented in both linear and matrix forms, for the complete causal model.

The Structural Model

$$B \eta = \Gamma \xi + \zeta$$

$$\begin{array}{cc} B & \eta \\ \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} & \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \end{bmatrix} \end{array} = \begin{array}{cc} \Gamma & \xi \\ \begin{bmatrix} \gamma_1 & \beta_3 & \beta_5 \\ \beta_1 & \gamma_2 & \beta_6 \\ \beta_2 & \beta_4 & \gamma_3 \end{bmatrix} & \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{bmatrix} \end{array} + \begin{array}{c} \zeta \\ \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \end{bmatrix} \end{array}$$

B = parameters fixed

Γ = parameters free

It is assumed that:

1. The latent variables and the associated errors in equations, are measured as deviations from their means; therefore, the expected values of their vectors η , ξ and ζ , are zero vectors.

$$\text{i.e. } E(\eta) = 0; E(\xi) = 0; E(\zeta) = 0$$

2. The independent latent variables are uncorrelated with the errors in equations.

$$\text{i.e. } E(\xi\zeta') = 0$$

3. The coefficient matrix B is nonsingular. This of course is true, since B is an identity matrix (see Joreskog and Sorbom, 1976; Olsson and Bergman, 1977).

$$\text{i.e. } B^{-1} \text{ exists since } B = I$$

4. Both the dependent and independent latent variables are unobserved.

$$\text{i.e. } \eta \text{ and } \xi \text{ are unobserved}$$

The Measurement Model

$$Y = \Lambda_Y \eta + \epsilon$$

$$\begin{array}{c} Y \\ \left[\begin{array}{c} Y_1 \\ Y_2 \\ Y_3 \\ Y_4 \\ Y_5 \\ Y_6 \end{array} \right] \end{array} = \begin{array}{c} \Lambda_Y \\ \left[\begin{array}{ccc} \lambda_{Y_1} & 0 & 0 \\ \lambda_{Y_2} & 0 & 0 \\ 0 & \lambda_{Y_3} & 0 \\ 0 & \lambda_{Y_4} & 0 \\ 0 & 0 & \lambda_{Y_5} \\ 0 & 0 & \lambda_{Y_6} \end{array} \right] \end{array} \begin{array}{c} \eta \\ \left[\begin{array}{c} \eta_1 \\ \eta_2 \\ \eta_3 \end{array} \right] \end{array} + \begin{array}{c} \epsilon \\ \left[\begin{array}{c} \epsilon_1 \\ \epsilon_2 \\ \epsilon_3 \\ \epsilon_4 \\ \epsilon_5 \\ \epsilon_6 \end{array} \right] \end{array}$$

Λ_Y = parameters $\lambda_1 - \lambda_6$ free;
fixed zeros elsewhere

$$X = \Lambda_x \xi + \delta$$

$$\begin{array}{c} X \\ \left[\begin{array}{c} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{array} \right] \end{array} = \begin{array}{c} \Lambda_x \\ \left[\begin{array}{ccc} \lambda_{x_1} & 0 & 0 \\ \lambda_{x_2} & 0 & 0 \\ 0 & \lambda_{x_3} & 0 \\ 0 & \lambda_{x_4} & 0 \\ 0 & 0 & \lambda_{x_5} \\ 0 & 0 & \lambda_{x_6} \end{array} \right] \end{array} \begin{array}{c} \xi \\ \left[\begin{array}{c} \xi_1 \\ \xi_2 \\ \xi_3 \end{array} \right] \end{array} + \begin{array}{c} \delta \\ \left[\begin{array}{c} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \end{array} \right] \end{array}$$

Λ_x = parameters $\lambda_{x_1} - \lambda_{x_6}$ free;
fixed zeros elsewhere.

It is assumed that:

1. The uniquenesses are uncorrelated, thus yielding diagonal matrices.

$$\text{i.e. } E(\epsilon\epsilon') = \Theta_\epsilon; E(\delta\delta') = \Theta_\delta$$

2. The uniquenesses are mutually uncorrelated.

$$\text{i.e. } E(\epsilon\delta') = 0$$

3. The uniquenesses are uncorrelated with the latent variables.

$$\text{i.e. } E(\epsilon\eta') = 0; E(\delta\eta') = 0$$

$$E(\epsilon\xi') = 0; E(\delta\xi') = 0$$

Variance-Covariance Matrices

a) The Independent Latent Variable Variance-Covariance Matrix (Φ)

$$\begin{bmatrix} \sigma_{\xi_1}^2 & \sigma_{\xi_1\xi_2} & \sigma_{\xi_1\xi_3} \\ \sigma_{\xi_2\xi_1} & \sigma_{\xi_2}^2 & \sigma_{\xi_2\xi_3} \\ \sigma_{\xi_3\xi_1} & \sigma_{\xi_3\xi_2} & \sigma_{\xi_3}^2 \end{bmatrix}$$

Φ = mixed parameters - diagonals free;
zeros elsewhere

b) The Residual Variance-Covariance Matrix (Ψ)

$$\begin{bmatrix} \sigma_{\xi_1}^2 & 0 & 0 \\ 0 & \sigma_{\xi_2}^2 & 0 \\ 0 & 0 & \sigma_{\xi_3}^2 \end{bmatrix}$$

Ψ = mixed parameters - diagonals free;
zeros elsewhere

It is assumed that:

1. Ψ is a diagonal matrix.
i.e. residuals are independent of each other.

c) The Uniqueness Variance-Covariance Matrices ($\Theta_{\epsilon}; \Theta_{\delta}$)

$$\begin{bmatrix} \sigma_{\epsilon_1}^2 & 0 & 0 & 0 & 0 & 0 \\ 0 & \sigma_{\epsilon_2}^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & \sigma_{\epsilon_3}^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & \sigma_{\epsilon_4}^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & \sigma_{\epsilon_5}^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & \sigma_{\epsilon_6}^2 \end{bmatrix}$$

Θ_{ϵ} = mixed parameters - diagonals free:
zeros elsewhere

$$\begin{bmatrix} \sigma_{\delta_1}^2 & 0 & 0 & 0 & 0 & 0 \\ 0 & \sigma_{\delta_2}^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & \sigma_{\delta_3}^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & \sigma_{\delta_4}^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & \sigma_{\delta_5}^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & \sigma_{\delta_6}^2 \end{bmatrix}$$

$\Theta_{\hat{\delta}}$ = mixed parameters - diagonals free;
zeros elsewhere

It is assumed that:

1. Θ_{ϵ} and $\Theta_{\hat{\delta}}$ are diagonal matrices.

i.e. unique variances, all independent of each other,

3.4.2.2 Identification

Before any attempt is made to evaluate the fit of a structural equation model to its data, the criterion of identification must be satisfied. It is essential that the complete model be identified before statistical estimation can be considered (Bentler, 1978; Kenny, 1979). That is to say, if a model is not identified, its parameters can assume

many values, rather than being uniquely defined; the model therefore, is not statistically estimable or testable.

The identification problem involves whether or not each parameter can be uniquely determined by Σ , the population variance-covariance matrix. Since there are $(p+q)(p+q+1)/2$ distinct parameters in Σ and s unknown parameters, a necessary condition for the identification of all parameters, is,

$$s \leq (p+q)(p+q+1)/2$$

From the equations associated with both the structural and measurement submodels of the proposed model (Figure 2), the population variance-covariance matrix can be shown to be related to the model parameters, as follows:

$$\Sigma = \begin{bmatrix} \Lambda_Y(B^{-1}\Gamma\Phi\Gamma'B^{-1} + B^{-1}\Psi B^{-1})\Lambda_Y' + \Theta_\epsilon & \Lambda_Y B^{-1}\Gamma\Phi\Lambda_X' \\ \Lambda_X\Phi\Gamma'B^{-1}\Lambda_Y' & \Lambda_X\Phi\Lambda_X' + \Theta_\delta \end{bmatrix}$$

(Joreskog, 1977)

Goldberger (1964) notes that in order to investigate the identification question, the researcher must bypass queries associated with sampling variability and instead, assume knowledge of the population variability of the observed variables. Therefore, the above expression with respect to this study, represents a set of 78 equations with 39 (s)

unknown parameters, given the population variance-covariance matrix Σ were known.

If these equations yield exactly one solution for each unknown parameter (i.e. there is one and only one estimate for each parameter), the model is said to be 'just-identified'. If all parameters of the model are identified, the entire model is said to be identified (Joreskog and Sorbom, 1978). Bentler (1978), however, points out that if a model is just-identified, it is not scientifically interesting, because it can never be rejected.

Given an identified model and subsequently, an estimate of Σ from the data, it is possible to estimate the model parameters. If, on the other hand, the equations yield no solution to any parameter (i.e. an infinite number of values would satisfy the equations), that parameter is said to be 'unidentified'. In a case where any parameter is not identified, the entire model is rendered unidentified (Joreskog, 1978).

Finally, if two or more equations yield different solutions to any parameter (i.e. there is more than one way of estimating the parameters in the system), that parameter is said to be 'overidentified', having one or more overidentifying restrictions. Thus, with reference to the model proposed for this study, if all parameters are identified and there are k overidentifying restrictions, the model is identified with $k=78-s$ overidentifying

restrictions, which provide degrees of freedom for fitting, in the test of the model. To be useful then, a model should be overidentified.

It is important to note, however, that although this minimum condition is a necessary requirement, it is not a sufficient condition for identification (Bielby and Hauser, 1977; Kenny, 1979). It is possible to specify a structural model wherein the number of variances and covariances greatly exceed the number of parameters and yet, some of the parameters may not be identified. Thus, a further requisite to identification of a model, is that each equation in the model be distinct from all other equations and all possible linear combinations of equations in the model (Duncan, 1975).

In order to exactly identify (or better, overidentify) a model, certain of its parameters may be assigned given values (fixed) or set equal to other unknown elements (constrained): The remaining parameters are free to be estimated (i.e. assume any value). For example, it has been shown that identification may be accomplished more easily by fixing to 1.0, a single parameter in each column of the matrices i.e. one indicator measure of each latent variable (see Wolfle, 1981).

As an aid to identification then, this model specified the first in each pair of indicator measures, to have a fixed value of 1.0. Thus, the total number of unknown

parameters (s) in the model equals 33; the total number of equations, 78. The model is found to be overidentified, with 45 (78-33) overidentifying restrictions; the latter, thus providing 45 degrees of freedom for the test of model fit.

3.4.2.3 Estimation

Since it is assumed that the variability of the observed variables is fully described by the covariance matrix, the estimation of the unknown parameters essentially entails fitting Σ imposed by the model, to the variance-covariance matrix S of the observed data, via the maximum likelihood (FIML) method that minimizes

$$F = \log |\Sigma| + \text{tr} (S \Sigma^{-1}) - \log |S| - (p+q)$$

where:

1. F is a function of the independent elements of B , Γ , Λ_Y , Λ_X , Φ , Ψ , Θ_ϵ , Θ_δ and a transform of the likelihood function obtained under the assumption that the observed variables have a multivariate normal distribution (Joreskog, 1969).
2. Σ is the $(p+q)(p+q)$ population variance-covariance matrix of observed variables (Joreskog, 1974).
3. S is the $(p+q)(p+q)$ sample variance-covariance matrix (Joreskog, 1974).

The procedure in effect, minimizes a scalar function of the difference between S and Σ . That is to say, the

unknown parameters of the specified model, are estimated such that the variances and covariances are in some sense, close to the observed data. A plausible model then, would exhibit a close approximation to the data. Conversely, should even the best estimators of parameter values produce a poor approximation to the data, the model must be rejected as a plausible representation of the causal process that generated the data (Bentler, 1980).

If the distribution of the observed variables is multivariate normal, the fitting function F yields maximum likelihood estimates which are efficient with large samples. The minimization of F with respect to independent model parameters, is accomplished by an iterative method which utilizes the first-order derivatives of F and the information matrix. The iteration converges rapidly from an arbitrary starting point, to a local minimum of F . Joreskog (1977), however, points out that if there are several minima of F , it cannot be guaranteed that the method will converge to the absolute minimum. At the starting point of the iterative process, the information matrix is computed for all independent unknown parameters. Joreskog and Sorbom (1977) note that for an identified model, the information matrix will almost certainly be positive definite; inversion of this matrix, provides standard errors for all estimated parameters. On the other hand, if the information matrix is singular, the specified model is not identified.

Unlike the causal modeling techniques of path analysis and cross-lagged panel correlation discussed earlier, the structural equation model of this study, does not use OLS or 2SLS procedures for parameter estimation; biased estimates would result (Johnston, 1972). Additionally, Goldberger (1964), notes that although the OLS and 2SLS estimation techniques consider the fact that each estimable equation is embedded in a system of equations, they are limited in their ability to do so (see also, Hanuschek and Jackson, 1977). Whereas the models associated with path analysis and cross-lagged panel correlations assume no measurement error, this study is more realistic in making allowance for it. The consideration of error, ultimately leads to the development of a more complex model. It is therefore important to use statistical procedures that provide the best possible estimates of the parameters; full-information maximum likelihood (FIML) procedures meet this requirement. The LISREL model of this study utilizes the maximum likelihood technique in the estimation of parameters and subsequent testing of the model.

It is important to note at least five advantages associated with the estimation of parameters via structural equation procedures. These are as follows:

1. The researcher is able to specify that the actual measurements contain error. Certainly, this offers a more realistic assumption, than the one underlying

OLS and 2SLS, that variables are observed without error.

2. In addition to gaining a more realistic model, the investigator has the bonus of being able to estimate simultaneously, the reliability of the measurement instruments, together with the parameters of the structural equation model (Rogosa, 1979). The assumption must be made, however, that the instruments are truly measuring the same phenomena.
3. The researcher is able to attain simultaneously, unbiased estimates of all the parameters in the model. Heise (1975) considers this factor one of the major advantages of the FIML procedure. He posits that by incorporating all such knowledge into the estimates of each parameter, not only is more efficient use made of the theory, but a greater precision of estimates, is attained (see also, Hanushek and Jackson, 1977). These results cannot be obtained by any other procedure, except for very simple models, carrying the assumption of no measurement error and which may not in fact, be estimating parameters of the underlying latent constructs.
4. Under the assumption of multivariate normality, maximum likelihood estimators exhibit very desirable asymptotic properties, in that they are consistent,

efficient and asymptotically normal, for large samples.

5. The maximum likelihood estimation procedure provides a very convenient method for hypothesis testing---the χ^2 likelihood ratio test; hypothesis-testing procedures using OLS and 2SLS estimation, are much less developed (Bielby and Hauser, 1977).

Of course, the benefits to the researcher, when maximum likelihood estimation is employed, come at the cost of imposing the assumptions of multivariate normality, linearity of relationships and continuity of variables (Long, 1976; Joreskog, 1978; Bentler, 1980); OLS and 2SLS also assume linearity of relationships. Although Bentler (1978) notes that recent statistical developments have made it possible to dispense with the assumption of multivariate normality (see Lee, 1977, cited in Bentler, 1978), he points out that as yet, such innovations still lack sufficient clarity regarding the forms that the variable distributions do take. Bentler and Weeks (in press), after a thorough review of the recent literature, conclude that to date, virtually nothing is known, regarding the relative robustness of the maximum likelihood estimators, to violations of assumptions.

3.5 HYPOTHESES

3.5.1 Tests of the Hypotheses

Hypothesis-testing, within the framework of causal modeling, denotes the analysis of an entire system of nonexperimental data. The model used in this study, represents the JKW model (Joreskog, 1977; Wiley, 1973), and is the most widely known hypothesis-testing model for quantitative data (Bentler and Woodward, 1979).

In causal analysis, it is assumed that most, if not all information can be summarized in the covariance matrix (Joreskog and Sorbom, 1977; Kenny, 1979); typically then, only variances and covariances are utilized. Although Bentler (1980) notes that within some contexts, the means may be relevant to analysis of the data, in this study, only the variances and covariances are of interest.

Once the data are collected, the hypothesized model is compared with the data. The minimum value of F provides a χ^2 goodness-of-fit measure of how well the model fits the data; this is known as the χ^2 likelihood ratio test. Using this technique with large samples, the null hypothesis (H_0) is tested against the more general hypothesis (H_1). More specifically, the hypothesized model (the more restrictive model wherein certain parameters are fixed and/or constrained), is tested against the more general alternative model (the less restrictive model wherein the parameters are free), that Σ is any unconstrained positive definite

matrix (Joreskog and Sorbom, 1977). H_1 is the least restrictive hypothesis possible for the model and therefore, provides a standard for a perfect fit (Long, 1976). The χ^2 likelihood ratio test consists of comparing the likelihood of H_0 generating the observed data, to the likelihood of H_1 generating the observed data.

Each model (i.e. more restrictive/less restrictive) is estimated separately and then the goodness-of-fit values compared. The difference between the two χ^2 values, is asymptotically a χ^2 value, with degrees of freedom equal to the corresponding difference in the degrees of freedom (Joreskog and Sorbom, 1977). When the number of unknown parameters is less than the total number of variances and covariances in Σ (i.e. when $s \leq (p+q)(p+q+1)/2$), the model imposes conditions on Σ which must hold if the null hypothesis is true and N is large. In FIML, the validity of the hypothesis is tested by the likelihood ratio test, the logarithm of which is $(N/2)$ times the minimum value of F (Joreskog, 1978). If the χ^2 is large and exceeds some critical value for the degrees of freedom, it is concluded that the specified model does not reflect the data. On the other hand, if the χ^2 is small compared with the degrees of freedom, the hypothesized model provides a plausible representation of the causal process.

In summary then, the decision rule associated with a test of the specified model is as follows: reject H_0 if and only

if $N/2 \min F > \chi^2(\alpha)$ where $\chi^2_{1-\alpha}(\alpha)$ is the $(1-\alpha)$ th quantile of the χ^2 distribution with d degrees of freedom. The degrees of freedom associated with the χ^2 likelihood ratio test, are equal to the total number of variances and covariances less the number of estimable parameters. That is to say, $d = (p+q)(p+q+1)/2 - s$ (Joreskog, 1977), where s is the number of unknown parameters to be estimated.

Up to this point in the hypothesis-testing procedure, the likelihood ratio test can only inform the investigator of the plausibility of the specified model as representative of the data. Should the model exhibit a poor fit, the same test is unable to pinpoint the problem areas. Long (1976) suggests that a poor fit of the model to the data can result from one or a combination of three situations: 1) an insufficient number of unobserved variables to explain the covariation in the observed variables 2) the selection of incorrect values with respect to the constrained and/or fixed parameters and 3) the selection of incorrect values with respect to the constrained and/or fixed covariances among both the parameters and error terms.

Given that the underlying assumptions of the model are tenable, there are 3 techniques for determining misspecification in a LISREL model. These are as follows:

1. By inspecting the estimated standard error of each parameter estimate, the investigator is given an indication of the importance of that parameter to the

model as a whole. If the critical ratio (parameter estimate divided by estimated standard error) is large, the parameter is considered essential to the model; if it is small, the parameter is likely unnecessary to the model (Bentler, 1980). Parameters whose critical ratios are small, can be eliminated from the model and the model reestimated. The LISREL IV program (Joreskog and Sorbom, 1978) provides estimated standard errors for each of the estimated parameters and terms the critical ratios as "T-values".

2. By examining the residual matrix, $(S - \Sigma)$, which contains the discrepancies between the observed variance-covariance matrix S and the estimate of Σ obtained by substituting estimates of the parameters into the equation for Σ as shown on page 125, the researcher is able to determine among which observed variables, the model was unable to adequately predict the observed covariance i.e. the specific paths of model misfit to the data (Long, 1976; Joreskog and Sorbom, 1977; Joreskog, 1978; Bentler, 1980). However, due to the complex relationship between the parameters of the model and the variance-covariance matrix, it is often difficult to determine from the residual matrix, the exact locus of misfit in the model.

3. By examining the magnitude of the first-order derivatives of F with respect to the fixed parameters, the investigator can determine which of these parameters if set free, would provide the largest decrease in the fitting function (Costner and Shoenberg, 1973; Sorbom, 1975).

Using one or a combination of these techniques then, the researcher can detect possible areas of misspecification and is thus able to improve the model fit to the data accordingly. This is done by fitting two models that are identical except that one contains more free parameters than the other. Joreskog (1978) points out that a large change in the χ^2 values of the two models relative to the difference in degrees of freedom, indicates that the adjustment to the model represents a real improvement. Conversely, if the change in χ^2 is close to the difference in degrees of freedom, it suggests that the improvement of fit is obtained merely by chance alone and the modified parameters may not have any real significance or meaning. Sorbom (1975), speaking generally of all methods for detecting errors in model specification, reminds researchers that such procedures at best, only provide hints and as long as the population parameters are unknown, it is never certain that the misspecified parameters have been found. However, he further admonishes that as long as these hints provide interpretable results, they should be accepted (see also, Wolfle, 1981).

It is important that the reader understand the basic philosophical tenet underlying hypothesis-testing, in causal modeling. Within contexts such as the one used in this study, Olsson and Bergman (1977) note that the χ^2 values are not regarded as tests in the strict statistical sense, but rather, as tools for comparing different specifications of a model. As Kenny (1979) points out, a postulated causal model can be disconfirmed by the data. However, no single model can be confirmed as a true representation of the population; rather, it stands as one of a host of plausible models (see also, Bentler, 1980). In this regard, Joreskog (1974) states,

The statistical problem is not one of testing a given hypothesis (which a priori may be considered false), but rather one of fitting various models with different numbers of parameters and of deciding when to stop fitting In such a problem, the differences between χ^2 values matter rather than the χ^2 values themselves (p.4).

Bentler (1978) very aptly summarizes the hypothesis-testing procedure, when he points out that the goal in causal modeling is not one of rejecting the null hypothesis, but rather of accepting it; the model is then considered plausible, because it cannot be rejected. This summative statement, however, must be accompanied by a caveat regarding the danger of overfitting the model. For example, although statistically, it may be possible to obtain a better-fitting model, substantively, the results may be meaningless (see Wolfle, 1981). Additionally, the mere fact

that a sample size is small, can lead to a better fit of the model (see Bentler and Bonett, 1980).

3.5.2 Statements of the Hypotheses

3.5.2.1 Hypothesis I

The first hypothesis addresses the question of whether academic achievement is stronger as a predictor of general self-concept than general self-concept is, as a predictor of academic achievement. A comparison of the lagged regression coefficients β_5 vs β_2 provides data bearing on this question (see Figure 1).

To test this hypothesis, H_0 is restricted such that β_5 is constrained to equal β_2 ; H_1 is unrestricted. The model under H_1 has one more parameter to be estimated than that under H_0 , hence the χ^2 differential for comparing the two models ($\Delta\chi^2$) has one degree of freedom. The null hypothesis is that $\beta_5 = \beta_2$ and the research hypothesis is that $\beta_5 > \beta_2$. The decision rule then, is:

$$\text{Reject } H_0 \text{ if } \Delta\chi^2 > \chi^2_{1, 0.95}$$

3.5.2.2 Hypothesis II

The second hypothesis addresses the question of whether academic achievement is a stronger predictor of academic self-concept than academic self-concept is, as a predictor of academic achievement. A comparison of the lagged

regression coefficients β_6 vs β_4 provides data bearing on this question (see Figure 1).

To test this hypothesis, H_0 is restricted such that β_6 is constrained to equal β_4 ; H_1 is unrestricted. This is similar to Hypothesis I. The null hypothesis is that $\beta_6 = \beta_4$ and the research hypothesis is that $\beta_6 > \beta_4$. The decision rule then, is:

Reject H_0 if $\Delta X^2 > X^2_{1, 0.95}$

3.5.2.3 Hypothesis III

The third hypothesis addresses the question of whether academic self-concept is causally stronger than academic achievement, as a predictor of general self-concept. A comparison of the lagged regression coefficients β_5 vs β_3 provides data bearing on this question (see Figure 1).

To test this hypothesis, H_0 is restricted such that β_5 is constrained to equal β_3 ; H_1 is unrestricted. As in Hypotheses I and II, the null hypothesis is that $\beta_5 = \beta_3$ and the research hypothesis is that $\beta_3 > \beta_5$. The decision rule then, is:

Reject H_0 if $\Delta X^2 > X^2_{1, 0.95}$

3.5.2.4 Hypothesis IV

The fourth hypothesis addresses the question of whether academic achievement is a stronger predictor of academic self-concept than academic achievement is, as a predictor of general self-concept. A comparison of the lagged regression coefficients β_6 vs β_5 provides data bearing on this question (see Figure 1).

To test this hypothesis, H_0 is restricted such that β_6 is constrained to equal β_5 ; H_1 is unrestricted. The null hypothesis is that $\beta_6 = \beta_5$ and the research hypothesis is that $\beta_6 > \beta_5$. The decision rule then, is:

$$\text{Reject } H_0 \text{ if } \Delta X^2 > \chi^2_{1, 0.95}$$

The findings of this investigation, together with a full description of the data, are now presented in Chapter IV.

Chapter IV

PRESENTATION AND ANALYSIS OF THE DATA

Analysis of the causal relationships among the latent constructs 'general self-concept', 'academic self-concept' and 'academic achievement', was accomplished in two basic stages. First, the overall fit of the specified model was determined. This task involved estimation of the initial model, followed by reestimation of subsequent models wherein certain parameters had been altered; these model respecification and reestimation procedures, being necessary steps towards the achievement of a final best-fitting model. All respecifications of parameters were made on the basis of both theory and examination of the first-order derivatives or critical ratio values (T-values). Second, once the best-fitting model was ascertained, this model (model H) was used as the basis upon which to test the hypotheses of the study.

It is important to note, that it was the original intent of this investigation, to subject the best-fitting model to further restriction, in order to test the stated hypotheses. However, the data provided information that made this procedure redundant.

A few words are in order, concerning the use of the LISREL program (Joreskog and Sorbom, 1978), as it pertains to this study. LISREL allows the researcher to input data in a variety of forms; raw data were input for this study. Additionally, the investigator must choose between a correlation or variance-covariance matrix, for analysis of the data. Since the metric differences among the indicator variables were both large and arbitrary, the correlation matrix was selected for the analysis (see Lomax, 1981).

Additionally, LISREL requires that both the type and size of all eight matrices involved in the program be specified, together with the specification of the elements comprising these matrices. That is to say, each element is designated as: 1) a parameter fixed at a prespecified value 2) a free parameter to be estimated by the program 3) a parameter constrained to be equal to the estimated value of some other free parameter.

Finally, since LISREL is an iterative program, it requires the input of starting values for all elements in each matrix, not defined as either an identity or zero matrix. The default value assumed by the program is zero, thus only those starting values for non-zero fixed and free parameters require specification. Although these starting values may be selected arbitrarily, they must in the first iteration, produce an estimated covariance matrix which is positive definite; if not, the program terminates.

abnormally. Heeding Kenny's (1979) advice, different starting values were used with the final model (model H) to uphold that a local minimum solution had not been obtained.

It has been found that solution to the identification problem can be simplified, by fixing parameters in the measurement portion of the model (Λ) to 1.0, for a single indicator measure of each latent variable (see Joreskog, 1977; Lomax, 1981; Wolfle, 1981). These fixed parameters then become reference indicators and serve to set the metric for the latent variables. In this investigation, the initial variable in the pair of indicator measures of each latent variable, was arbitrarily chosen to have a specified fixed value of 1.0.

The empirical results are now presented with respect to:

1. The model
2. Tests of the hypotheses
3. Supplementary data

4.1 THE MODEL

4.1.1 The Fitting Procedure

A number of specifications were required in order to obtain the best-fitting model. The summary goodness-of-fit statistics for these specifications, are presented in Table 1. Using as a guide, Wolfle's (1981) excellent example of the model-fitting procedure, these specifications are now discussed in both rational and substantive terms.

TABLE 1

Goodness-of-Fit Statistics for Models Representing the
Relationship Among GSC, ASC and AA

Model	χ^2	DF	Prob	$\Delta\chi^2$	DF
A. Ψ = diagonal, free θ_{ϵ} = diagonal, free	2072.36	45	0.0		
B. θ_{ϵ} = diagonal, free $\psi_{33} = .001$	2211.50	46	0.0		
C. $\psi_{33} = .001$ ψ_{31} = free θ_{ϵ} = diagonal, free	2185.25	45	0.0	26.25*	1
D. $\psi_{33} = .001$ ψ_{31} = free $\theta_{11,5}; \theta_{7,1}; \theta_{9,3}$ free	1046.47	42	0.0	1138.78*	3
E. $\psi_{33} = .001$ $\psi_{11}; \psi_{22}; \psi_{21}; \psi_{31}; \psi_{32}$ free $\phi_{11}; \phi_{22}; \phi_{33}; \phi_{21}; \phi_{31}; \phi_{32}$ free $\theta_{11,5}; \theta_{7,1}; \theta_{9,3}$ free	323.58	37	0.0	722.89*	5
F. Model E with $\theta_{2,2}; \theta_{10,4}$ free	223.18	35	0.0	100.40*	2
G. Model F with $\theta_{3,1}; \theta_{9,7}$ free	206.10	33	0.0	17.08*	2
H. Model G with $\beta_1, \beta_3, \beta_5, \beta_4, \beta_2 = 0$	210.96	38	0.0	4.85	5

* Statistically significant $\alpha = .05$

Model A assumes the errors of measurement are uncorrelated and imposes a causal structure among the latent factors as shown in Figure 2. The matrices Ψ , Φ , Θ_ϵ and Θ_δ , were specified as diagonal matrices, where the diagonal elements were allowed to be free. The likelihood ratio χ^2 value for this model, was found to be 2072.36 with 45 degrees of freedom. This value of course, suggests an extremely poor fit of the model to the data. Additionally, however, examination of the LISREL estimates as shown in Figure 3, reveals ψ_{33} to be a negative number. This parameter value represents the variance of the residual in 'academic achievement' at time 2. Although it is not uncommon for maximum likelihood estimates to converge at a value less than zero (Bentler, 1980; Wolfle, 1981), clearly, negative variance estimates are not permissible. Wolfle (1981) suggests that the standard fix in this instance, is to constrain the offending variance to zero, or some small positive number. Model A was initially reestimated with ψ_{33} fixed at zero; this specification, however, led to uninterpretable results. The outcome was likely a function of the mathematics involved in the generation of covariances in the Ψ matrix; the multiplication of a zero value with a constant, cannot yield a nonzero covariance value. Model A was subsequently respecified with ψ_{33} fixed at .001 and again reestimated.

TIME 1

TIME 2

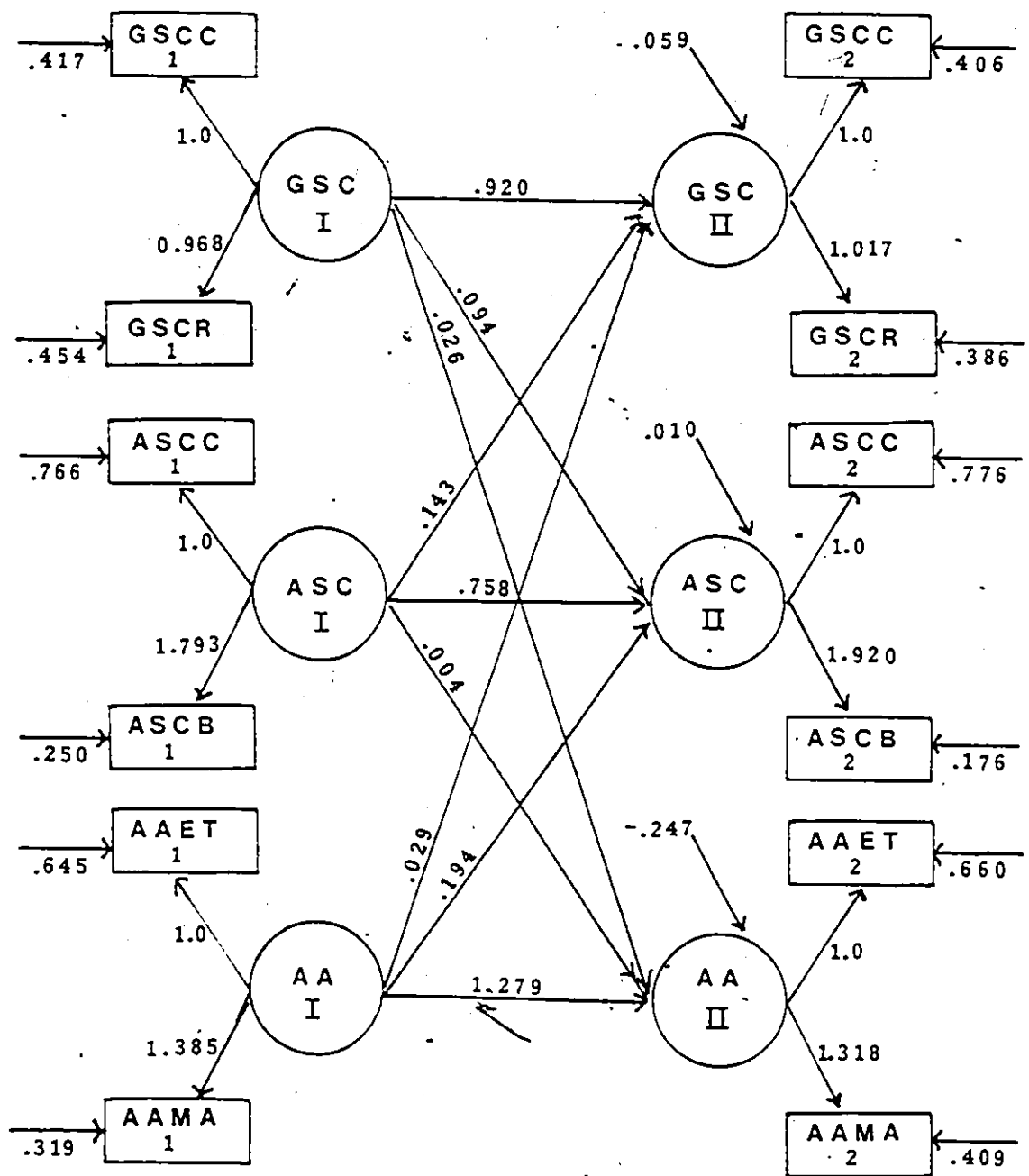


Figure 3: Unstandardized Solution for LISREL Model A

Model B represents the reestimated model with ψ_{33} fixed at .001. Substantively, this means that 'academic achievement' at time 2, can be predicted almost perfectly from some linear combination of 'general self-concept', 'academic self-concept' and 'academic achievement', at time 1. Model B is shown to have a χ^2 value of 2211.50 with 46 degrees of freedom. Again, the LISREL estimates suggest a poorly-fitting model. Examination of the first-order derivatives among the fixed parameters of the Ψ matrix, suggested that the correlation between ξ_3 and ξ_1 (ψ_{31}) was the parameter most likely not to be zero. That is to say, if ψ_{31} were allowed to go free, this parameter would be the value most likely to contribute the most, in the search for a better-fitting model. In substantive terms, this indicates that the 3 independent latent variables (ξ_1, ξ_2, ξ_3), have not explained all of the covariation between 'academic self-concept' and 'academic achievement', at time 2; it is likely that the correlation between these two constructs, is partially explainable by variables other than those appearing in the model. ψ_{31} was therefore permitted to be freely estimated in a new model.

Model C was subsequently estimated, allowing ψ_{31} to be free. The χ^2 value for this model is shown in Table 1 to be 2185.25 with 45 degrees of freedom. The difference between the χ^2 values for models B and C, was 26.25, which was distributed as χ^2 with 1 degree of freedom; this value is significant.

To this point, the model has assumed that the uniquenesses are uncorrelated. However, the severe lack of model fit to the data, suggests that this assumption is not tenable. Joreskog and Sorbom (1976, 1977) note that when constructs are measured with the same instruments at different occasions, it may not be reasonable to assume zero correlation among the variable uniquenesses. Rather, due to the effects of memory and other retest factors, it is more plausible to assume a tendency for these uniquenesses to correlate over time. This current study used the same instruments to measure each of the 3 latent constructs (GSC, ASC, AA) at two points in time. Despite the fact that a period of 6 months was allowed between test administrations, in an attempt to minimize uniqueness associated with retest situations, examination of the first-order derivatives suggested such correlations for AAET ($\theta_{\delta_5 \epsilon_5}$), ASCC ($\theta_{\delta_3 \epsilon_3}$) and GSCC ($\theta_{\delta_1 \epsilon_1}$) over time. In order to allow the uniquenesses for these variables to covary from time 1 to time 2, it was necessary to restructure the input data, congruent with the 'No-X' option of the LISREL program. Subsequently, $\theta_{\delta_5 \epsilon_5}$, $\theta_{\delta_3 \epsilon_3}$ and $\theta_{\delta_1 \epsilon_1}$ were designated as free parameters and the model reestimated.

The revamped model can be found in Appendix A. With the No-X model, LISREL totally restructures the matrices, which ultimately alters the notation and numbering of the elements. Therefore, in order to avoid confusing the

reader, the results of this study are presented and discussed with reference to the matrices and notation of the original model. An exception must be made, however, in the case of the θ_{ϵ} and θ_{δ} matrices, since it is necessary to be able to denote covariation between some ϵ 's and some δ 's. Consequently, θ must represent a matrix of all variances and covariances between the ϵ 's and the δ 's. Thus, $\theta_{11}, \theta_{22}, \dots, \theta_{66}$, represent the new notation for the diagonal elements of θ_{ϵ} ; $\theta_{77}, \theta_{88}, \dots, \theta_{12,12}$, the notation for the diagonal elements of θ_{δ} ; and $\theta_{11,5}$ for example, represents the covariance between δ_5 and ϵ_5 .

Model D represents the new model allowing for the above specified correlations among the uniquenesses of the indicator variables. The χ^2 value for Model D is 1046.47 with 42 degrees of freedom. The difference in χ^2 values between models C and D, was 1138.78 with 3 degrees of freedom. Clearly, this discrepancy between the two models, represents a substantial improvement in fit; the χ^2 value of course, is statistically significant.

After continuing this process of examining the first-order derivatives and subsequently respecifying and reestimating the model, it was found that by freeing all parameters in the Φ matrix (variances and covariances of the ξ 's i.e. GSCI, ASCI and AAI) and the Ψ matrix (variances and covariances of the ζ 's i.e. residuals in predicting GSCII, ASCII and AAI), with the exception of

ψ_{33} , which remained fixed at .001, a much better-fitting model could be obtained. Model E then, represents a model which, in addition to the previously specified free parameters, designated the matrix as symmetric, fixed, with the following parameters free: $\psi_{11}, \psi_{22}, \psi_{31}, \psi_{21}, \psi_{32}, \phi_{11}, \phi_{22}, \phi_{33}, \phi_{21}, \phi_{31}, \phi_{32}$.

The likelihood ratio χ^2 value for Model E dropped to 323.58 with 37 degrees of freedom. Thus, the χ^2 difference between models D and E was shown to be 722.89 with 5 degrees of freedom. Again, this model specification revealed a major improvement in fit. Substantively, this means that not only are the constructs correlated among themselves at time 1 ($\phi_{21}, \phi_{31}, \phi_{32}$), but that there is evidence of systematic, unexplained correlation among these constructs, at time 2 ($\psi_{21}, \psi_{31}, \psi_{32}$). Shavelson and Bolus (in press) suggest that such evidence of correlation among the residuals, may be attributed to two major factors: 1) similarity of measurement methods (i.e. self-report measures of self-concept) and 2) failure to include other important variables in the model (i.e. model misspecification).

Indeed, the four instruments used to measure both 'general self-concept' and 'academic self-concept', were all self-report measures. Therefore, it is likely that some of the variance between these two latent variables, may be accounted for by errors of measurement associated with similar methods of measurement. With respect to misspecification, it appears that some other variable or

variables not included in the model, is (are) accounting for some of the variance between 'general self-concept' and 'academic self-concept' (ψ_{21}), 'academic self-concept' and 'academic achievement' (ψ_{32}) and 'general self-concept' and 'academic achievement' (ψ_{31}).

Further examination of the first-order derivatives revealed that within the Θ matrix, two additional parameters if set free, were least likely to be zero values. These parameters were $\theta_{8,2}$ and $\theta_{10,4}$, the covariances between the uniquenesses of the indicator variables ASCB and GSCR, from time 1 to time 2. These parameters were allowed to go free and then the model reestimated.

Model F represents the newly estimated model and exhibits a χ^2 value of 223.18 with 35 degrees of freedom. The difference between models E and F produced a χ^2 difference of 100.40 with 2 degrees of freedom; again, indicating a major improvement in model fit, and statistically significant.

There are of course, many types of measurement error. Thus, within the model, other sources of covariation among the uniquenesses, are possible. One such possibility exists when the errors in one variable are correlated with errors in another variable (Patteson and Wolfle, 1981). Since the indicator variables ASCC and GSCC were separate subscales of the same measurement instrument, it would seem feasible that they might have correlated uniqueness. Indeed, inspection

of the first-order derivatives in the Θ matrix, offered support for this prognosis. Thus, the parameters $\theta_{3,1}$ and $\theta_{9,7}$ were set free and the model reestimated.

The new model G, when compared with Model F, again suggests a significant improvement in fit. The χ^2 value for Model G was 206.10 with 33 degrees of freedom; the $\Delta\chi^2$ being 17.08 with 2 degrees of freedom.

Although further scrutiny of the first-order derivatives from Model G revealed other parameters in the Θ matrix which if set free, would be the values most likely to be non-zero, the decision was made to discontinue the search for a better-fitting model, through the freeing of these particular parameters. It was believed that a continuation of this process would involve overfitting the model. In actual fact, several other models were estimated beyond this point, with successively more error terms set free. Indeed, the parameters which the first-order derivatives indicated should next be set free, were $\theta_{9,5}$ and $\theta_{8,5}$; these were the covariances between the error terms for GSCC and ASCB at time 1, with those of AAET at time 2. When these two parameters were allowed to be freely estimated, the χ^2 dropped to 181.73 with 31 degrees of freedom. The difference in χ^2 values from Model G being 24.37 with 2 degrees of freedom, indicating a statistically significant improvement in model fit.

However, although further decrements in χ^2 values were found to be statistically significant, there was little variation of the structural parameter estimates (β values) from those of Model G. Additionally, it is widely known that likelihood ratio χ^2 values tend to be extremely sensitive to even minute deviations from a perfect fit, with large samples (see Bentler and Bonett, 1980, for a more extensive discussion).

Examination of the T-values in Model G, for each of the structural coefficients (B matrix), however, suggested that within the B matrix, parameters β_1 , β_3 , β_5 , β_4 and β_2 , were not significantly different from zero. The fact that these critical ratio values were so small, provided an indication of their irrelevancy to the model (Bentler, 1980). At this stage of the model fitting process, Lomax (1981) suggests that such parameters be fixed to zero and the model subsequently reestimated.

Model H was specified in compliance with this suggestion and indeed, no significant difference was found between the χ^2 values of models G and H. Model H exhibited a χ^2 value of 210.96 with 38 degrees of freedom; the $\Delta\chi^2$ was 4.85 with 5 degrees of freedom. This result then, supported the notion that β_1 , β_3 , β_5 , β_4 and β_2 are indeed, equal to zero. In substantive terms, these parameters represent the direct effects at time 2 of: GSC on ASC (β_1), ASC on GSC (β_3), AA on GSC (β_5), ASC on AA (β_4) and GSC on AA (β_2), respectively.

The decision to accept Model H as the best-fitting model to explain the causal relationship of 'general self-concept', 'academic self-concept' and 'academic achievement', was made on both statistical and theoretical grounds. It was noted earlier, that additional model respecifications and reestimations resulted in minimal fluctuations among the Beta estimates. Furthermore, the known sensitivity of the likelihood ratio χ^2 value with large samples, was also noted. Finally, Model H yielded a χ^2 ratio value of 5.55 (χ^2/df). Schmitt (1978) suggests that a model of adequate fit will exhibit a χ^2 ratio value of between 1.00 and 10.00; the lower the ratio, the better the fit. It is the opinion of this investigator, however, that since the χ^2 ratio value is based on the expectation of a χ^2 -distributed random variate being equal to the number of degrees of freedom, a ratio of 10.0, appears rather large. In this regard, Wolfle (1981) suggests that when the sample size is large, the χ^2 ratio value should be less than 5.0. Statistically then, Model H was accepted as representing the best fit of the model to the data.

From a theoretical perspective, Model H is consistent with that which is known to date, concerning the relationship among the three constructs. Heed was paid to Lomax's (1981) admonition that further model modifications should only be carried out, when they are congruent with the underlying theory and only when such changes are meaningful

to the investigator; indeed, further modifications of Model H yielded meaningless and confusing results. Theoretically then, Model H was accepted as the best-fitting model.

4.1.2 Empirical Results

This section presents the results from both the measurement and structural analyses of Model H; each analysis is discussed separately. The unstandardized solution for this final self-concept/academic achievement model, is shown schematically, in Figure 4 and tabularly, in Table 2; the estimated standard errors being included in the latter. For ease of conceptual understanding, these data mirror that of the model specified in Figure 2.

4.1.2.1 The Measurement Parameters

The LISREL estimates for only those parameters comprising the measurement component of the full model, are presented in Table 3. The unique variance estimates for each of the indicator variables are taken from the theta (Θ) matrices. The estimates for time 1 are represented by $\theta_{\delta 11}$ through $\theta_{\delta 66}$; those for time 2, by $\theta_{\epsilon 11}$ through $\theta_{\epsilon 66}$. The parameter estimates for each of the latent variables, represent estimates of true score variance. These values are found in the estimated covariance matrix 'C', of the LISREL printout. Finally, the estimated slopes of each of the indicator variables, as regressed onto their respective latent variables, are shown in the lambda γ ($\Lambda \gamma$) matrix.

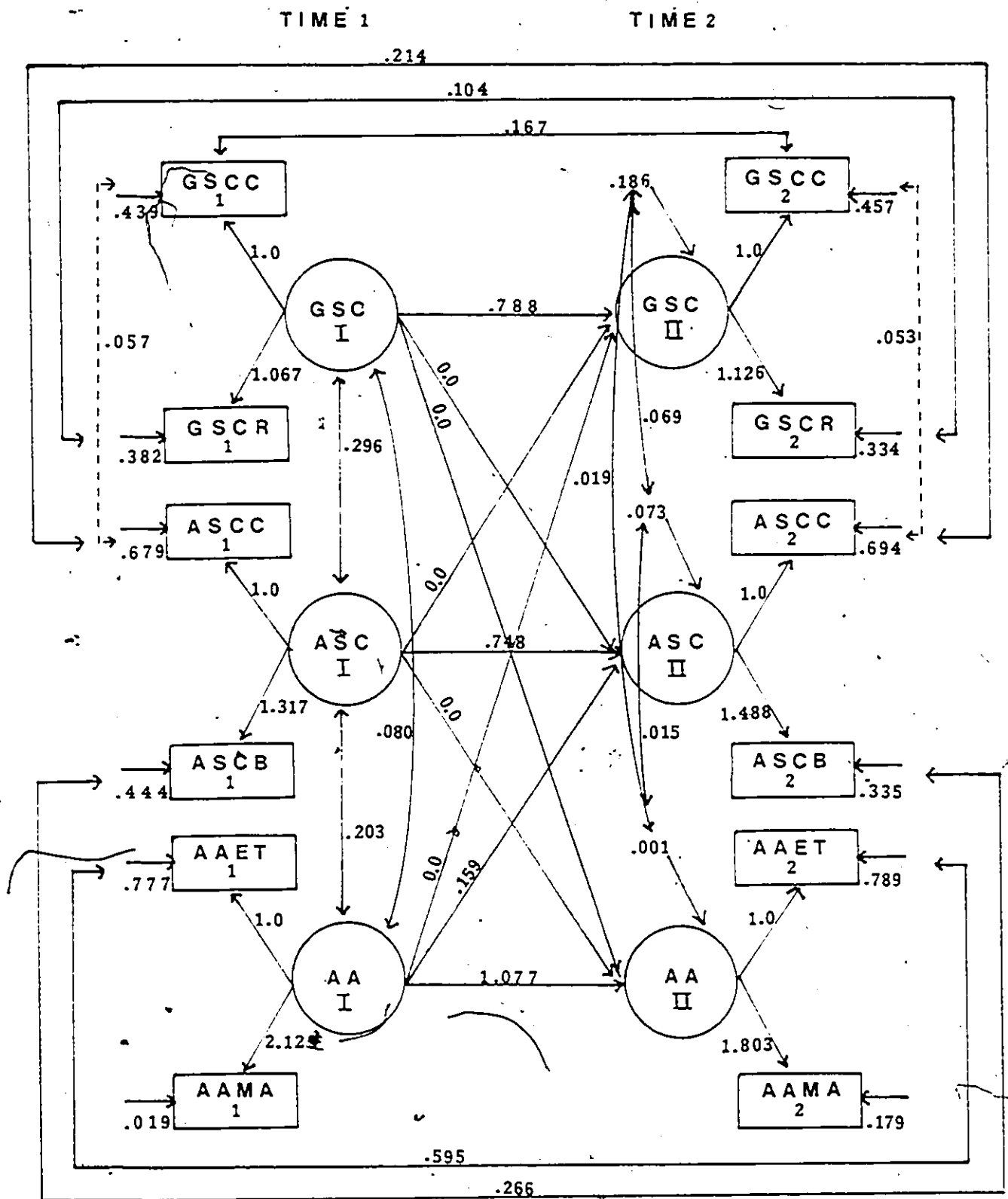


Figure 4: Unstandardized Solution for Final LISREL Model

TABLE 2

LISREL Estimates for the Model in Figure 2

General SC	Academic SC	Academic Ach		θ
$\hat{\Lambda}_x = \begin{bmatrix} 1.0^* \\ 1.067 (.066) \\ 0.0 \\ 0.0 \\ 0.0 \\ 0.0 \end{bmatrix}$	$\begin{bmatrix} 0.0 \\ 0.0 \\ 1.0^* \\ 1.317 (.082) \\ 0.0 \\ 0.0 \end{bmatrix}$	$\begin{bmatrix} 0.0 \\ 0.0 \\ 0.0 \\ 0.0 \\ 1.0^* \\ 2.129 (.137) \end{bmatrix}$	$\begin{bmatrix} \text{GSCC I} \\ \text{GSCR I} \\ \text{ASCC I} \\ \text{ASCB I} \\ \text{AAET I} \\ \text{AAMA I} \end{bmatrix}$	$\begin{bmatrix} .439 \\ .382 \\ .679 \\ .444 \\ .777 \\ .019 \end{bmatrix}$

General SC	Academic SC	Academic Ach		θ
$\hat{\Lambda}_y = \begin{bmatrix} 1.0^* \\ 1.126 (.070) \\ 0.0 \\ 0.0 \\ 0.0 \\ 0.0 \end{bmatrix}$	$\begin{bmatrix} 0.0 \\ 0.0 \\ 1.0^* \\ 1.488 (.094) \\ 0.0 \\ 0.0 \end{bmatrix}$	$\begin{bmatrix} 0.0 \\ 0.0 \\ 0.0 \\ 0.0 \\ 1.0^* \\ 1.803 (.105) \end{bmatrix}$	$\begin{bmatrix} \text{GSCC II} \\ \text{GSCR II} \\ \text{ASCC II} \\ \text{ASCB II} \\ \text{AAET II} \\ \text{AAMA II} \end{bmatrix}$	$\begin{bmatrix} .457 \\ .334 \\ .694 \\ .335 \\ .739 \\ .179 \end{bmatrix}$

General SC	Academic SC	Academic Ach	
$\hat{\Gamma} = \begin{bmatrix} .788 (.043) \\ 0.0^* \\ 0.0^* \end{bmatrix}$	$\begin{bmatrix} 0.0^* \\ .748 (.065) \\ 0.0^* \end{bmatrix}$	$\begin{bmatrix} 0.0^* \\ .153 (.052) \\ 1.077 (.043) \end{bmatrix}$	$\begin{bmatrix} \text{GSC II} \\ \text{ASC II} \\ \text{AA II} \end{bmatrix}$

General SC	Academic SC	Academic Ach	
$\hat{\Phi} = \begin{bmatrix} .546 (.050) \\ .296 (.029) \\ .080 (.015) \end{bmatrix}$	$\begin{bmatrix} .319 (.037) \\ .203 (.020) \end{bmatrix}$	$\begin{bmatrix} .216 (.029) \end{bmatrix}$	$\begin{bmatrix} \text{GSC I} \\ \text{ASC I} \\ \text{AA I} \end{bmatrix}$

ξ_1	ξ_2	ξ_3
$\hat{\Psi} = \begin{bmatrix} .186 (.023) \\ .069 (.010) \\ .015 (.005) \end{bmatrix}$	$\begin{bmatrix} .073 (.012) \\ .019 (.003) \end{bmatrix}$	$\begin{bmatrix} .001^* \end{bmatrix}$

Corr ($\delta_1 \epsilon_1$) = .167
 Corr ($\delta_2 \epsilon_2$) = .104
 Corr ($\delta_3 \epsilon_3$) = .214
 Corr ($\delta_4 \epsilon_4$) = .266
 Corr ($\delta_5 \epsilon_5$) = .595
 Corr ($\delta_1 \delta_3$) = .057
 Corr ($\epsilon_1 \epsilon_3$) = .053

$\chi^2 = 210.956$ df = 38
 $\chi^2/df = 5.551$

* Fixed Parameter
 ** Standard errors in parentheses

The LISREL estimates for time 1 are represented by $\lambda_{8,4}$, $\lambda_{10,5}$ and $\lambda_{12,6}$; those representing time 2, by $\lambda_{2,1}$, $\lambda_{4,2}$ and $\lambda_{6,3}$.

Examination of the data in Table 3, demonstrates very clearly, that the indicator variables overall, do not function satisfactorily in measuring the latent constructs. The variables measuring 'general self-concept' (GSCC and GSCR), appear to be the most adequate of the group; at best, even they do only a mediocre job in accounting for true score variance in the latent construct. The true score variance in this instance, means that when the SEI--General Self subscale (Coopersmith, 1967) and the Self-esteem Scale (Rosenberg, 1965) are used together as measures of 'general self-concept', they can account for only 54.6% of true score variance; the remaining variance being explained by unique error, or the possibility that one of the instruments may not be measuring GSC in the same way that the other one is. With the exception of 'Mark Average' (AAMA), much of the variance in the indicator variables, is explained by uniqueness, rather than true score variance. In fact, in the case of both indicator variables measuring 'academic self-concept' (ASCC and ASCB), together with the Reading Comprehension measure of 'academic achievement' (AAET), uniqueness is shown to account for more variance in the latent constructs, than does true score variance; AAET being the most blatant example of this problem.

TABLE 3
Measurement Parameters for Model H

Construct	Indicator Variable	Unique Variance	Factor Loadings	Latent Variable Variance
<u>Time 1</u>				
GSC	GSCC	.439	1.00*	.546
	GSCR	.382	1.067	
ASC	ASCC	.679	1.00*	.319
	ASCB	.444	1.317	
AA	AAET	.777	1.00*	.216
	AAMA	.019	2.130	
<u>Time 2</u>				
GSC	GSCC	.457	1.00*	.524
	GSCR	.334	1.126	
ASC	ASCC	.694	1.00*	.303
	ASCB	.335	1.488	
AA	AAET	.739	1.00*	.252
	AAMA	.179	1.803	

* Fixed Parameter

These relatively large uniqueness values may be attributed to any one or a combination of factors. One possible explanation that must always be considered in the measurement of social phenomena of course, is the presence of random measurement error. A further alternative interpretation concerns the possibility that the two instruments used as measures of the same latent variable, may not in fact, be measuring the same construct; or at least, not measuring it in exactly the same manner. For example, the data in Table 3 provide evidence that AAET and AAMA together, measured 'academic achievement' (true score variance at time 1 = .216; time 2 = .252). However, given the differential between the unique variances associated with AAET (time 1 = .777; time 2 = .739) and AAMA (time 1 = .019; time 2 = .179), the data strongly suggest the possibility that the ETS (1960) Reading Comprehension Test (AAET) may not be measuring 'academic achievement', in the same way that Mark Average (AAMA) does.

A final contributing factor to the unique variance of each indicator variable and one found to be present in this study, concerns the correlation of error factors associated with the administration of the same instrument at two different points in time. In this regard, Table 2 demonstrates that uniqueness associated with five of the indicator variables (all except AAMA), contained components that were correlated from one administration of the tests to the next.

These uniqueness correlation values over time, as presented in Table 2, are identified with their respective indicator variables, as follows:

corr $\delta_1 \epsilon_1$ (.167) - GSCC

corr $\delta_2 \epsilon_2$ (.104) - GSCR

corr $\delta_3 \epsilon_3$ (.214) - ASCC

corr $\delta_4 \epsilon_4$ (.266) - ASCB

corr $\delta_5 \epsilon_5$ (.595) - AAET

These values indicate the amount of unique variance that can be explained by the fact that the same instrument was used to measure the same construct, at two different points in time. Overall, the ETS (1960) Reading Comprehension Test (AAET) can again be seen to exhibit the highest degree of uniqueness correlation over time (corr $\delta_5 \epsilon_5 = .595$); 35.4% of the unique variance can be explained by error factors associated with both test administrations.

In summary, however, the fact that there is some variance explained by the latent true scores, among the indicator variables, indicates that indeed, there do seem to be underlying factors which measure one's general self-concept, academic self-concept and academic achievement. The question therefore, of whether or not the construct of 'academic self-concept' can be measured separately from the more global construct of 'general self-concept', appears to be affirmative.

4.1.2.2 The Structural Parameters

The parameters associated with the structural portion of the specified model, are shown in Table 4. It may be seen from these results, that the only noteworthy causal effect among the three latent constructs, flows from 'academic achievement' to 'academic self-concept'; all other causal effects are nonsignificant.

Correlations among the latent constructs can be seen in Table 5. The results in Table 5 demonstrate that all 3 constructs are fairly stable; of the 3, however, 'academic achievement' was found to be the most stable. With a correlation of .998 over time, 'academic achievement' is a very stable construct indeed. With respect to correlations among the constructs within each time-period, the relationship between 'general self-concept'/'academic achievement' and 'academic self-concept'/'academic achievement' are shown to remain essentially unchanged over time. On the other hand, the correlation between the two self-concept constructs, do vary between occasions; the relationship was stronger at time 1 than at time 2.

Finally, examination of Table 2 reveals correlations among the residual terms in the Ψ matrix. This phenomenon can have implications for both the structural and measurement parameters of the specified model. Structurally, it is a clear indication that the model has in some way, been misspecified. That is to say, the structural

TABLE 4

Structural Parameter Estimates for Model H

<u>Dependent Latent Variables</u>	<u>Independent Latent Variables</u> (Time 1)		
	<u>GSC</u>	<u>ASC</u>	<u>AA</u>
<u>Standardized Coefficients</u>			
(Time 2)			
GSC	.804	0.0*	0.0*
ASC	0.0*	.767	.129
AA	0.0*	0.0*	.998
<u>Unstandardized Coefficients</u> **			
GSC	.788 (.043)	0.0*	0.0*
ASC	0.0*	.748 (.065)	.153 (.052)
	0.0*	0.0*	1.077 (.043)

* Fixed parameter

** Standard errors shown in parentheses

TABLE 5
Latent Variable Correlations

1. Inter-occasion

GSC	.804
ASC	.867
AA	.998

2. Intra-occasion

	<u>Time 1</u>	<u>Time 2</u>	<u>Mean</u>
GSC/ASC	.709	.635	.672
GSC/AA	.231	.227	.229
ASC/AA	.774	.791	.782

equations did not include sufficient information to adequately demonstrate the causal effects of 'general self-concept', 'academic self-concept' and 'academic achievement' on each other, at a later time. It appears that another variable or combination of variables (exclusive of the specified model) are not only accounting for some of the unique variance associated with each construct, but are correlated with each other; these variables should be specified in the model. Measurement-wise, the presence of correlated residual terms can result from measurement of the same construct through maximally similar instrumental techniques (Shavelson and Bolus, in press).

4.2 TESTS OF THE HYPOTHESES

In a recent investigation of the relationship between self-concept and academic achievement, Shavelson and Bolus (in press) point out two important assumptions that must be met, in order to make interpretations of causal predominance. First, there should be equal stability paths from the constructs at time 1, to their corresponding constructs at time 2. Second, there should be equal residual variances for each construct at time 2. These assumptions state that, if all other things in the model are held constant, the beta coefficients associated with the cross-lagged arrows in Figure 2, can be compared in order to establish causal predominance. In contrast to Shavelson and

Bolus (in press), whose data prevented them from meeting these assumptions, this study was able to satisfy these requirements fairly well and thus, interpretations of causal predominance can be made.

Although the results herein did not represent truly equivalent stability paths between the constructs at times 1 and 2, the coefficient values were fairly close (.804, .867, .998). The Shavelson and Bolus (in press) study on the other hand, exhibited median stability coefficients ranging from 0.59 to 0.90. With respect to the second assumption, the findings of this study again, revealed values that were fairly close (.186 and .073; .001 being a fixed value). In this regard, Shavelson and Bolus (in press) found median residual variances ranging from 0.13 to 0.50.

As noted earlier, it was the original intent of this investigation, to test all hypotheses by placing further restrictions on the model. More specifically, each hypothesis is tested by means of a 3-step process. First, the model is specified such that two beta coefficients, relative to the hypothesis being tested, are constrained to equality. Second, the model is reestimated. Third, the difference in χ^2 values between the restricted model and the final best-fitting model is obtained; as noted earlier, this χ^2 difference value ($\Delta \chi^2$) is itself, χ^2 -distributed, with degrees of freedom equal to the differential in degrees of freedom between the two specified

models. If this $\Delta \chi^2$ value is found to be statistically significant, then the stated hypothesis is confirmed. For example, Hypothesis I states that 'academic achievement' (AA) is causally predominant over 'general self-concept' (GSC). To test this hypothesis, the model would be estimated with β_5 constrained to equal β_2 (see Figure 1). The likelihood ratio χ^2 value for this model would then be compared with that of Model G and subsequently, the χ^2 difference value ($\Delta \chi^2$) ascertained and checked for statistical significance.

In the initial procedure to determine a best-fitting model, however, the T-values for the structural parameters in model G, suggested that the beta parameters $\beta_1, \beta_3, \beta_5, \beta_4$ and β_2 , were very close to being equal to zero. Thus, Model H was specified with these parameters fixed to zero and the model reestimated.

Since it is known then, that these beta coefficients are not significantly different from zero, testing of the hypotheses (which include these parameters), can be considered redundant. Consequently, it is concluded that all hypotheses specified in this study, are statistically nonsignificant, given that they include structural parameters that have been fixed to zero ($\beta_1, \beta_3, \beta_5, \beta_4, \beta_2$, respectively). The results concerning the hypotheses of this study, are summarized in Table 6.

TABLE 6
Tests of the Hypotheses

<u>Hypotheses</u>	<u>Structural Parameters</u>	<u>Statistical Significance</u>
I AA is a stronger predictor of GSC, than GSC is, as a predictor of AA.	$\beta_5 > \beta_2$	Not Sig.
II AA is a stronger predictor of ASC, than ASC is, as a predictor of AA.	$\beta_6 > \beta_4$	Not Sig.
III ASC is causally stronger than AA, as a predictor of GSC.	$\beta_3 > \beta_5$	Not Sig.
IV AA is a stronger predictor of ASC, than AA is, as a predictor of GSC.	$\beta_6 > \beta_5$	Not Sig.

4.3 SUPPLEMENTARY DATA

These data are based on zero-order correlations among the indicator variables. The correlations serve only to describe relationships among the variables, in terms of stability, convergent and discriminant validity, as they bear on the relationship between self-concept and academic achievement; in no way, are they meant to imply causal predominance.

4.3.1 Stability

The stability of each measurement can be estimated by computing the correlation between the scores at time 1, with the same scores at time 2. Table 7 shows the correlation for each of the instruments used in this study, over a 6-month time period.

With respect to the self-concept measures, both the Coopersmith (1967) (GSCC) and Rosenberg (1965) (GSCR) instruments appear to be fairly stable over time. The SCA (Brookover, 1962) (ASCB) in its measurement of 'academic self-concept' is also shown to be quite stable and substantially more so, than the School-Academic subscale of the SEI (Coopersmith (1967) (ASCC).

In terms of 'academic achievement', Mark Average (AAMA) appears to be very stable, in its measurement capabilities. Although the ETS instrument (1960) also seems very stable,

TABLE 7

Stability of Self-concept and Academic Achievement Measures

<u>Instruments</u>	<u>Latent Variables</u>	<u>General Self-concept</u>	<u>Academic Self-concept</u>	<u>Academic Achievement</u>
GSCC GSCR	GSC	.628 .615		
ASCC ASCB	ASC		.498 .791	
AAET AAMA	AA			.838 .895

earlier analyses suggest there is some question of its validity as a measure of 'academic achievement'.

4.3.2 Convergent Validity

One approach to construct validity, suggests that if various instruments are measuring the same construct, then they should produce the same results. That is to say, they should intercorrelate highly, since they are underlain with the same hypothetical construct. This type of construct validity is termed 'convergent validity'.

Convergent validity of both self-concept measures, together with academic achievement measures, were examined by correlating one measure of each of the latent variables, with the second measure of the same latent variable. Since each latent variable was measured at two points in time, convergent validity was estimated at both occasions. For example, to establish convergent validity estimates of 'general self-concept' measures of the Coopersmith (1967) SEI---General Self subscale (GSCC), were correlated with measures of the Rosenberg (1965) Self-esteem Scale (GSCR) at both time 1 and time 2. These two measures of 'general self-concept' were shown to have a correlation of .584 on the first occasion of testing and .604, on the second occasion. These results can be seen in Table 8.

Shavelson and Bolus (in press) note that these convergent validities should be statistically significant (i.e. greater

than zero) and of practical value. Although this criterion of convergent validity was met for each construct, only the measures of 'general self-concept', which at best are only moderately correlated, appear the most useful for further research, as measures of self-concept. However, a review of the literature reveals that intercorrelations higher than 0.60 are indeed rare. For example, Wylie (1974) reports that of 93 cross-instrument correlations, she found only 7 which reached as high as 0.80. Burns (1979) points out that even where a more specific facet of self-concept has been of interest (eg. academic self-concept), findings concerning the correlations between instruments, suggest that slightly different elements of the same facet, are being measured. To this end, Cronbach (1971) has pointed out that although indicators of the same construct are expected to converge, high correlations are not necessarily expected. The intercorrelations between instruments in this study then, appear to be congruent with the literature. Given a broader range of possible element differentiation, however, it is surprising that convergent validity for the 'general self-concept' instruments was found to be higher than for the 'academic self-concept' instruments.

TABLE 8

Convergent Validity of Self-concept and Academic
Achievement Measures

<u>Instrument</u>	<u>Latent Variable</u>	<u>Time 1</u>	<u>Time 2</u>
GSCC	GSC	.584	.604
GSCR			
ASCC	ASC	.432	.429
ASCB			
AAET	AA	.467	.448
AAMA			

4.3.3 Discriminant Validity

Campbell and Fiske (1959) posit that convergent validity is not sufficient in and of itself, in the assessment of validity; rather, a second criterion of discriminant validity should be employed. Discriminant validity of self-concept and academic achievement measures can be examined by comparing the correlation between two measures of the same latent variable (eg. general self-concept), with the correlation between two measures of different latent variables (eg. general self-concept and academic achievement). Evidence of discriminant validity exists when the correlation between two measures of the same latent variable (convergent validity) are greater than the correlation between measures of different latent variables. The results of an investigation of discriminant validity among the measures of 'general self-concept', 'academic self-concept' and 'academic achievement' as they pertain to this study, are presented in Table 9. The correlations shown above the diagonal line, refer to time 1; those below the diagonal, to time 2. Convergent validity correlations are shown in the boxes.

Clearly, the criterion of discriminant validity was met by the two measures of 'general self-concept' (GSCC and GSCR). However, this was not the case with the measures of both 'academic self-concept' and 'academic achievement'.

TABLE 9

Discriminant Validity of Self-Concept and Academic Achievement Measures

<u>Instrument</u>	<u>Latent Variable</u>	<u>Time 1</u>					
		<u>GSCC</u>	<u>GSCR</u>	<u>ASCC</u>	<u>ASCB</u>	<u>AAET</u>	<u>AAMA</u>
GSCC	GSC		.584	.460	.346	.171	.209
GSCR		.604		.377	.373	.113	.141
ASCC	ASC	.416	.370		.429	.174	.358
ASCB		.343	.370	.432		.447	.615
AAET	AA	.139	.149	.139	.445		.448
AAMA		.178	.164	.350	.622	.467	

Time 2

the case of 'academic self-concept', the School-Academic subscale of the Coopersmith (1967) SEI (ASCC), correlated higher with the General Self subscale of the same instrument at time 1, than it did with the Brookover (1962) SCA (ASCB); this was not the case at time 2. These findings of course, come as no surprise, given the earlier analysis which showed uniqueness correlation between these subscales. The Brookover (1962) instrument was totally unsuccessful in meeting the criterion of discriminant validity; on both occasions, it correlated higher with AAET and AAMA, than it did with ASCC. It should be noted, however, that these results may have arisen as a consequence of the apparent unreliability of the Coopersmith (1967) instrument and may not be a fault of the Brookover (1962) instrument at all. In this regard, Winne and his colleagues (1980, 1981) have noted the record of failure to achieve discriminant validity among the theoretically differentiable components of self-concept (eg. academic, physical, social) and consider this fact one of the major problems to plague self-concept research.

The Reading Comprehension Test (ETS, 1960), as a measure of 'academic achievement', was able to meet the criterion of discriminant validity; Mark Average, was not successful in this regard. At time 1, the correlation between Mark Average (AAMA) and the SCA (Brookover, 1962) (ASCB), was .615 (convergent validity = .448). As noted earlier, the

question must be raised, as to whether the ETS (1960) Reading Comprehension Test does in fact, measure 'academic achievement', at least in the same way that Mark Average does. It would appear from the results of this inquiry, that it does not; consequently, a low convergent validity coefficient appears reasonable.

Summary reliability and validity data for the measurement instruments used in this study, are shown in Table 10.

Additional instrument information with respect to the descriptive statistics associated with the sample, is presented in Table 11.

In summary, Chapter IV has presented the empirical results of this study, together with the procedure followed in fitting a structural equation model that proposed a causal relationship among the constructs of 'general self-concept', 'academic self-concept' and 'academic achievement'. Two instruments of measurement were used to provide independent measures of the same construct at two points in time; six separate instruments then, were used as measures of the independent constructs, on each occasion. Supplementary data regarding each of the instruments of measurement, were also presented. Discussion of the results from this investigation, follow in Chapter V.

TABLE 10

Summary Reliability and Validity Data for Instruments of Measurement

<u>Latent Variable</u>	<u>Instrument of Measurement</u>	<u>Reliability</u>	<u>Convergent Validity</u>		<u>Discriminant Validity</u>
			<u>Time 1</u>	<u>Time 2</u>	
GSC	GSCC	.628	.584	.604	Criterion met
	GSCR	.615	.584	.604	Criterion met
ASC	ASCC	.488	.432	.429	Criterion not met; correlated higher with GSCC at time 1 only.
	ASCB	.791	.432	.429	Criterion not met; correlated higher with AAET and AAMA at times 1 and 2.
AA	AAET	.838	.467	.448	Criterion met
	AAMA	.895	.467	.448	Criterion not met; correlated higher with ASCB at times 1 and 2.

TABLE 11

Summary Descriptive Statistics for the Sample (N=929)

	<u>Indicator Variable</u>	<u>Mean Score</u>	<u>Standard Deviation</u>	<u>Lowest Score</u>	<u>Highest Score</u>	<u>Maximum Possible Score</u>	<u>Number of Items</u>
T	GSCC	19.10	4.42	1.0	26.0	26.0	26
I	GSCR	31.07	4.66	10.0	40.0	40.0	10
M	ASCC	4.45	1.84	0.0	8.0	8.0	8
E	ASCB	28.39	5.04	12.0	40.0	40.0	8
	AAET	35.25	8.42	13.0	58.0	60.0	120
1	AAMA	66.35	10.73	31.0	95.0	100.0	NA
T	GSCC	19.69	4.26	3.0	26.0	26.0	26
I	GSCR	31.71	5.04	13.0	40.0	40.0	10
M	ASCC	4.47	1.78	0.0	8.0	8.0	8
E	ASCB	28.43	5.26	12.0	40.0	40.0	8
	AAET	36.05	10.69	0.0	60.0	60.0	120
2	AAMA	67.21	11.23	24.0	96.0	100.0	NA

Chapter V

SUMMARY AND CONCLUSIONS

The primary focus of this investigation was directed towards validation of the self-concept construct. Specifically, the study examined the relationship among 'general self-concept', 'academic self-concept' and 'academic achievement', within a causal framework. This causal modeling approach to construct validation employed a multiple-indicator structural equation model spanning two time points. Based on theory and empirical research, a model was proposed in which the causally predominant relationships among the three constructs were hypothesized. The model was subsequently tested for its overall fit to the data and the hypotheses tested for statistical significance. Although causal direction among the constructs could not be firmly established, important information regarding their measurement and structure, was ascertained. Supplementary data provided critically needed information concerning the reliability and validity of all instruments of measurement used in the study.

Summary and discussion of the findings from the research, are now presented.

P.

5.1 SUMMARY AND DISCUSSION OF THE RESULTS

5.1.1 The Model

The results presented in Chapter IV clearly demonstrated that before any conclusions could be drawn concerning attributes of the constructs 'general self-concept', 'academic self-concept' or 'academic achievement' and/or their relationship with one another, the model had to undergo a series of respecifications and reestimations, in order to achieve one which exhibited a reasonable fit to the data. Only with this best-fitting model as the point of reference then, was it deemed legitimate to make conclusive statements regarding the proposed relationships among the constructs.

Therefore, discussion of the specified self-concept/academic achievement model in this study, is presented separately for each of these phases: 1) the fitting procedure and 2) the empirical results.

5.1.1.1 The Fitting Procedure

The process involved in advancing from the initial hypothesized model to a final best-fitting model based on theory and statistical estimation, required innumerable respecifications of parameters, followed by reestimations of the model. Selecting starting values for the LISREL program can be a very time-consuming activity; users of the program are therefore strongly urged to select values which are

considered most appropriate for the parameters involved. This investigator found that the start values had to be readjusted several times during the process of fitting the model. Alteration of starting values congruent with those of the previously estimated model, was found to be the most successful approach to solving this problem.

Another problem encountered in the fitting process, was the presence of a negative variance in the ψ (Ψ) matrix. Fixing the offending parameter to 0.0 as suggested by Wolfle (1981), was not successful in alleviating this condition; fixing the parameter to .001, however, proved to be a successful solution to the problem.

It became very evident in the fitting of the specified model in this study, that a substantial improvement in fit can be achieved through the allowance of correlation among uniquenesses associated with the indicator variables. This finding adds further empirical support to similar conclusions from other studies using structural equation modeling in longitudinal studies (Olsson and Bergman, 1977; Kohn and Schooler, 1978; Wolfle, 1981; Lomax, 1981; Wolfle and Robertshaw, 1981).

A further substantially better fit of the model was realized by allowing for correlation among the three constructs at time 1, and among their residuals, at time 2. Correlation among the residual terms of course, indicates that additional information by means of other variables,

needs to be incorporated into the model. Inclusion of the appropriate variables, however, may negate the need to allow for correlation among the residual terms.

Finally, plots of differential scores between time 1 and time 2, for each indicator variable, revealed a large number of outlier values. It is believed that these outliers were the major barrier to achievement of a better-fitting model than that of Model H. The complexity of problems associated with measuring the self-concept constructs are believed responsible for the outlier scores.

The writer is cognizant of the fact that the final best-fitting model may not hold up in further samples because the process of fitting a sequence of models capitalizes on chance relationships in the sample.

5.1.1.2 Empirical Results

a) The Measurement Model

The results of this study have shown that the 5 selected standardized instruments of measurement performed rather poorly, in their measurement of 'general self-concept', 'academic self-concept' and 'academic achievement', among high school students; most of the variance in these indicator variables, being explained by uniqueness, rather than true score variance of the latent variables. Of these 5 indicator variables, those measuring 'general self-concept' (GSCC and GSCR), provided the highest degree of

true score variance (.546). In contrast to the standardized instruments, Mark Average was found to function exceptionally well as a measure of 'academic achievement'.

These findings serve to validate claims cited earlier in this document, regarding problems of measurement associated with self-concept research (see eg. Wylie, 1974; Wells and Marwell, 1976; LaBenne and Greene, 1969). Aside from the question of reliability and validity associated with each of the standardized instruments used, the unique variances could have resulted from one or a combination of the following factors:

1. Random measurement error.
2. Systematic variation that was unique to each instrument.
3. The correlation of error factors associated with the administration of the same instrument, on two different occasions.

In summary, with respect to the measurement model, it can be concluded that although the indicator variables overall, did a less than adequate job of measuring the latent variables, at least they were able to explain some of the variance associated with the latent true scores. This fact is evidence that indeed, inherent in these selected indicator variables, are underlying factors capable of measuring 'general self-concept', 'academic self-concept'

and 'academic achievement'. Furthermore, the results of this study have shown that although correlated among themselves, the constructs of 'general self-concept', 'academic self-concept' and 'academic achievement' each exhibit attributes which are unique unto themselves, thus making them differentiable from one another.

b) The Structural Model

Regression Effects

It was noted earlier, that causal direction among the latent constructs could not be firmly established. This resulted from the fact that 5 of the 9 structural parameters were found to have beta estimates not significantly different from zero; they were therefore, subsequently fixed to 0.0 for the final Model H.

Stability

Analysis of the correlations for each latent variable with itself over time, revealed all three, to be very stable constructs; 'academic achievement', being the most stable, with an extremely high stability coefficient of .998. These findings support those of Maruyama and Miller (1979), but run counter to the recent similar investigation by Shavelson and Bolus (in press), who found 'academic achievement' to be less stable than both 'general self-concept' and 'academic self-concept'. However, the results of this study were able

to support the finding by Shavelson and Bolus (in press) that facets of self-concept do not become increasingly stable in the direction of more specific self-concept (ASC) to global self-concept (GSC). Whereas Shavelson and Bolus (in press) found 'academic self-concept' and 'general self-concept' to be equally stable, this research revealed 'academic self-concept' to be slightly more stable than 'general self-concept' (.867 and .804, respectively).

With respect to the stability of the relationships among the latent variables, only the relationship between the two self-concept constructs (GSC with ASC) appeared to lack stability over time; the correlation of both 'general self-concept' and 'academic self-concept' with 'academic achievement', remaining virtually unchanged over time.

Relationship

As might be expected, examination of the correlations among the latent variables within time periods, reveals the strongest relationship to exist between 'academic self-concept' and 'academic achievement' (.782). This moderately high correlation supports other empirical efforts in this regard (West and Fish, 1973; Kifer, 1975; Calsyn and Kenny, 1977; Almaguer and Daniel, 1981; Shavelson and Bolus, in press).

The next strongest relationship, not surprisingly, was found to exist between 'general self-concept' and 'academic

self-concept' (.672). These results offer support to studies by Marx and Winne (1975) and Shavelson and Bolus (in press), where a similar relationship between the two constructs was found. Evidence of a moderate correlation between 'general self-concept' and 'academic self-concept' implies that students were able to distinguish between aspects of their self-concept which relate to academic behavior, from those which relate to other types of behavior, such as social and physical. From a theoretical perspective then, there is evidence to suggest that 'academic self-concept', although a facet of overall 'general self-concept', exhibits particular attributes which distinguish it from other facets of self-concept. Support is thus provided for the earlier findings by Brookover and his colleagues (1962, 1964, 1965, 1967) and more recently, Shavelson and Bolus (in press), that 'academic self-concept' is distinct from 'general self-concept', albeit correlated.

Finally, the relationship between 'general self-concept' and 'academic achievement' was found to be fairly low (.229); this finding paralleling those of O'Malley and Bachman (1979), Mintz and Muller (1977), Bridgeman and Shipman (1978) and Joiner et al. (1969).

Other Important Variables

The results of this investigation have revealed that the specified model may lack sufficient information to adequately demonstrate the causal effects of 'general self-concept', 'academic self-concept' and 'academic achievement' on each other, over time. Analysis of the data suggests that certain other variables should be included in the model, either as additional or intervening variables in the causal link between self-concept and academic achievement. In their most recent study of self-concept and academic achievement, Shavelson and Bolus (in press), although unsuccessful in their attempt to establish causal predominance among the constructs, also concluded that future self-concept/academic achievement models should incorporate other latent variables. The research question now of course, focusses on the selection of variables for inclusion. Several suggestions have been made in this regard, consequent to a diversity of investigative approaches in examining the relationship between self-concept and academic achievement; these variables are now presented and discussed.

1. Past Academic Performance

In a recent study, O'Malley and Bachman (1979) were able to document their earlier findings (Bachman and O'Malley, 1977) that in high school, past academic performance impacts

very heavily on a student's self-concept. In total accord, are the results from studies by Rubin et al. (1977) and Kifer (1975). In fact, Kifer (1975) posits that the relationship between self-concept and academic achievement becomes stronger and more powerful, as the pattern of success or failure in academic pursuits becomes prolonged. Given this view then, it follows that relationships between self-concept and academic achievement, among secondary school students, should be well-established, based on a student's knowledge of his past academic accomplishments. The variable 'past academic performance' then, might well be an important variable to consider in future self-concept/academic achievement causal models, using a high school population.

Alternatively, investigators might be well-advised to keep this important factor in mind in the structure of their research design. For instance, data collection should be planned such that data obtained on self-concept variables, are collected after students have received some feedback regarding their overall academic achievement; the collection of both sets of data, however, being obtained within the same time frame. Only the Shavelson and Bolus (in press) study to date, appears to have made a concerted effort to consider time precedence, with respect to the collection of data for self-concept and academic achievement variables.

2. Academic Ability

Another variable for possible inclusion in future self-concept/academic achievement models, is that of 'academic ability'. Indeed, Burns (1979) rationalizes that the clarity and degree to which an individual is aware of aspects of his self-concept, appear related to level of education and academic ability.

Empirically, there appears to be sufficient evidence to conclude the existence of a positive correlation between self-concept and academic ability. The findings, however, vary in the degree of correlation. Rubin et al. (1977) and Bachman and O'Malley (1977) found 'academic ability' to be a strong determinant of both 'self-concept' and 'academic achievement'. Wylie (1979), on the other hand, in her review of the literature, found low correlations between 'general self-concept' and 'academic ability' to be the most typical findings; correlations between 'academic self-concept' and 'ability', were slightly higher.

3. Socio-economic Status (SES)

Another variable which can possibly impact on measures of the relationship between self-concept and academic achievement, is 'socio-economic status'. Sociological theory suggests that parents from different socio-economic classes, hold different values for themselves and their children. Factors of socialization therefore, make it conceivable that children assimilate these values and differentially behave in accordance with their value system.

Therefore, given the assumptions of some theorists, that parents of the lower SES group are more likely to feel inferior, while those of the middle and upper SES groups are likely to feel superior, it seems reasonable to assume that parental SES can determine a child's general self-concept.

Empirically, the findings are generally confusing. Rubin et al. (1977), Bachman and O'Malley (1977) and O'Malley and Bachman (1979), in their investigations, found SES to have an influencing effect on the relationship between self-concept and academic achievement. Bachman and O'Malley (1977), however, found that SES impacted to a lesser degree than either 'past academic performance' or 'academic ability'. Contradictory findings, however, were reported by Calsyn and Kenny (1977) in their study of the relationship between self-concept and academic achievement, among adolescents. Their results revealed that in fact, causal patterns did not appear to vary across socio-economic status levels. Finally, Wylie (1979), following an extensive review of studies concerned with the relationship between self-concept and SES, drew conclusions which differed, with respect to 'general self-concept' and 'academic self-concept'. Although she was able to conclude a significant association between 'general self-concept' and 'SES', this conclusion did not hold for 'academic self-concept' and 'SES'. Wylie (1979), however, suggests a strong possibility that the relationship between 'academic self-concept' and 'SES', may be nonlinear.

4. Influence of Significant Others

Shavelson and Bolus (in press) have suggested that 'influence of peers and/or parents' be considered as intervening or additional variables, in the causal relationship between self-concept and academic achievement. Certainly, it is widely known that the peer group in North American society, is an extremely influential, if not the most powerful agent, in the socialization of adolescents (see eg. McNeil, 1969; Elkin and Handel, 1978). Burns (1979) points out that for adolescents, the crucial arena for deriving a realistic assessment of oneself, is most certainly via interaction with the peer group. Certainly, different expectations are held with respect to the adolescent, by both the peer group and parents. While parents place a high premium on behavior and expect differences in competence among siblings, peers place their emphasis on performance and demand only at least equal competence with other members of the peer group. Consequently, where certain behavior may be unacceptable to parents, it might be totally ignored by the peer group, in lieu of an individual's competence in an area highly regarded by the group. It would appear then, that 'peer influence' at least, might be an important variable in research concerned with the relationship between self-concept and academic achievement among secondary school students.

Empirical research to date, however, has not supported this view.) In their study of the relationship between 'academic self-concept' and 'academic achievement', Calsyn and Kenny (1977) found no evidence that 'perceived evaluations of peers, parents, or teachers' were causally predominant over 'academic self-concept'. Rather, they found 'academic achievement' to be causally predominant over both 'academic self-concept' and 'perceived evaluations of others'. With respect to parental influence, Kifer (1975) suggests that as patterns of past academic performance become more prolonged and hence stronger, the parental variable becomes weakened. He recognizes parental influence as an important variable, only in the early school years.

5.1.1.3 Instruments of Measurement

In response to pleas by researchers (see eg. Paterson, 1967; Kimball, 1973; Wells and Marwell, 1976; Wylie, 1979) for critically needed data on self-concept instruments of measurement, supplementary analyses of data were performed. Information specific to each instrument, with regard to its stability reliability, convergent and discriminant validity, is shown in Table 10. All stability coefficients are based on a 6-month time lapse.

Summary discussion with respect to each instrument of measurement, is now presented.

Self-esteem Inventory---General Self Subscale (Coopersmith, 1967)

The test-retest reliability coefficient of .628 found in this study, is slightly higher than the one reported by Drummond et al. (1977) (.558) and Rubin (1978) (0.55) for students in the same age range. This current study and the Drummond et al. (1977) study, were based on a 6-month time period; the Rubin (1978) investigation was over a span of 3 years. These correlations, however, were all lower than those reported by Coopersmith (1967) for either 5 weeks (0.88) or 3 years (0.70).

The convergent validity coefficients of .584 and .604 for times 1 and 2 respectively, based on correlation between the SEI and the Rosenberg (1965) SE Scale, appear to concur with similar findings reported by Getsinger et al. (1972), with respect to the Self-perception Inventory (Soares and Soares, 1975). These coefficients, however, were slightly higher than those reported by Taylor and Reitz (cited in Crandall, 1973) and Ziller et al. (1969).

The fact that the SEI---General Self subscale was able to meet the criteria of both convergent and discriminant validity, provides confirmation of similar results obtained by Fullerton (1973).

Self-esteem Scale (Rosenberg, 1965)

The test-retest coefficient of .615 is lower than the correlation of 0.85 reported by Silber and Tippet (1965),

for college students. However, the fact that the Silber and Tippet (1965) study only spanned a 2-week period, suggests a spuriously high correlation, due to memory effects.

The convergent validity coefficients are almost identical to the one reported by Crandall (1973) for the same two instruments (SEI and RSE). The correlations are also similar to two of the three values reported by Silber and Tippet (1965).

The fact that the Rosenberg (1965) instrument was able to meet the criterion of discriminant validity, also supports the Silber and Tippet (1965) investigation.

Self-esteem Inventory---School-Academic Subscale
(Coopersmith, 1967)

The test-retest reliability coefficient for this instrument, is slightly lower than that reported by Drummond et al. (1977) and Rubin (1978) for students of the same age group. The results of this study are much lower than the test-retest coefficient of 0.88 reported by Lakey (1977), over a 6-week period. However, inspection of the items in this subscale reveals that considerable verbal skill is required, in order to fully comprehend them. House et al. (1978) have cited this problem with respect to grade 3 children. They point out that before making a response, the child must first read a statement and then keep it in mind long and well enough, to judge the extent to which it is "like me" or "unlike me". This factor therefore, makes credibility of the Lakey (1977) findings, questionable.

No specific data with respect to convergent validity is reported for the SEI---School-Academic subscale. Lakey (1977), however, reports that as a result of multitrait-multimethod analysis, both the criteria of convergent and discriminant validity were met.

In this study, however, the criterion of discriminant validity was not met; the School-Academic subscale correlated higher with the General Self subscale at time 1 only.

Self-Concept of Ability Scale (Brookover, 1962)

The test-retest coefficient of .791 is very similar to that reported by Brookover et al. (1967) and Paterson (1967), for a high school population; they reported correlations of 0.71 (mean of correlations for grades 9-12) and 0.76 (mean of correlations for males and females), respectively.

Convergent validity coefficients of .432 and .429 are found to be much lower than that reported by Reid (cited in Burns, 1979); she found a correlation of 0.70 between SCA and the Academic Self-image Scale (Barker Lunn, 1970). However, the fact that SEI---School-Academic subscale appears to be measuring other phenomena in addition to academic self-concept, would tend to reduce the convergent validity coefficient. This factor similarly, is likely responsible for failure of the SCA to meet the criterion of discriminant validity.

Reading Comprehension: Cooperative English Tests (ETS, 1960)

The test-retest reliability coefficient found in this study, is slightly lower than the value of 0.92 reported by Clemans (1972).

No data are available against which to compare the results of this study with respect to both convergent and discriminant validity.

Mark Average

Test-retest reliability for students' mark averages, was found to be very high (.895).

Convergent validity for Mark Average with the ETS (1960) Reading Comprehension Test, was found to be moderately low (.467). This result possibly, is consequent to the fact that although reading comprehension has been postulated as one of the best predictors of academic achievement, the ETS (1960) instrument is not measuring academic achievement, in the same way that Mark Average is. This same argument stands, with respect to failure of Mark Average, to meet the criterion of discriminant validity.

5.2 CONCLUSIONS

This study sought to answer the call for a fresh approach to validation of the nomological network associated with the self-concept construct. Specifically, the research investigated causal relationships among 'general self-concept', 'academic self-concept' and 'academic

achievement', via the medium of a multiple-indicator structural equation model, operating at two points in time. Although the results of this investigation do not justify conclusions being drawn regarding causal predominance among these constructs, the study was nonetheless successful in its attempt to provide important theoretical and methodological contributions to self-concept research and its application in educational settings.

The question of how self-concept is viewed theoretically of course, is the fundamental issue. This theoretical view frames both the dimensionality of the construct itself and its relationship with other important variables. Both kinds of theoretical relations directly determine the operationalization of self-concept for empirical study and influence interpretation of observed relationships among the facets of self-concept (within network relations) and between self-concept and other variables (between-network relations).

The findings of this study were able to clarify many theoretical issues in need of validation, regarding the structural embodiment of the self-concept construct within its nomological network. These conclusions are as follows:

1. 'Academic achievement', 'academic self-concept' and 'general self-concept' are all very stable constructs; 'academic achievement' being the most stable, followed by 'academic self-concept' and 'general self-concept', respectively.

2. The correlation between 'general self-concept' and 'academic achievement', together with the correlation between 'academic self-concept' and 'academic achievement', are very stable over time; the correlation between 'general self-concept' and 'academic self-concept' is less stable.
3. The relationship between 'academic self-concept' and 'academic achievement' is found to be the strongest, followed by the relationship between 'general self-concept' and 'academic self-concept', and 'general self-concept' and 'academic achievement', respectively.
4. 'Academic self-concept', although correlated with 'general self-concept', can be distinguished from 'general self-concept'; both 'academic self-concept' and 'general self-concept' are distinct from 'academic achievement'.
5. Other important variables appear to influence the causal relationship among 'general self-concept', 'academic self-concept' and 'academic achievement'.

Methodologically, the findings of this study were able to provide some "hands on" experiential guidance to future users of the LISREL IV computer program (Joreskog and Sorbom, 1978), as applied to longitudinal studies involving the academic achievement and self-concept constructs.

Except for recent papers by Wolfle (1981) and Lomax (1981), the literature is devoid of explicit information in this regard.

Additionally, the results demonstrated that the use of maximally dissimilar instrumentation in the measurement of a single construct, may reduce the incidence of correlated residual terms associated with the academic achievement and self-concept constructs.

Finally, this study was able to provide critically needed reliability and validity data concerning the following standardized instruments of measurement: Self-esteem Inventory---General Self and School-Academic subscales (Coopersmith, 1967), Self-esteem Scale (Rosenberg, 1965), Self-concept of Ability Scale (Brookover, 1962) and Reading Comprehension: Cooperative English Tests (ETS, 1960).

5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

Although the relationship between self-concept and academic achievement has piqued the interest of self-concept theorists and educational researchers since the early 1960's, only recently have investigations taken on an explanatory, rather than a descriptive empirical approach. Indeed, use of the LISREL model offers to date, the most promising means of untangling the nomological network of the self-concept construct. By providing a few more pieces to the self-concept puzzle, it is hoped that this study will

encourage educational researchers interested in self-concept, to continue the search for not only the missing pieces, but also, a more precise fit of the existing puzzle elements, by using a structural equation modeling approach to construct validation. Suggestions worthy of consideration for future research, are now presented.

1. The standardized instruments of measurement used in this study, were all self-report inventories. Winne and Marx (1981), together with Shavelson and Bolus (in press), have pointed out the methodological and statistical problems associated with using multiple measures of the same type, in a single empirical study. A future study might consider using different types of instruments in measuring the same construct.
2. The current findings, inasmuch as they support certain past empirical data concerning the relationship between academic achievement and facets of self-concept with respect to high school students, suggest that researchers might be well advised to incorporate other background and/or intervening variables, into their structural equation models. Possible variables for consideration are: past academic performance, academic ability, socio-economic status and influence of peers.
3. Multidimensionality of the self-concept construct has been postulated and strongly supported by Shavelson

and his colleagues (1976, 1977); academic, social and physical dimensions have been proposed. Although most empirical studies to date, have involved only the academic component of self-concept, Marx and Winne, together with their colleagues (1977, 1978, 1980, 1981) have recently been reporting very interesting findings from their examinations of the social and physical facets. Research involving the social and physical components of self-concept, however, is still in the infancy stage. Replication of the current study, incorporating either or both the social and physical facets of the self-concept construct, might be considered.

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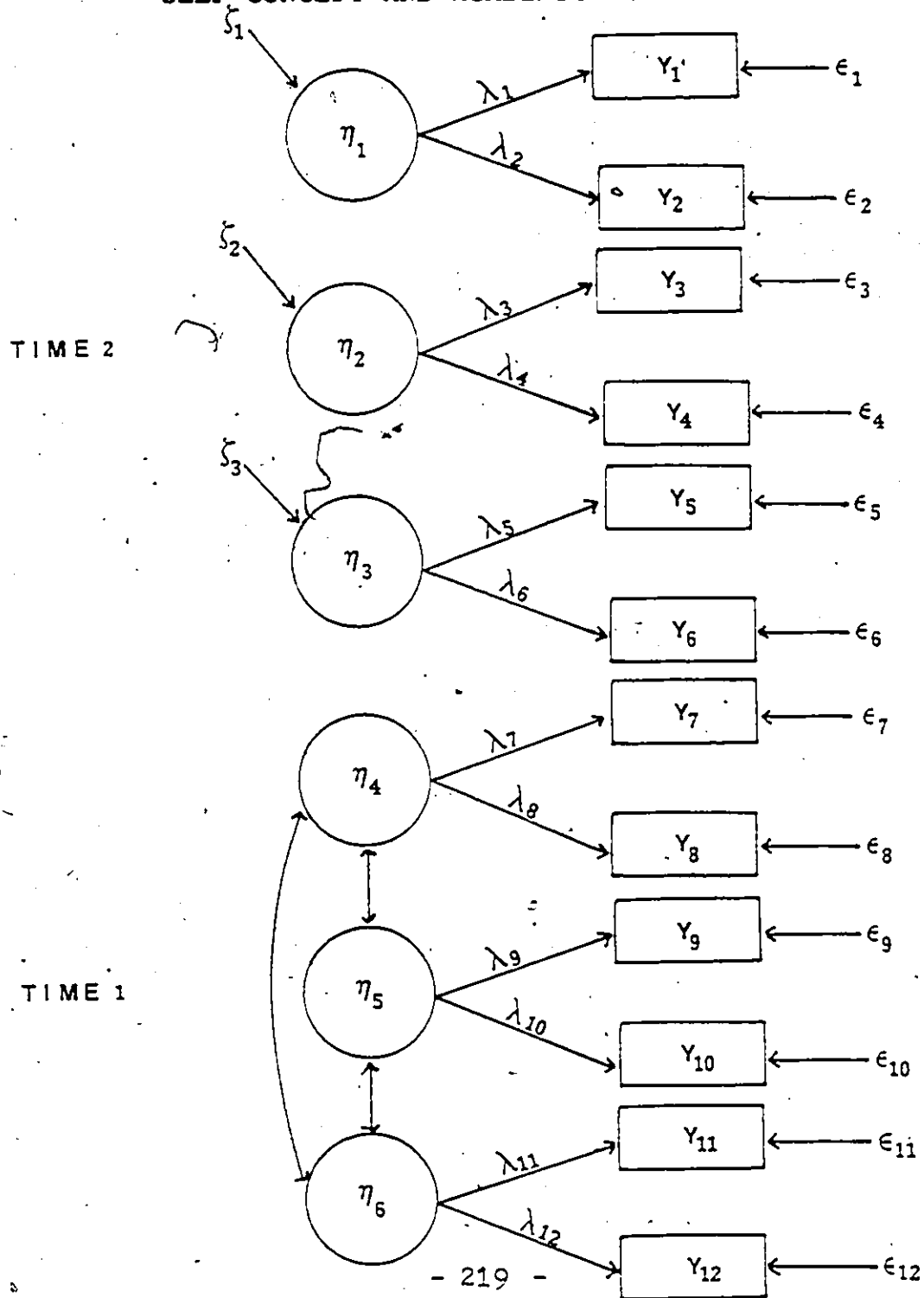
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Appendix A

A. LISREL NO-X OPTION MODEL OF THE RELATIONSHIP BETWEEN SELF-CONCEPT AND ACADEMIC ACHIEVEMENT



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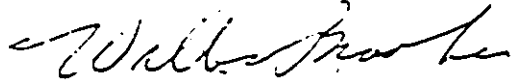
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Cordially yours,



W. B. Brookover
Professor

WBB:aap