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Cognitive complexity, problem-solving skill, and career decision-making: A structural equation model

Prosser, Diane Johnson, Ph.D.

The Ohio State University, 1989
COGNITIVE COMPLEXITY, PROBLEM SOLVING SKILL, AND CAREER DECISION MAKING: A STRUCTURAL EQUATION MODEL

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Graduate School of the Ohio State University

By

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The author is grateful permission to reprint from the following:

In memory of my father,
who read to me
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All who have preceded me in accomplishing this task know that while the candidate is entirely responsible for the dissertation research, it cannot be completed without the task performance and emotional support of a multitude of special people. The words on this page seem inadequate to acknowledge the significant contributions others have made, yet with deep appreciation for the assistance and support that made this achievement possible, these words are offered.

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CHAPTER I
INTRODUCTION

Historical Context

The survival of humankind has always depended upon the work necessary to obtain food, clothing and shelter. During the period of prehistory, it was necessary for individuals to devote most of their waking hours to the performance of the activities necessary to survival. There was no other choice.

Until recent history, entry to the world of work did not involve choice for most individuals. Even with the progression to an agricultural society, choice remained limited. Due to the limited number of occupations, and to rigid social structures, few individuals had the opportunity to choose their work activities. Most individuals carried on the occupation their parents performed. Only occasionally did parents elected to bind a son to an apprenticeship with a master craftsman in order to learn an occupation different from the father's. Daughter's even more rarely found employment other than extensive household duties and child care. Choosing a career was most often restricted to the sons of noble families (Chabassus & Zytowski, 1987). Class structures allowed only a narrow band of choice even for the higher classes. Interestingly, this process of limited choice was facilitated in the 15th Century by Rodrigo Sanchez de Arevalo, son of an aristocratic family, who published a volume recounting to his own choice process as a guide to others making an occupational choice (Chabassus & Zytowski, 1987). The book offers detailed occupational descriptions and philosophical discussions of the decision process. (It also served to "scoop" Frank Parsons by about 560 years.)
The advent of the Industrial Revolution broadened occupational choice for all classes. Added to opportunities in agriculture, shop keeping, craft guilds and trades, were jobs in manufacturing, milling, mining, and railroad operation. Survival depended more frequently on working for others. Yet, jobs in industry were increasingly subject to supply and demand. Social class, type of industry, local geographic features and natural resources, the number of individuals available to fill positions, and the mobility of potential workers, all of these had greater influence on choice of occupation than individual preference. Social class served as a limiting factor in occupational choice. Entry into the professions continue to be primarily limited to children from the upper class.

Although the advent of normal schools and land grant institutions increased the opportunity for individuals from a broader range of social class to choose a college education prior to their entry into the labor force, the effect was limited. Workers from lower class families had their occupational choices constrained by their lack of education, limited skills, and a narrow range of opportunity. These lower class workers frequently entered the unskilled labor force at an early age, as their wages were important to the family survival. However, occupational choice began to widen for those with innovative ideas, intelligence, and the willingness to take risks. This choice of occupation was in the hands of a few through entrepreneurial ventures, and occasionally this provided an avenue for upward social mobility.

Recognition is given to Frank Parsons (1909) for developing the first modern attempt to consider a rational approach to choosing an occupation early in the 20th century. Rather than the haphazard methods usually used in the choice of how to make a living, Parsons introduced the notion of matching the individual to an occupation. Although his work was foreshadowed in the 1468 publication of Rodrigo Sanchez de Arevalo (Chabassus & Zytowski, 1987), Parsons (1909) is credited with being the first offer a guide for making the best vocational choice. He advocated first a thorough assessment of
the individual's abilities, interests, and skills; then obtaining knowledge of occupations; and finally choosing on the basis of a consideration of the two together.

**The Individual and Career Development**

"*Lieben und arbeiten.*" To love and to work. Attributed to Freud, this often reported, although never cited, quote is said to be his curt answer to the question, "what constitutes normal adult functioning?" (Erickson, 1963, pg. 265). If true, it appears that the founder of psychoanalysis viewed occupational choice at a high level of importance. These thoughts on the prominence of love and work in psychological health are later echoed in Erickson's theory of social psychological development. The consideration of the capacity for work and love are imbedded in Erickson's stages of Identity vs. Role Confusion, and of Intimacy vs. Isolation. For Erickson (1980), the establishment of identity and the capacity for intimacy, which result from the successful resolution of these developmental crises, provide the foundation for psychological health in adulthood.

Erickson (1968) devoted a great deal of attention to the need for the individual to establish a stable identity during adolescence; this was seen as a critical precursor to becoming a psychologically healthy adult. In his view, without a well established identity, the individual remains in a state of role confusion, which in extreme instances may lead to delinquency or even emotional disturbance (Erickson, 1963, pg.262). Although, the emotional difficulties of this period seem to result in less permanent damage than if they were to occur at other ages, the lack of a successful resolution of the identity crisis leads to difficulties throughout adulthood. Erickson viewed choosing satisfying work to be an integral part of establishing identity.

The integration now taking place in the form of ego identity is, as pointed out, more than the sum of the childhood identifications. It is the accrued experience of the ego's ability to integrate all identifications with the vicissitudes of the libido, with the aptitudes developed out of endowment,
and with the opportunities offered in social roles. The sense of ego identity, then, is the accrued confidence that the inner sameness and continuity prepared in the past are matched by the sameness and continuity of one's meaning for others, as evidenced in the tangible promise of a "career". (Erickson, 1963, pp. 261-262)

While couched in the language of psychoanalysis, these ideas presented by Erickson seem to be imbedded in the thoughts a counseling psychologist uses when speaking of the need to consider the individual's motivation and drives, abilities, and interests, and social class and chance factors in career choice. The importance of choosing a vocational pursuit as part of the transition from adolescence to adulthood is also given attention in the theories of others. An early human development theorist, Charlotte Bühler (1933), in delineating the stages of life and the tasks of each age, designated the period from ages seventeen to twenty one to be the time for establishing independence and discovering one's life work. Selecting an occupation was also viewed as an important part of adolescent identity to psychologist, Gordon Allport (1961). It seems clear that an important component in the establishment of adolescent identity, which serves as a base for later adult psychological health, lies in choosing an occupation. Yet in a rapidly changing world, the discovery of one's life work becomes increasingly difficult.

**Impact of Social Change on Career Decision Making**

The world of work itself has changed a great deal in the last twenty five years. Many occupations, held by workers in the previous generation, no longer exist. Many more workers today fill positions that were not in existence when their parents first sought employment. Many of the changes in the world of work occurred as a result of changes in technology. The use of computers and automated equipment, including robots, caused the elimination of many of the lower level labor intensive positions and resulted in the creation of positions requiring more technical knowledge. Even in the professions change occurs.
Architects increasingly need computer assisted drafting and computer programming skills, while scientific knowledge is critical to lawyers dealing with environmental issues.

Not only do more occupations require higher level training and skills from employees, as the economy changed from an agrarian, to an industrial, to an information base, more work is completed outside of the view of children and adolescents. Individuals, therefore, have less career information for making progress through the stages of vocational developmental set forth by Super (1951, 1957) Ginzberg, Ginzberg, Axelrad and Herma (1951); and Tiedeman (1963). (See Osipow, 1983 for a thorough discussion of these theories) One result may be less vocationally mature individuals attempting to make career decisions. Those seeking to enter their first career, and those seeking to change from a dissatisfying career, increasingly lacking in specific information about world of work. Even individuals working to facilitate the decision making process lack information about positions available. This is especially true for the more unique and less advertised occupations.

With few role models, choices may be based more on stereotypes of careers that are more visible, though perhaps not as well suited to the individual as a less salient, yet closely related career. Fire fighter occurs as a more frequent choice than construction supervisor; pharmacist more often than research chemist. However, even with role models, the choice may have been made on the basis of a stereotype, or a salient aspect of the occupation that seems appealing, yet disregards distasteful more prevalent aspects. A comment from a college student illustrates this problem:

I know what I want out of life. A degree, family, well paying job. I am unsure of every thing else. All my life I've wanted to be an architect, but when I got into it, I hated it. I'm now asking the question what else do I want?. (anonymous response to the open ended item on the Career Decision Scale; April, 1989).

The stereotyped view of an occupation often fails to reflect reality.
One of the more puzzling issues in career choice is related to the issues involved in obtaining a career position for which no clear path could have been known at the point of the first career decision. This problem in career choice is embodied in the considering the academic and career paths needed to become, for example, commissioner of baseball. Some individuals are able to obtain a position because they have the experience or the education necessary, yet choices were made in advance, without the knowledge of what the end goal might be. Making career decisions is a lifelong process, that begins before entry into employment occurs. Given the importance of career decision making to establishing individual identity and considering social and occupational changes, choosing a vocation has become increasingly difficult, even with assistance.

These changes in employment have accompanied, or propelled, changes in the number of individuals choosing to continue their education beyond high school. Despite a shrinking population of high school graduates, college and university enrollments have increased. Fears that the disappearance of the postwar population bulge would result in drastic reductions in enrollments in post-secondary education have not materialized. More are choosing to become students prior to entry into an occupation, and during or after obtaining employment. This increased interest in higher education results from the several changes which

...include, but are not limited to, the following ...greater availability and access of higher education to the masses within American society, which has led to a wider expectation that post-secondary education can be attained by everyone and, therefore, is expected; and ...more opportunities for those individuals within American society whose traditional roles are changing, such as women and minorities. (Ikenberry, 1987; p. 2)

Change creates challenge. One challenge created by the changes in society, the world of work, and the resultant changes in the college student population, is an increase in
the complexity of the work of those who attempt to assist college students in making
decisions which have impact on future employment. Increased complexity increases the
sense of challenge students feel as they face making a career choice. One in six, from a
total pool of two-hundred students, expressed doubts or fears, or both, about their own
career choice process in response to the open ended item on the Career Decision Scale
(Prosser, 1989; Unpublished data). A similar number took the time to write a assertion of
their positive feelings about their career choice. However, at least a few of these positive
respondents may have been writing in an attempt to convince themselves. For
interestingly, the opportunity to indicate high levels of comfort had already been presented
by other items on the scale. The open ended item is offered to give those who feel their
unique situation was not covered well in the previous responses. Discomfort may exist for
those who have stated a decision, as well as for those who remain undecided about an
occupation.

Discomfort with Indecision

It is human nature to feel discomfort when facing lack of closure. Incompleteness
creates a state of tension. The state of not knowing an outcome creates discomfort.
Humans prefer the completed gestalt. Even in those instances where information is
incomplete, sense organs act to connect aspects of physical phenomenon that experiences
have taught are related in some pattern. It is human to feel a need to "know", a need to gain
a sense of mastery over our environment. Erickson (1963) gives credence to the need to
decide on a career. He follows a discussion about the causes of delinquency and the
development of psychosis in individuals during adolescence, by stating that: "In most
instances,...it is the inability to settle on an occupational identity which disturbs individual
young people" (Erickson, 1963, p. 262).
When a young person seems unable to decide upon which occupation to pursue, others are also disturbed. The state of indecision is an incomplete gestalt for those who work with undergraduate students. The state of indecision creates tension in not only the undecided individual, but in parents and in others who are involved in facilitating the young person’s development. Interested individuals have attempted to understand the phenomenon, in order to facilitate that closure. A large body of literature on career development and career indecision has accumulated. Many variables thought to be related to career indecision have been investigated.

This investigation was implemented toward the goal of adding greater understanding to some of the aspects related to the career decision process. An integrated view of several of the aspects career decision making was the anticipated outcome. In this study college students’ responses were used to assess the causal relationships among educational and occupational aspects of the mother and father, cognitive complexity, problem solving skill, and career decision making.

Outline for Report.

Following this introductory chapter, a review of the literature relevant to the topics of cognitive complexity, personal problem solving, and career decision making are offered. A chapter describing the methods used to carry out the investigation is then presented. Included in the third chapter are the hypotheses developed, based on the findings reported in the literature review. Also in the methodology chapter, the research design is delineated, and the sampling and data collection procedures used to gather information necessary to the study are described. Chapter three also includes a description of the variables of interest and the instruments used to measure them. Data analysis procedures conclude the methodology chapter. The statistical results of the investigation are offered in chapter four,
followed by a chapter presenting a discussion of the findings. Finally, this report concludes a brief summary statement.
This review of literature offers an overview of the theory and research related to the present investigation. The topics discussed are decision making, both general and career; personal problem solving, in general and related to career decisions; cognitive development; the measurement of cognitive processes by theory based methods and by grid methodology; and finally a discussion of complex statistical analyses as applied to career choice is offered. The review ends with a statement of the problem submitted to analysis. The hypotheses offered in the methodology chapter are derived from the information presented in this chapter.

Importance of Decision Making

The impact of decision making is critical to the development of the individual. Leona Tyler (1978) states that individuality depends upon the choices and decisions a person makes. The importance of decision making for the individual occurs through its power to determine what is learned, what situations and environments are experienced, and with whom the individual will interact (pp. 204-205).

Understanding the underlying processes which act to filter and organize perceptions and experiences has long been the goal of those who study decision making. Decisions are limited, not only by the situational and environmental elements in which the individual is imbedded, but individual characteristics and structures that serve to filter perceptions and organize the information that is received (Tyler, 1978). To a great extent, it is these
individual qualities that determine beliefs and knowledge about the self and the world. The study of the association between cognitive processes and decision making seems to be basic to understanding the manner in which the individual continues to change through choosing from the myriad of possibilities present to each person. Human development occurs primarily as a result of decision making.

**Career Decision Making**

The act of making a career choice illustrates the impact of decision making on personal development. The choice of a career has been viewed as important to mental health (Erickson, 1963) and to the development of the person (Tyler, 1978). Career development has impact on personal satisfaction, environmental and social setting, and economic well being. Implementing a career decision is choosing a lifestyle. While the first choice occupational position does not determine the career pattern over a lifetime, it can seem momentous at the time it is made.

For some, it is the perception of the first decision as holding such importance that causes anxiety. A delay or difficulty in making a career decision can cause discomfort for the individual. Career choice can be facilitated through the use of explanatory theory, through the use of information about personality characteristics related to career decision making, and through knowledge about the cognitive processes involved.

The use of a career theory, which might facilitate the process, has been the subject of investigation. The work of John Holland is one such career theory that has generated a large body of research. This theory holds that individuals' choice of occupation is an extension of their personality, and their view the world of work is in terms of occupational stereotypes. The choice process then becomes one of finding a match between personal orientation and occupational environment.
In an early attempt to test the theory, Osipow, Ashby and Wall (1966) found that college students did indeed express themselves in choosing an occupation. It was also found that students expressing higher levels of certainty about their occupational preferences were more likely to be considering an occupation consistent with their personal orientation, in terms of Holland Code information. These investigators also found no differences in terms of degree of occupational certainty for students exhibiting a Holland Code in the Social category. Nor were differences found between highly decided students and undecided students, in terms of consistency between the student's first and second choice occupational preference.

Evidence supporting the Holland view of career choice was found in another study by Ashby, Wall, and Osipow (1967). They examined the consistency between college students' personal orientation and the scores from a standard occupational inventory (Strong Vocational Interest Blank, or SVIB). Appropriate Holland codes were assigned to the occupations suggested by the inventory results to assess consistency. Based on the results of this investigation, Ashby and associates (1967) concluded that considerable construct validity exists between an individual's orientation in terms of their Holland code, their SVIB scores and their occupational preferences.

Support for Holland's theory is also offered by Southworth and Morningstar (1970). Their results showed that Vocational Preference Inventory scores obtained during the first year of college were related to later academic status. Based on scores from first year engineering students, it was discovered that those remaining in engineering into the junior year were higher on the Investigative scale, than those who left the university. It was also found that students who changed from engineering to another college within the university had higher scores for the Social and Artistic codes. These results support Holland's matching model. In an application of Holland's theory to a population other than university students, Mount and Muchinsky (1978) also found support for the theory. They
found that those employed in work environments congruent with their individual Holland code experienced more overall satisfaction with their work and with the specific conditions of the work.

The presence of the Holland theory provides a useful method for assisting individuals making career decisions. Yet, it does not offer a panacea for ending career indecision. Students must still act to find the specific career that may suit them based on their personal orientation in terms of Holland code. In addition, with the changes in the economy, the stereotypes held may need to be assessed in terms of current factual data. Despite 500 years of interest in career decision making, the process still creates difficulty for some individuals.

Academic advisers, career counselors, faculty members, and counseling psychologists, who work with individuals on the threshold of occupational identity, usually agree that individual who have difficulty making a career decision seem to differ from those who easily progress from a state of indecision to declaring a choice. In order to discover those differences many investigators have tried to isolate specific qualities of individuals experiencing difficulty making a career decision. These investigations have examined at differences in general personality characteristics in these undecided students. Some qualities that have been investigated are: achievement motivation (Angers, 1961); anxiety (Hartman & Fuqua, 1983; Hartman, Fuqua & Blum, 1985; Hawkins, Bradley & White, 1977; Ikenberry, 1987; Kimes & Toth, 1974; Lucas & Epperson, 1988); self-esteem (Brimsted, 1984; Lucas & Epperson, 1988; Maier & Herman, 1974; Resnick, Fauble & Osipow, 1970); identity (Galinsky & Fast, 1966; Hartman & Fuqua, 1983; Hartman Fuqua & Blum, 1985; Ikenberry, 1987); locus of control (Cellini, 1978; Hartman & Fuqua, 1983; Hartman, Fuqua, & Blum, 1985; Ikenberry, 1987; Lucas & Epperson, 1988; Taylor, 1979); fear of failure (Saltoun, 1980); fear of success (Taylor 1979); and Meyers Briggs type (Gordon, Coscarelli, Sears, 1986; Ikenberry, 1987).
The relationship of career decision making to thought processes used in the individual's general approach to problem solving has also been examined in the search for greater understanding of the phenomenon of career decision making (Krieshok & Heppner, 1983; Larson & Heppner, 1985; Larson, Heppner, Ham & Dugan, 1988; Phillips, Pazienza, & Ferrin, 1984). The relationship between career decision making and decision making style has also been examined (Gordon, Coscarelli, Sears, 1986; Harren, Kass, Tinsley, & Moreland, 1978, 1979). Some have attempted to assess possible difference in cognitive processes involved in career decision making by means of a measure cognitive complexity. Much of the research on cognitive complexity in career decision making utilizes a career grid methodology based on Kelly's (1955; 1963) work with the Interpersonal Role Construct Repertory Grid (Bodden, 1970; Bodden & Klien, 1972; Neimeyer, 1988; Nevill, Neimeyer, Probert, & Fukuyama, 1986; Oppenheimer, 1966; Winer, Cesari, Haase 1979). Others have used measures of cognitive complexity in examining career decision making which are not based on the grid format (Harren, Kass, Tinsley, & Moreland, 1978; Kneflekamp & Slepitza, 1976). The relationships among career decision making, more general problem solving skill, cognitive processes and parental influences have been studied in various ways, many of which are reviewed in this chapter.

Career Decision Making and Parental Influence

Child psychologists and researchers in child development have long been interested in the impact of the mother and father on the development of a child. When considering the importance of choosing a career, it is not surprising that many researchers have studied the relationship between a parent's behavior and a child's vocational interests. The influence of parents through family dynamics from a psychoanalytic framework and from genetic influences are important aspects of Roe's (1956) theory of occupational choice. Parental
influence was found to be significant in an early study Schaefer and Bell (1958) who studied the relationship between a child's vocational choice and the mother's attitude toward child rearing.

However, it is Holland's theory that has stimulated many investigators in the exploration of the relationship between parent variables and occupational choice of the child. Holland (1962) found the high point code from his *Vocational Preference Inventory* (VPI) was significantly related to values held by the young person's parents. Fathers valuing popularity had significantly more sons who were Enterprising, while fathers who valued curiosity had significantly more sons who were Investigative. Mothers holding authoritarian attitudes fostered the development of children who were more often classified as Conventional. Father's occupation, mother's occupation, student's sex, and father's political beliefs were also found to be moderate predictors of college students' high point Holland code (Grandy & Stahmann, 1974). Following this investigation, other researchers found a positive relationship when comparing occupational codes of parents and children (DeWinne, Overton, & Schneider, 1978). In terms of occupational aspiration, fathers were discovered to influence both daughters and sons, while mothers were found to influence sons only. These same researchers later studied a small sample of parents with matching high point codes and found a significant parental influence on the occupational choice of daughters, but not sons (Schneider, DeWinne, & Overton, 1980). While these findings indicate a relationship between parental variables and the career choices made by their children, the patterns are not yet delineated, and the it seems unlikely that the relationship will be specified exactly.

The relative contributions of heredity and environment to occupational choice and to cognitive development of a child cannot be fully determined. Bronfenbrenner (1972) stated that both heredity and environment, as well as differences in social class and early child rearing practices all contributed to cognitive development, but the determining of the
proportion of variance from any single factor was impossible. However, many have found relationships between the cognitive development of a child and aspects of the parents. From their renowned study, Kagan and Moss (1959) offered results that showed a mother's behavior with her child at age three proved to be a significant predictor of the child's increase in IQ between six and ten years old. Mothers who encouraged their child and exhibited concern during early development raised more intelligent children. Along these same lines, Kagan and Freeman (1963) found that IQ scores at ages three, five, and nine were correlated with maternal behavior in early preschool years. A positive relationship was discovered between IQ and having a mother who stressed intellectual mastery, and who gave reasons for her demands and disciplinary actions. In this same investigation, a high correlation between a child's IQ and the mother's educational level was discovered by Kagan and Freeman; their results also showed a high correlation between father's education and IQ for nine year old girls, and a somewhat lower correlation between father's education and IQ for boys and girls at three or five years old. Bayley and Schaefer (1960) found that encouraging a child, offering positive evaluations, utilizing a democratic style, and exhibiting affection and expectations for achievement at age three, correlated with cognitive development at older ages. Children whose mothers used several of these dimensions seemed to be mentally healthier and more personally adequate than children whose mothers did not use these dimensions. It is of interest that Schaefer found similar dynamics operating between parent and child when she studied occupational choice with Bell (1958) and when she studied cognitive development with Bayley (1960). The relationship between mental health and the ability to solve problems and make decisions has been well documented in the psychological literature.
Personal Problem Solving

In a relatively recent report, Heppner and Petersen (1982) offer a discussion of the importance of problem solving within the psychological literature. These investigators note the lack of research on problem solving in the counseling psychology literature, and surmise the source of the problem lies, at least partially, in the fact that few instruments are available to measure personal problem solving. Moreover, the psychological literature on problem solving that is available, is largely unrelated to the type of problem solving that occurs in counseling.

The focus of attention most commonly utilized in problem solving research is on abstractions, such as tower problems, arithmetic problems, anagrams, puzzles, or other pre-defined laboratory problems. Even if results from these studies were more easily transferred to the work of the practitioner, such findings may not be useful when dealing with problems involving consequences in the life of the client (Heppner & Petersen, 1982). Evidence suggests that individuals do not react to hypothetical problems in the laboratory in the same way they react to the personal problems they confront in their life (Janis & Mann, 1977). Heppner and Petersen (1982) express a view indicating a need for an instrument to measure general personal problem solving. They point to the potential usefulness of findings from studies utilizing a general measure of problem solving to counseling psychologists as they address the concerns of clients.

Heppner and Petersen (1982) address this need by developing an instrument that might be useful in the attempt to study personal problem solving as it is experienced in the problems of every day life. They offer the Problem Solving Inventory [PSI] as a measure of self-appraised problem solving skill which serves as a tool to assess an individual's perception of their general problem solving skill. The PSI was developed to be a relatively short, objective instrument in an easily scored format.
The results of a factor analysis of the items from the PSI revealed three dimensions of personal problem solving: problem solving confidence, approach-avoidance style, and personal control. The PSI was found to correlate moderately well with a simple self-rating of problem solving skill, and to be useful in detecting differences between groups of students who had received problems solving training and those who had not. In addition, the PSI had only low correlations with several measures of verbal and quantitative intellectual skills. No statistically significant relationship was found between the Social Desirability Scale (Crowne & Marlowe, 1964) and the PSI. Therefore, PSI scores are assumed to have no direct relationship to intelligence nor is it perceived to be an attempt to appear only in a socially desirable light. Thus, Heppner's (1988) *Problem Solving Inventory* provides an easily interpreted instrument to assess an individual's self-perceptions about their personal problem solving effectiveness.

**Career Decision Making and Personal Problem Solving**

The thought that career decision making may be a specific case of personal problem solving can be seen in the frequency with which the terms decision making and problem solving have been used as interchangeable concepts (Heppner & Krieshok, 1983, citing Horan, 1979). Holland and Holland (1977) also argue that career decision making processes are related to problem solving, and might be viewed as a specific instance of more general problem solving. Therefore, it seems logical that the relationship between these two constructs would be the subject of investigation, provided the existence of appropriate measurement devices. A review of the vocational psychology literature reveals the existence of several measures to assess various aspects of career maturity and career decision making. However, until the development of the Problem Solving Inventory, few measures of general problem solving were available.
The appearance of the PSI allowed researchers to investigate the suspected relationship between career decision making and more general personal problem solving. The earliest attempt to assess career related issues and problem solving appraisal in the more general sense, was reported by Heppner and Krieshok (1983). Students using the services of a college career planning and placement center were chosen as the focus of their study. The PSI was used to measure self-appraised general problem solving skill. My Vocational Situation (Holland, Daiger, & Power, 1980) was chosen to determine the career difficulties respondents were experiencing, either lack of vocational identity, lack of information or training, or environmental or personal barriers.

In addition, the investigators prepared a questionnaire to assess level of student satisfaction with the services of the center, type of services sought, and the purpose for seeking services. The type of service was assessed on two levels, seeking either information only or career counseling. The purpose for use of the services was classified as either working on an immediate objective, such as writing a resume or seeking a job, or as seeking a long-term objective, such as choosing a major or choosing a future career.

The reported findings suggest that personal problem solving appraisal is related to aspects of the career planning process in a real life setting. Based on the results from those participants receiving total PSI scores in the top and bottom third of the total sample, respondents with more effective self-appraised problem solving skill were more satisfied with the career services they received and returned more frequently in subsequent weeks.

In addition, the interaction of involvement with goal on the Approach-Avoidance factor was found to be significant. Those students who came to the center seeking either information for a long-term objective or counseling for an immediate objective received lower scores on the Approach-Avoidance factor than students who sought information for an immediate objective, or counseling for a long-term objective. (Lower scores on the PSI indicate more effective self-appraised problem solving skills.) Also, the students'
vocational identity scales scores were significantly correlated with problem solving confidence, with approach-avoidance style, with personal control, and with total PSI scores. Heppner and Krieshok interpret their findings as indicating a need to offer problem solving training in career interventions. Practitioners were also encouraged to present strategies that assist clients to eliminate the sources of their indecision, and lower anxiety and avoidance behaviors related to career decision making.

Other investigators explored the relationship between problem solving style and career decision making style. Phillips, Pazienza, and Ferrin (1984) administered the Problem Solving Inventory [PSI] (Heppner & Petersen, 1985) and the Assessment of Career Decision Making [ACDM] (Harren, 1978) to a large sample of college undergraduates. Scores from the subscales of each instrument were subject to a canonical analysis. Subscales from the PSI include: Problem Solving Confidence, Approach-Avoidance, and Personal Control. ACDM decision making styles were referred to as: Rational, Intuitive, and Dependent. These investigators found that individuals who employ a rational career decision making style are more likely to approach problem solving tasks.

Other results showed that, while individuals who were assessed as relying on a dependent career decision making style persisted in approaching problem solving tasks, they did so with little confidence about their problem solving abilities. In addition, the findings showed those who endorsed both rational and intuitive career decision making strategies, held a more confident view of their problem solving skills, yet at the same time they held lowered perceptions of personal control in solving their problems.

The investigators offered an interesting interpretation about those individuals relying on a dependent decision making style. The fact that those who used a dependent style also endorsed lowered confidence for success in problem solving seemed consistent with previous findings. However, the accompanying finding that these individuals persisted and continued to approach a task in which they have little confidence that their
efforts will result in successful resolution seemed theoretically inconsistent. This inconsistency was interpreted in light of Knefelkamp and Slepitza's (1976) finding that individuals at a dualistic level of cognitive development more willingly rely on experts and authority figures for assistance with a career decision. Thus despite low confidence in their own ability, they have no hesitancy in enlisting the advice or help from others. Phillips and associates (1984) suggest an examination of the relationship between problem solving approach and level of cognitive development may prove fruitful.

An investigation providing a more direct examination of the relationship of problem solving appraisal and career decision making has been presented by Larson and Heppner (1985). In order to measure the college students' perceptions of their problem solving skill, the *Problem Solving Inventory* (Heppner & Petersen, 1982) was utilized. Career decision and indecision were assessed with the Vocational Decision Scale [VDS] (Jones & Chenery, 1980) and the *Career Decision Scale* [CDS] (Osipow, Carney, Winer, Yanico, & Koschier, 1976). From a larger group of respondents, who had completed the PSI, a random sample was drawn for the top 20 percent and the lowest 20 percent. These subsamples, designated as effective and ineffective, in terms of perceived problem solving skills, were then administered the VDS and the CDS.

Results comparing self-perceived effective problem solvers to self-perceived ineffective problem solvers, based on PSI and VDS scores, revealed that more effective problem solvers endorsed significantly fewer reasons for being undecided. These effective problem solvers also had significantly lower self-uncertainty scores, lower choice/work salience scores, and lower transitional self score. Based upon these results, comparing the PSI to the VDS, effective problem solvers were interpreted to be:

(a) more confident in their decision making ability and occupational potential, (b) more likely to have related their abilities to an occupational field and were more motivated to do so, and (c) less likely to view the
source of their indecision outside of themselves. (Larson & Heppner, 1985, pg. 61)

Similar results were revealed from the analysis of PSI and CDS scores. Self-perceived effective problem solvers were more certain of their vocational and educational choices, and endorsed fewer antecedents of career indecision, than less effective problem solvers (Larson & Heppner, 1985).

Interestingly, despite significant difference between means on CDS certainty scores (effective-low PSI scores, $M = 6.59$; ineffective-high PSI score, $M = 5.28$; $p > .01$; $SD$ not provided; Larson & Heppner, 1985), both effective and ineffective problem solving groups were interpreted to be relatively certain of their career choice. Also, in spite of the similarity on certainty of decision, the effective and ineffective groups differed on three factors of the VDS and on the sum score of the Reasons Scale (Indecision sub-scale) from the CDS. The authors cite this finding as evidence of the need for career planning assistance even for those students with a fair degree of certainty about their career decision.

**Personal Problem Solving and Cognitive Processes**

Just as there is an interest in the relationship between problem solving and career decision making, the information about cognitive processes used in problem solving was also viewed as worthy of investigation. Reports from two such investigations illustrate the attempt to link these variables.

Aspects of the relationship between personal problem solving and cognition have been described by Heppner, Hibel, Neal, Weinstein, and Rabinowitz (1982). They report finding significant differences in the cognitive attributions used by the respondents based on their problem solving effectiveness and their answers to specific items in a structured interview. Effective self-appraised problem solvers were found to differ in terms of their attributions and expectations for successful problem outcome. When compared with
ineffective problem solvers, effective problem solvers viewed the problem outcome to be more dependent on their skills and effort, and less on chance factors.

Following these findings, Heppner, along with Reeder and Larson, (1983) endeavored to extend the exploration of the relationship between cognitive variables and self-appraised personal problem solving skill in their attempt to assess both cognitive content and process. These investigators offer a relatively lengthy discussion connecting previous work in the area of cognitive assessment to their study. Citing the work of Mischel (1981) and the five variables he identified as important in human assessment, Heppner and colleagues chose two variables which they saw as having particular relevance to problem solving.

Encoding and self-regulation, the two constructs chosen for the study, were designated as the content of cognition by these researchers. The investigators promoted a view of self-concept as representative of encoding and categorizing events, people, and the self. They stated that a global measure of self-concept may be "A specific instance of encoding related to the self" (1983, pg. 538). Next, the authors offer a discussion of the ways in which self-regulation involves "...cognitions relate[d] to planning, initiating, and maintaining behavior"(1983, pg. 538). In addition to the content variables, the cognitive assessment paradigm of Hollon and Bemis (1981) was cited as indicative of the need to include cognitive processes, along with cognitive content. Heppner and colleagues viewed assessment of cognitive processes as a way to obtaining information about cognitive style differences.

Although Heppner and associates (1983) provid a rationale for the use of instruments they chose as measures of cognitive content and process, they fail to demonstrate construct validity. Without other evidence to support their claims that instruments developed to measure personality characteristics and thinking styles can also be used as measures of cognitive variables, their assertions alone are insufficient.
Instruments they chose to measure cognitive content were:

(1.) Tennessee Self-Concept Scale (Fitts, 1965), based on the belief that self-appraised ineffective problem solvers would encode a more negative picture of self-concept.

(2.) Irrational Beliefs Test (Jones, 1968), based on the belief that self-appraised ineffective problem solvers would hold higher and more unrealistic goals and standards.

(3.) Thought Stopping Survey Schedule (Cautela, 1972), based on the belief that self-appraised ineffective problem solvers would have an increased frequency of dysfunctional thoughts. (Heppner et al., 1983)

Other measures were said to assess the methods of cognition. Instruments chosen to measure cognitive process were:

(1.) Need for Cognition Scale (Cacioppo & Petty, 1982), based on the belief that self-appraised ineffective problem solvers would report less enjoyment of the process of abstract thinking.

(2.) Ways of Coping Scale (Folkman & Lazarus, 1980), based on the belief that self-appraised ineffective problem solvers would be less problem focused, and would be more focused on emotions engendered by the problem. (Heppner et al., 1983)

Heppner and associates (1983) report finding statistically significant results for the main effect of problem solving appraisal scores on each of the dependent variables. Effective self-appraised problem solvers rated themselves as having higher self-concepts and lower self-criticism score, fewer irrational beliefs, lower frequencies of dysfunctional thoughts, a greater tendency to enjoy cognitive activities, and a coping style that was less blaming and more problem focused than ineffective self-appraised problem solvers.

Stating that problem solving ability levels differed on the basis of both content, what the respondents thought, and process, how the respondents thought, Heppner and associates
support the need for further research into the relationship between cognitive processes and problem solving.

While accepting the statistical results in this investigation, the meaning of the findings as they relate to cognitive processes may be questioned. Further research is needed to assess the relationship of problem solving appraisal and cognitions with instruments developed specifically to measure cognitive processes. Moreover, utilizing instruments grounded in a theory of cognitive processes to measure cognitive processes would prove more fruitful.

**Theories of Cognitive Development**

Discovery of mechanisms, such as cognitions, which cannot be directly observed demands that inferences be made. Based on behavioral observations, on verbal reports from the observed individuals as they describe their thoughts and offer explanations of their deductive and inductive processes, such inferences can be made. Despite the difficulties inherent in the study of cognition, interested observers have eagerly articulated theories about cognitive processes which arose from their observations of human behavior and from conversations with those they observe.

Initiated by observations of his own children, as they progressed through childhood, Piaget (1960) developed a theory of intellectual development. His work fostered widespread interest in cognition and the changes in cognitive structure as a child developed. Piaget delineated universal and sequential patterns of development, which he inferred from the verbal responses children gave to explain their thinking processes and from their epistemological assumptions about the world. His stage theory encompasses the years from birth to adolescence. Pre-operations, the period of infancy and early childhood; Concrete Operations, operating during the elementary school years; and Formal Operations, beginning in early adolescence.
While Piaget limited his study of cognitive development primarily to the years before adolescence, the work of Perry (1970) presents a theory of intellectual development in young adults of college age. His theory arose out of unstructured, informal, interviews with college students. Perry noted a pattern in the ways that students changed their perspectives on meaning making and on epistemological concerns, as a result of time spent in pursuit of college education and also their own individual development.

These interviews were later subjected to a qualitative analysis, the results of which were published a volume describing the theory (Perry, 1970). This work garnered strong interest by those who work with college students. The development of a theory of intellectual development which occurs during the college years, and the potential for providing an environment which would facilitate optimum movement across the stages, drew the attention of college student life professionals, academic advisers, career planning and placement personnel, and administrators and faculty members in higher education.


Perry's scheme consists of nine positions, each representing a qualitatively different structure or way of thinking. The positions are categorized into three areas based on similarities in the organization of the structures. The scheme is outlined below.

**Dualism.** The first three positions are characterized by a dichotomous structure from which the world is viewed in absolute either-or terms. Truth is assumed to be known and information is processed to fall neatly into one of the two categories: right or wrong, good or bad, et cetera. The student perceiving the world from one of these structures views authority figures as the holders of truth from whom he must learn. Thus reliance on authority rather than one's own ideas is the order of the day in learning and decision-making.
Position One. Perry (1970) describes this position as a pure, closed structure. The world as seen from this structure is free of conflict since uncertainty is not perceived. Everything is absolute to the point of inability to imagine the existence of more than one answer to a question. Truth is accepted without question from the authorities, since they are always right.

Position Two. Diversity and alternate possibilities are recognized in this structure in a limited fashion. The truth still exists and is known to authorities. Two new twists appear however. Authorities introduce uncertainty as a way of helping students learn to find the truth on their own. Perry (1970) notes that this uncertainty is seen as "temporary, good for the mind, resolvable and therefore ultimately unreal" (p. 78). Learning to find one's own answers is dealt with through a focus on quantity and hard work. Complexity as such also represents the freedom to explore in the process of acquiring the truth. A second change is that some authorities do not seem to know the answers, and in accord with the dualistic structure are categorized as wrong.

Position Three. The major discovery in this position is that some truth is not known at present, even to authorities. Uncertainty is more uncomfortable since it cannot be immediately resolved by appeal to authority. Confusion over evaluation of work arises since authorities cannot be expected to know the answers in all areas. In the attempt to relieve anxiety the student focuses on quantity of work and holds tightly to the notion that the authority will lead the way to finding the truth in the future.

Relativism. Positions Four, Five, and Six represent a view of knowledge as relative. The dualistic structure is discarded in favor of recognition of the numerous possibilities. Uncertainty replaces absolutism as the order of the day. This change releases authority from its previous all-knowing position and elevates the student's ideas to an equal status. The search for absolute right answers is abandoned as the structure calls for a variety of answers dependent on the context.

Position Four. Position Four represents the beginning of the shift from certainty as the way reality is perceived. Some truth remains in limited areas. For the most part, there are no answers and no criteria with
which to distinguish one opinion from another. Learning focuses on thinking about thinking, or practising the way the authorities want us to think with their guidance.

**Position Five.** All knowledge is now viewed as relative and contextual. Opinions can be judged better or worse depending on the existence of supportive evidence. Authorities are redefined as those who have experience and competence in groping for the truth in a given context. Introspection and detachment are possible for the first time. The ability to evaluate and subsequently choose creates the fear of narrowing one's options.

**Position Six.** The acceptance of a truly relativistic world in which infinite contexts exist is accompanied by the realization that choosing is essential to avoid disorientation. One must affirm one's identity through establishing a context in which to invest oneself. The Position Six individual recognizes this need for commitment but has not yet acted on it.

**Commitment in Relativism.** Positions Seven, Eight and Nine do not represent restructuring as do the previous positions. They are characterized by development of commitment. The individual takes responsibility for making choices and affirming his or her identity in numerous contexts or areas of life. Perry notes that this process addresses both the content and style of identity.

**Position Seven.** Position Seven marks the point of initial commitment in some aspect of life such as career, relationships, or values. The commitment is an act, presupposing a genuine exploration some order to one's life.

**Position Eight.** Position Eight is accompanied by the emergence of additional choices regarding how to carry out initial commitments. The major focus is on the style with which to implement the commitments as well as the issue of responsibility. The recognition of the infinite nature of choosing comes with the acceptance of relativism in its fullest sense.

**Position Nine.** This constitutes an integration of commitments and one's lifestyle as determined by implementation of commitments. Commitment is recognized as an ongoing activity, never to be settled in a final sense.
In addition to the main line of development Perry notes three alternatives to growth. Although evidence of these occurring is minimal, they warrant mention as possibilities. Temporizing involves a pause in growth for a period of a year or more. Perry describes these students as gathering their energy to be more ready for the next challenge. Temporizing could occur at any point along the scheme when students find themselves unable to take the next step. Retreat refers to the actual regression to an earlier position. Retreat is most likely to be back to dualism in order to maintain the needed structure for emotional control. Retreat is possible in more complex positions, but escape is a more likely alternative. Escape involves an abandonment of responsibility through detachment. The advanced structures are more conducive to detachment by their very nature. Perry identifies two types of escape. The first, labelled dissociation, involves a rather passive delegation of all responsibility to fate. Rather than participating in exploring growth, the individual drifts along, waiting for fate to guide his or her identity. This type of escape is most likely to occur in the stage of Multiplicity. The second type, encapsulation, is more likely to occur in the position of Relativism due to the greater complexity of thinking at this level. This involves submersion in activity to avoid the implications of establishing one's values. The individual maintains an identity through doing rather than choosing and identity in a relativistic world. (pp. 15-19)

Assuming cognitive processes and structural changes exist as articulated, the next step lies in devising tools with which to measure the means by which humans use their cognitions to make sense of their world. The availability of an instrument to measure the level of cognitive development used by an individual would allow professional to evaluate programs, observe changes in individuals over time, and diagnose individuals in need of intervention.

**Cognitive Processes Measurement**

The difficulty of attempting to understand an unseen phenomenon, a process that can only be inferred from observing the effects, presents a challenge to the investigator
who requires a concrete measure of a process which is assumed to have taken place. Developing measurement devices to provide this data is an important facet of the work in psychology research. Instruments are needed, indirect measures of the processes, in order to increase an understanding of a phenomenon, to assess individual differences, and to investigate the relationship between cognitive processes and other human qualities.

Measurement of behavioral changes which result from an internal mechanism is no easy task. Neither Piaget nor Perry developed instruments to quantify the cognitive changes they observed. However, there have been attempts to measure cognitive processes. These attempts come from three main conceptual frameworks: interpersonal and vocational role construct grid methodology, cognitive science and information processing, and from cognitive development theorists in developmental psychology.

**Cognitive Construct Grids.** The grid methodology was developed by Kelly as a metric for examining how individuals construe the personalities of those around them. For Kelly, the use of Role Construct Repertory Grids offered a means for viewing the structure or framework with which an individual classifies other individuals in terms of dichotomous constructs. Underlying Kelly's use of the grid was his view that

The minimum context for a construct is three things. We cannot express a construct, either explicitly or implicitly, without involving at least two things which have a likeness and one which is, by the same token, different (Kelly, 1955; 1963; p. 111-112).

Obviously Kelly is attempting to devise a means for measuring some aspects of the cognitive processes humans use in making sense of the behaviors of other individuals around them (1963, p. 47).

A grid was the tool he chose to reflect these thought processes. The grid consisted of a column listing the persons being judged, in terms of their interpersonal role to the respondent (e.g.: mother, best friend, teacher) crossed with a row listing dichotomous variables which describe human qualities chosen by the respondent to be important in the
judgements (e.g.: shy-outgoing; indecisive-decisive, ill humored-cheerful). Based on the Kelly's definition of a construct, as quoted above, the use of the grid depends on judging the persons listed in triads. Judging the individuals requires that two of the interpersonal role holders be judged alike on some quality, yet at the same time different from a third for that same quality. It is this characteristic that is then, by definition, a construct.

**Cognitive Construct Grids and Career Decision Making.** An investigation by Oppenhiemer (1966) establishes the first link between the concepts of interpersonal cognitive complexity and occupational preferences. Using a modification of the Role Construct Repertory Grid methodology developed by Kelly (1955, 1963), Oppenheimer found that interpersonal cognitive complexity was not associated with the degree of relationship between self-concept and occupational ratings; he concluded from this that cognitive complexity was not related to Super's concepts of vocational choice (1966).

From this inauspicious beginning, a large body of literature has been developed using repertory grids in the attempt to improve our understanding of the cognitive processes used in career decision making. (See Neimeyer, 1988, for a thorough review of the literature on the use of grid methodology in vocational behavior.)

**Modified Rep Grids.** However, the existing literature linking cognitive constructs with vocational behavior uses a grid methodology modified by Bieri (1966). This modified grid utilizes constructs provided by the investigator rather than allowing respondents to personally choose individuals what they believe to be important to their lives. The use of a standardized grid allows the researcher to apply statistical manipulations across all respondents using the same constructs. In addition, when using the Bieri methodology, the personal role positions are not compared together in triads, but on the basis of a Likert scaling for each quality listed by the investigator, and usually referred to as a construct. However, the use of the term in these grids differs significantly from Kelly's definition.
Most recent investigations of career decision and indecision using Rep Grids, as they have come to be known, are based on a further modification first utilized by Bodden (1969). In an examination of the relationship between cognitive complexity and appropriateness of career choice, Bodden offered respondents two grids, one an interpersonal role grid, like that used by Bieri, and a second vocational role grid. This vocational grid listed occupations in the columns and job related constructs in the rows. The elements and constructs within the columns and rows were provided by the investigator, not generated by the respondent as with Kelly's methodology. Individuals who received higher scores derived from the grids were assumed to have better cognitive differentiation skills, and therefore, be better able to discriminate among a variety of occupations. The results obtained from the modification of Kelly's Interpersonal Role Construct Grid were designated as a measure of cognitive complexity.

Bodden (1969) defined the measure of appropriateness of choice in terms of Congruence and Realism for the choice. Congruence was viewed in terms of high point Holland code, based on a match between the respondent's code from the Vocational Preference Inventory and the code designated for the respondent's stated occupational choice. Realistic choice was defined as a match between a respondent's American College Test score percentile rank and vocational level assigned to their chosen occupation by Roe's (1956) scheme.

Using the grid methodology, results showed no significant relationship between vocational choice and either vocational complexity or interpersonal complexity. Neither was a significant relationship found between congruence in personality and occupational characteristics and either vocational or interpersonal cognitive complexity. There was one exception to the nonsignificant findings. For undergraduate junior and senior males only, vocational cognitive complexity was significantly related to a highly congruent match between occupational and personal characteristics. Despite finding no significant results
for the main effects, Bodden stated that cognitive complexity does seem to be related to information processing and decision making.

**Issues in Using Modified Grids.** When considering the use of the vocational cognitive complexity grid as a measurement device, it seems important to note the violations of Kelly's original use of the device and the theory underlying it. Interpersonal role construct grids were developed to assist in interviewing. They were devised as a means for helping an individual describe relationships with others in ways they might not be able to do in response to an interviewer's questions. The grids were developed to facilitate conversation (Bonarius, 1977).

However, though not without problems, grids have been applied to many other purposes. When used for clinical and social judgments, findings reveal that rep grid scores are affected by the particular stimuli being judged. More constructs are used to describe individuals known well, as opposed to those less well acquainted to the respondent (Crockett, 1965). Articulation of judgements about an individual are more specific when more is known about the individual; the same is probably true for judging occupations. Scores are also affected by the "vigilance hypotheses" both in interpersonal judgements (Turner & Tripodi, 1966) and in vocational judgments (Bodden & Klien, 1972). More complex discriminations are found when the stimuli presented engender negative affect than those which generate positive affect.

It seems that to merely state a dislike for one of the elements presented is not enough; after a negative reaction, a respondent becomes more vigilant about the judgments of that element and expresses more specificity by choosing more constructs to describe it. For the same individual, different levels of complexity were reflected in the grid scores, depending on the affect involved with respect to the stimuli. Humans seem to have a need to bring more evidence to bear in support of their dislikes; and they have less need to list the specifics for a positive responses. A global "I like it" suffices.
Other limitations of career grid methodology have been outlined by Krieshok, Arnold, Kuperman, & Schmitz (1986) as a result of their investigation. They found the grids to demand too much attentional to detail, requiring a new decision at each point on the grid, which led to fatigue and lowered interest in the students over time. They suggested that the grid may be particularly unsuitable for undecided students. It was hypothesized that those low in the ability to accurately articulate personal values may less able to make the judgments needed for optimum use of the career grid.

Another criticism of the grid methodology is related to its reliance on nominal scaling. Schroder, Drive, and Streufert (1967) discuss limits to the device in measuring abstract thinking, due to the absence of ordinal and ratio scales in the grid. They state that the rep test though useful in predicting a range of behavior, "...would not be expected to relate strongly to abstractness" (1967, p. 169).

It seems that the philosophy of scientific logical positivism may have influenced the reliance on a device which offers an appeal, based on the desire for easily quantified data. The Rep Grids offer

1. objective results with relatively easily obtained ratings;
2. yield numerical values which can be manipulated and calculated in various way to obtain scores said to measure (a.) differentiation, (b.) integration, and (c.) conflict;
3. numerical scores based on the standardized stimuli for each respondent which lend themselves easily to statistical manipulations and allow comparison of scores across samples.

In fact, psychologists are well served by instruments that offer numerical values to reflect individual qualities. This allows comparison to a norm group and facilitates the attempt to gain an understanding of some characteristic of interest. However, it might also be that the complexities involved in the metrics themselves lead to an overvaluing of the resultant findings from the Role Construct Repertory Test. It is interesting that grid
methodology continues to hold such prominence in the literature of vocational behavior. Other areas of psychology have discarded the method as a measure of cognitive complexity. "Since about 1965, the attempt to score construct protocols for complexity—or, indeed, for any other personality trait—has been largely abandoned" (Tyler, 1978; p. 121).

The continued use of the grid methodology also raises other concerns. One important matter is the question raised by the presentation of stimuli chosen by the experimenter. The cognitive processes involved in reacting to information structured by the investigator may differ greatly from those cognitive processes used by respondents free to engage themselves with an array of factors more closely linked to their real life decisions.

Generally speaking, the experimental research on decision making has not told us anything about [generating alternative solutions]. In the usual experimental design, the experimenter provides the alternatives to be considered by the subject. No room is left for others, especially alternatives the experimenter might not have thought of. What we need if we are to understand how individuals create themselves through their decisions is a theory broad enough to cover the possibilities as well as the choices between them. We do not as yet have such a theory (Tyler, 1978, pg. 208).

Nor do we have many reports of information grounded in research results from decision making completed in realistic settings. Just as findings from both laboratory analogue studies and field studies contribute to the understanding of therapeutic processes, both laboratory methods and more realistic methods are needed in the study of cognitive processes.

Another important issue in judging the findings based on grid methodology lies in the high probability that results are based on stereotyped views of occupations. In fact, it might be argued that even individuals very familiar with someone employed in a one of the occupations listed on the Rep Grid react based only on the specifics of that particular
position holders duties and responsibilities, which may not generalize to other holders of the same occupation. The stimulus word "Physician" may elicit a response based upon childhood visits for immunization, rarely would the responses be based on experiences with a cancer research physician, or even on the work of prominent person, such as Christian Barnard.

An investigation by Bihm & Winer (1983) found that people may rely less on information and more on thematically organized impressions about careers. Information itself seems to have little impact in reshaping the stereotypes people have about occupations. Using impression theory, these researchers studied the impact of the occupational information giving aspects of career counseling. Students who listened to occupational information, were asked to describe the occupations, either immediately or one week later. False positives were taken as evidence of thematic intrusion. These thematic intrusions were found to increase over time. More importantly, no support was found for the hypothesis that more thematic intrusions would occur in the recall of familiar occupations as opposed to unfamiliar occupations.

The importance of human feelings in making choices are also missing from the use of grid methodology and from laboratory anagrams or creativity problems often used in the attempt to understand cognitive processes. Presenting problems that involve logic may offer ease in scoring and analyzing, however, humans rarely decide a course of action on logic alone. In a recent presentation, Herbert Simon, the renowned cognitive scientist offered the following views.

...Reasoning conjures up logic, symbolic logic. But reasoning in human beings is a more general process (and more subject to error)"...."Logicians appreciate rigor; they guarantee conclusions follow the premises. They create tautological lines of argument without error. They need to use very tiny steps to accomplish this. It takes books [volumes] to get the logic of mathematics written out... (Simon, 1989).
Simon then draws attention to the fact that cognitive science has had little or nothing to say about affect. "...Empiricists' views leave out how emotions and cognitions are connected. They ignore how individuals evaluate situations, good/bad consequences, pleasure/pain, the consequences of decision making..." (Simon, 1989). The serial processing ability in humans which allows them to attend to the facts and to their feelings in evaluating a desirable outcome is critical in decision making (Simon, 1989). Yet these qualities are very difficult to incorporate into a research design, given the current state of the art.

**Information Processing Measures of Cognition.** Measurement of cognitive processes from the field of information processing seem to come from the work of three investigators working together or with others (Harvey, Hunt, & Schroder, 1961; Hunt, Butler, Noy, & Rosser, 1978; Hunt, Greenwood, Noy, & Watson, 1973; Schroder, Driver, & Streufert, 1967). Their theories were developed from inferences that particular external indicators reflect internal process.

The unit of analysis these researchers use for assessing information processing is a structural analysis of verbal responses. Content is disregarded in favor of the cognitive structural properties of the response. Because the cognitive processes used by an individual often vary over stimuli or domains, for example, interpersonal, political, mathematical, these authors prefer the use a great many stimuli within the instrument. These measures present a stimuli, a sentence stem or a partially written paragraph, which require the participant to produce a written response (Schroder, Driver, & Streufert, 1967).

Such instruments are said to offer an alternative to standardized tests and allow the investigator to gain cognitive construct relevant information. Schroder, Driver, and Streufert produced an early attempt to measure "the integrative complexity of conceptual rules generating verbal responses over a range of source materials" (1967, p. 185). In addition to the instrument itself, they also provided a scoring manual which allowed the
investigator to assign specific conceptual level to the respondent's production. The use of this methodology appears often to measures of conceptual level in the study of a variety of variables: counselor skill level (Berg & Stone, 1980); counseling process variables and client type, (Blaas & Heck, 1978); as a mediator in cognitive restructuring, (Bruch, Juster, & Heisler, 1982); clinical hypothesis development, (Holloway & Wolleat, 1980); and initial interview behavior (Stein & Stone, 1978). The instruments, however, are not widely available. While they appear to be used fairly frequently by others, articles by the authors themselves, about either the development or the use of the instruments, cannot be easily located. These instruments, with the exception of the Structural Analysis of Verbal Responses (Schroder, Driver, & Streufert, 1967), remain unpublished and must be obtained directly from the authors. In addition, the user must learn the scoring system.

Cognitive Developmental Instrumentation. Publication of the Perry (1970) model of cognitive development served to trigger attempts to provide an accurate measure the intellectual development of college students in terms of the stages and positions described in the theory. The first such instrument was devised by Knefelkamp (1974) and Widick (1975). Working together, they developed the KneWi. This instrument required written responses to presented sentence stems and essays questions. A rating manual was also produced which gave cues to indicate the Perry positions used by the respondent. Later Knefelkamp, together with Moore, created a new version of the KneWi, renamed the Measure of Intellectual Development [MID] (1982); this version retained only the two essay questions from the original instrument and added a third (Baxter Magolda & Porterfield, 1988). The MID, however, did not correlate well with increased levels of education (Baxter Magolda & Porterfield, 1985).

While researchers view the production format as necessary to the accuracy of the rating obtained, practitioners, who look for ease of scoring in an assessment device, favored an objective format. Several attempts were made to assess intellectual
development, in terms of the Perry model using standardized stimuli. These objective formats required a recognition response rather than a production response. However, the objective measures offer more global stage scores, rather than position scores, and do not seem to correlate well with the position scores obtained using the more demanding production methods. (Cited in Baxter Magolda & Porterfield, 1988, while discussing Erwin's, 1983, Scale of Intellectual Development [SID], and Parker's, 1984, Parker Cognitive Development Inventory [PCDI]). The recognition responses, as opposed to production responses, also can result in elevated ratings in the modal position scores.

Using the work of Knefelkamp, Widick, and Moore as a point of departure, Baxter Magolda (1983) and Porterfield (1984) developed the Measure of Epistemological Reflection (MER). The MER maintains the production methodology said to be necessary to obtain accurate ratings of intellectual development. It was designed to decrease the degree of subjectivity in the ratings that seemed difficult to avoid with the KneWi, through the detailed manual developed in conjunction with the instrument.

The MER requires the respondent to write essays in response to questions on six different aspects, or domains, of academic learning. Specific probe items are included with each domain to enhance the probability of obtaining a response that can be rated according to the Perry stage model. In addition to the instrument, a key element in development was the production of a rating manual. The manual serves two purposes. First it presents specific cues for each position by domain, thus reducing the subjectivity of the rating. Secondly, it serves as a source for self-training in the rating system. Thus the need to send instruments back to the authors for rating is eliminated, as is the alternative need to spend time and money obtaining training directly from the author.

**Issues in Using the Measure of Epistemological Reflection.** The strengths of the MER lie in the fact that it is based in theory, and valid in terms of the corresponding rise in MER Total Protocol Rating as years in college increases. Additionally, the MER has been
shown to be statistically valid and reliable, in terms of both internal consistency and interrater reliability. (A more detailed description of the validity and reliability of the MER can be found in the methodology chapter.) The use of a production response can be viewed as both a strength and a shortcoming. The production response eliminates the possibility that the respondent will choose items reflecting a level of thought processes beyond that which they operate. Yet at the same time, the need to rate each protocol greatly increases the costs when compared to an objective format. The development of the self-instruction manual does, however, somewhat alleviates the costs if an investigator chooses to learn the rating system. Also, the presence of the rating manual ensures more accurate ratings by limiting the amount of subjectivity raters use.

The factor producing the greatest constraint lies in the cost of its use. While less costly than interviewing, it is far more expensive to use than a more objective measure. The cost of self-instruction is much less than necessary when training is sought directly from the author of an instrument. Yet, it remains costly in terms of time to learn the system, and to practice sufficiently to reach certification criterion (Moore, 1989).

A criticism of the MER also lies in the restriction of range in the scores obtained. While the score values parallel the Perry positions, only the positions from one to five are considered indicative of increased structural cognitive change. The last four positions are viewed as related more to identity issues based in level five thinking processes (Baxter Magolda & Porterfield, 1988). This limit in range creates statistical problems, especially in more complex manipulations. Despite the potential statistical and procedural difficulties inherent in the MER, the strength of the MER lies in its solid theoretical and substantive base.

Conclusions Derived from Review of Cognitive Measurement. Based on the preceding information regarding attempts to measure cognitive processes, an instrument which requires the respondent to produce a written response, rather than to respond by
rating a series of elements and constructs, was chosen for the investigation which is reported here. The view underlying this choice is that an instrument which requires a productions task results in a more effective measures intellectual processes than a recognition task would be. Just as a measure of general problem solving contributed additional information to the study of career decision making, the use of a measure of cognitive processes, which is based on a theory of intellectual development, was used to extend the understanding of career choice. The goal sought by using a measure, which elicits descriptions of the thinking processes the respondent uses and evokes written samples of their thoughts and ideas, was a meaningful extension of the understanding of cognitive complexity in career decision making.

**Vocational Psychology and Complex Statistical Analysis**

The long history of vocational psychology has provided the base for an increased use of sophisticated statistical techniques in the study of career development and decision making. Many of the essential features related to career decision making have been analyzed and delineated. While the knowledge gathered does not allow a precise prescriptive formula for making career decisions as yet, there are strong indications of the relationships among various psychological characteristics and career decision making. The availability of this strong knowledge base of the particulars suggests that it is time to begin the process of synthesizing. And in fact, the vocational psychology literature increasingly includes research reports of attempts to examine the effects of several variables taken together.

The use of complex statistical methods such as multiple linear regression, factor analysis, cluster analysis, path analysis, and structural equation modeling have all been applied to aspects of the psychology of careers. These techniques allow the consideration of the effect of several variables on one or more other variables in a specified pattern.
Multiple linear regression allows several measured variables to be regressed on one dependent variable. With this technique, it is assumed that the measured variables are correlated to some degree, so error of measure is not taken into account (Fassinger, 1987). Cluster analysis can be employed when a method less stringent than factor analysis is desired; when analyzing many variables, it pulls out those with common variance and categorizes them as a cluster or subgroup (Larson, Heppner, Ham & Dugan, 1988). With factor analysis several measured variables (for example, the items in an inventory), load on two or more orthogonal or latent variables, which are the factors or categories in which the measured variables seem to fit best (Fassinger, 1987). Path analysis is employed using only measured variables, when they are assumed to be equivalent to the underlying construct that is being assessed. However, this method is limited in that the error of measurement is not considered (Fassinger, 1987).

The most encompassing technique is structural equation modeling. With this method of analysis, the relationships among all of the variables, both measured and latent, can be stated as a series of regression equations. Measurement or indicator variables are chosen to measure latent variables which cannot be measured directly. Each relationship is represented in a diagram as a pathway between the variables, and relationships can be assessed in terms of causality. The power of this statistical technique allows both exploratory and confirmatory testing. An additional strength of the technique is an accommodation for the error of measurement.

Several of these techniques alone, or in combination, have been applied to aspects of career decision making. The technique of cluster analysis has been used to measure the degree of occupational decidedness of college students (Lucas & Epperson, 1988), and to examine subtypes of students undecided about a major (Larson, Heppner, Ham, & Dugan, 1988). Factor analysis, used in conjunction with canonical correlation analysis (Fuqua, Seaworth, & Newman, 1987) and with multilinear regression (Fuqua, Newman, &
Seaworth 1988), has been employed to examine the relationships among career decision making, state and trait anxiety and several other variables. Path analysis was applied to assess aspects of career indecisiveness-career indecision, state-trait anxiety, and external-internal locus of control (Hartman, Fuqua, & Blum, 1985). Two articles by Harren, Kass, Tinsley and Moreland (1978, 1979) utilized path analysis and multilinear regression in the attempt to offer models linking gender, sex role self-concept, sex role attitudes and career choice. Based on data gathered from a very large sample, Farmer (1985) presented several models of career achievement and motivation in men and women in the attempt to offer a more complete, broadly focused view of the phenomenon. Examining the data first with a hierarchical multilinear regression analysis, and then with path analysis, Farmer developed several models using mastery, career aspiration, career goals for women, and career goals for men as dependent variables. An even more sophisticated attempt at model construction was presented by Fassinger (1985). Using the technique of structural equation modeling, Fassinger tested a proposed causal model for college women's career choice. The power of this statistical technique allows it to be used for both exploratory investigations and for confirmatory testing.

**Cognitive Processes, Problem Solving, and Career Decision Making**

An overview of the history and importance of career decision making to individuals and professional has been presented as a background for the proposed study. Following a discussion of the usefulness of a measure of general problem solving in the study of career decision making, findings obtained by researchers who examine the relationship between career decision making and more general personal problem solving have been presented. Also tendered was a discussion of findings from an investigation attempting to discover the ways in which cognitive processes affect personal problem solving.
Furthermore, a brief overview of cognitive developmental theory has been offered, as well as a discussion of the attempts to measure the theorized changes in cognitive structures. Information has been reviewed here examining previous investigations which have linked career decision making to cognitive complexity. Researchers attempt to increase the understanding of cognitive processes used in choosing an occupation by means of both grid methodology and non-grid measures. It has been argued that a measure of cognitive processes which requires a production response will allow participants greater opportunity to operate in a manner close to that which they use in real life decision making. Thus, a measure of cognitive complexity which requires respondents to produce written samples of their thinking has been proposed for the current investigation. Finally, some examples of the growing use of complex statistical techniques in the study of career decision making were listed. It is hoped that the research presented in this report, which is assumed to be the first to link the three variables of interest, cognitive complexity, problem solving, and career decision making, will contribute new information to the field of vocational psychology.

The instruments chosen to examine these relationships were: The Measure of Epistemological Reflection (Baxter Magolda & Porterfield, 1984), the Problem Solving Inventory, (Heppner & Petersen, 1982), and the Career Decision Scale (Osipow, Carney, Winer, Yanico, & Koschier, 1976). In addition to these standardized instruments, descriptive data were gathered from each participant in order to examine the relationships among several variables, including educational and occupational information for the mother and father of the respondent. The data gathered through the use of the Personal Data Sheet, developed for this study, and the copyrighted instruments were then submitted for statistical analysis in an attempt to assess a proposed causal model of the relationships among the variables of interest. Based on the information developed in this literature review, a statement of the problem for the proposed research is offered.
Statement of the Problem

In what ways are the constructs mother, father, cognitive complexity, problem solving, and career decision making causally related? How well are the constructs, mother and father, measured by achieved level of education, level of general educational development, and level of specific vocational preparation? How useful are college class rank, high school grade point average, college grade point average, and level of intellectual development as indicators of cognitive complexity? To what extent do problem solving confidence, problems solving approach-avoidance, and personal control serve to measure problem solving skill? How successfully is career decision making measured by comfort with current career choice, strength of commitment to current career choice, and certainty and indecision with regard to career decision?

Purpose of the Study

The primary purpose of this study was to test a causal model of the relationships among parental educational and occupational influences, cognitive complexity, self-appraised personal problem solving skill and career decision making. The use of structural equation modeling was employed to carry out this purpose. An additional goal of the research was to apply a measure of cognitive complexity, which requires a written subjective response from respondents, as a means for adding to an understanding of the cognitive processes used in career decision making and in more general personal problem solving. Furthermore, several demographic variables were examined for the purpose of describing the characteristics of the group of college students from whom data were collected.
CHAPTER III

METHOD

Information included in this chapter describes the design of the study, as well as the hypotheses developed based on the review of the literature. A description of the methods by which participants volunteered for the study, as well as the procedures used to collect the data, are also included. The instruments utilized to carry out the investigation are described along with reliability and validity data. The chapter concludes with a brief description of the methods chosen for the statistical analysis of the data.

Description of the Design

Information about the relationships among cognitive complexity, problem solving skill, career decision making, and parental educational and occupational variables, was gathered in this research project. While there exists a large body of literature reporting the findings on factors related to career decision making, only recently have attempts been made to present a unifying theory describing the relationships among variables determined to be important components of career decision making. However, interest in attempting to develop multidimensional models for describing career motivation and decision making are increasingly evident in the psychological literature. In the attempt to offer expanded views of the phenomenon, reports implementing sophisticated statistical techniques, such as multilinear and stepwise regression, path analysis, and structural equation modeling, have been applied in hopes of developing a unified theory of career choice (Hartman, Fuqua, &

The purpose for this research was to study some of the factors influencing the career decision making of college students. More specifically, the intent was to test a proposed structural model of career decision making with a relatively large sample of undergraduate students by means of the structural equation modeling methodology. This technique allows the measurement of latent variables using multiple indicators. This ability to utilize several measures of a variable offers an improvement over path analysis. The latent variables, which cannot be directly observed, are functionally equivalent to the factors in a factor analysis.

A visual representation of the final design of the model examined in this investigation is represented in Figure 1. Latent variables in the model are represented by circles and designated as \( \eta \), if dependent, and \( \xi \), if independent. Indicator variables are represented by rectangles and labeled \( x \) if measuring an independent variable and \( y \) if measuring a dependent variable. The pathways are labeled: \( \beta \), for paths between the dependent latent variables; \( \gamma \), for paths between an independent latent variable and a dependent latent variable; and \( \lambda \), for paths between the measurement variables and the latent variables. Error terms are indicated by \( \zeta \), for dependent latent variables, \( \delta \), for measurement variables of independent latent variables, and \( \epsilon \), for measurement variables of the dependent latent variables. Mother (MO) and Father (FA) were regarded as exogenous latent variables (\( \xi \)). Cognitive Complexity (CGC), Problem Solving (PSS), and Career Decision Making (CDM) were designated as endogenous latent variable (\( \eta \)). Measured variables were chosen as indicators of the latent constructs postulated in the proposed model of career decision making to be tested. Indicator variables for the exogenous variables are labeled \( x \) in the model, while indicator variables for the endogenous variables are labeled \( y \) in the model.
CGC=cognitive complexity, PSS=problem solving skill, CDM=career decision making, EDM=mother's achieved level of education, GEM=general educational development expected for mother's occupation, SVM=specific vocational preparation expected for mother's occupation, EDF=father's achieved level of education, GEF=general educational development expected for father's occupation, SVF=specific vocational preparation expected for father's occupation, RNK=college class rank, HSG=high school G.P.A., GPA=college G.P.A., MER=total protocol rating (Measure of Epistemological Reflection), CNFD=confidence, APAV=approach-avoidance, CTRL=personal control, CFT=level of comfort w/ career choice, CMT=strength of commitment to career choice, CRTY=certainty, INDC=Indecision.

Figure 1
Path Diagram for Proposed Causal Model of Career Decision Making
The model depicted in Figure 1 suggests that the two exogenous independent variables, Mother (MO) and Father (FA), effect the endogenous dependent variable, Cognitive Complexity (CGC). The model represents the endogenous dependent variables effect on each other by means of directional arrows. As presented, Cognitive Complexity (CGC) affects Problem Solving Skill (PSS) and Career Decision Making (CDM), and Problem Solving Skill (PSS) is also represented as having an effect on Decision Making (CDM). The model shows that the Father variable was expected to have a direct effect on Career Decision Making.

Included in the model are the indicator variables which were chosen to measure the latent variables. The latent variable Mother was measured by mother's achieved education level (EDM), mother's general educational development (GEM) needed for her stated occupation, and mother's specific vocational preparation (SVM) needed for performing her current occupation. Measures for the latent variable Father were, his achieved education level (EDM), the general educational development (GEM) needed for his stated occupation, and the specific vocational preparation (SVM) needed for performing his current occupation. The latent variable Cognitive Complexity was measured by three items taken from the Personal Data sheet, high school G.P.A. (HSG), college G.P.A. (GPA) and college class rank (RNK) and by the Total Protocol Rating (TPR) from the Measure of Epistemological Reflection [MER] (Magolda & Porterfield, 1984). Measures of the latent variable Problem Solving Skill were provided by three sub-scales from the Problem Solving Inventory (Heppner, 1988): Problem Solving Confidence (CNFD), Approach-Avoidance (APAV), and Personal Control (CTRL). The latent variable Career Decision Making was measured by the sub-scales from the Career Decision Scale (Osipow, Carney, Winer, Yanico & Koschier, 1976): the Certainty Scale (CRTY) and the Indecision Scale (INDC).
In the model presented in Figure 1, the constructs represented by circles constitute the latent variables. These latent variables were measured by the indicator variables represented by rectangles. The relationships among the latent variables are represented by directional arrows (which are labeled $\lambda$, $\beta$, and $\gamma$ in the path diagram). The pathways represent hypothesized causal relations among the independent latent variables on the dependent latent variables. In addition, the structural component of the model also contains errors in the equations (which are labeled $\zeta$, $\delta$, and $\varepsilon$ in the path diagram). These error terms result from predicting latent variables from other variables. The error terms are essentially residuals that can be either random or the result of systematic influences not accounted for in the model.

**Hypotheses**

The model presented suggests the following hypotheses:

a.) -educational and occupational aspects of the mother causally and directly affect cognitive complexity

b.) -educational and occupational aspects of the father causally and directly affect cognitive complexity and career decision making.

c.) -cognitive complexity causally and directly affects problem solving skill and career decision making.

d.) -problem solving skill causally and directly affects career decision making.

**Description of the Participants**

A group of 199 undergraduate students were recruited through the procedures prescribed by the Ohio State University Psychology Department for use of the introductory psychology course respondent group. The data analysis was performed on the basis of information gathered from 152 participants; missing data caused 47 respondents to be
eliminated. Data describing the total sample, the data analysis group, and the group
eliminated because of missing data are included in the results chapter.

The volunteers solicited from the population of students enrolled in the introductory
psychology course at The Ohio State University during Spring and Summer of 1989 made
up the sample of respondents in this study. These students chose to either participate as a
research respondent or to submit a term paper as partial fulfillment of the requirements for
the course. Both male and female students were recruited. The research topic and a brief
description of the procedure were posted with the time and place of the data collection
sessions. Students volunteered to participate by signing their name for an available
appointment time listed on the poster.

Those taking introductory psychology are predominantly first and second year
undergraduate students. Because psychology is a required course for a wide range of
academic majors, and also meets a basic education requirement in social science for most
degree programs, the students enrolled in the course were considered to be generally
representative of the student body at The Ohio State University. However, the respondents
were not selected through random sampling procedures, and therefore, the sample cannot
be viewed as representative of all students enrolled in introductory psychology, nor as a
random sample of all students at The Ohio State University. While the lack of random
selection of participants places some limits on the ability to generalize from the findings to
all college student, the salience of career decision making during the early years of
undergraduate education was assumed to provide strong grounds for choosing this
population for the research.

Description of the Variables and Instruments

This research project was developed to examine the relationship among several
variables viewed as having an effect on occupational choice. Constructs assessed for this
study were: (a.) cognitive complexity, (b.) high school G.P.A., (c.) college G.P.A.,
(d.) college class rank, (e.) three aspects of problem solving skill, (f.) two aspects of
career decision, (g.) level of comfort with current career choice, (h.) strength of
commitment to current career choice, (i.) mother's achieved education level, (j.) general
educational development expected for mother's occupation, (k.) specific vocational
preparation expected for mother's occupation, (l.) father's achieved education level,
(m.) general educational development expected for father's occupation, and (n.) specific
vocational preparation expected for father's occupation. These constructs, used to assess
the latent variables in this research project, are described in the following section of this
chapter.

Descriptive Information - Personal Data Sheet Items: Sex, Age, Race, High School
G.P.A., College G.P.A., College Class Rank, Comfort with Current Career Choice,
Strength of Commitment to Current Career Choice, Mother's Achieved Education level,
Mother's Occupation, Father's Achieved Education Level, Father's Occupation. The
Personal Data [PD] sheet was developed for this study to gather information describing
specific characteristics of each respondent. This information was used to describe the
sample. Also several items from this sheet were used as measured variables for the latent
variables in the structural equation model. Information about the following attributes were
included on the Personal Data sheet: sex, age, and race; high school G.P.A. and college
G.P.A.; college class rank; college major and intended occupational choice; mother's
occupation, her achieved education level, father's occupation, his achieved education
level. (Appendix C).

Latent Variable - Mother. The measured variables chosen to indicate the latent
variable, Mother, for the structural equation model were: mother's achieved education level
(EDM), mother's general educational development (GEM) needed for her stated
occupation, and mother's specific vocational preparation (SVM) needed for performing her
current occupation. Respondents noted mother's occupation and education on the Personal Data sheet. The general educational development needed for the mother's occupation and the specific vocational preparation needed for the indicated occupation were derived from the information provided in the *Dictionary of Holland Occupational Codes* (Gottfredson, Holland, & Ogawa, 1982). The title of the mother's occupation, as provided by the respondent on the PD sheet, was used to obtain the Holland Code, as well as the measure of general educational development (values from 1-6) and specific vocational preparation (values from 1-9) listed as necessary for each occupation listed in the Holland Code dictionary.

**Latent Variable - Father.** The measured variables chosen to indicate the latent variable, Father, in the structural equation model were: father's achieved education level (EDF), the general educational development (GEF) required for performance of the stated occupation, and the specific vocational preparation (SVF) necessary in his current occupation. Information about the father's occupation and education were obtained by means of the Personal Data sheet. The father's general educational development and the specific vocational preparation needed in the occupation named were derived from information provided in the *Dictionary of Holland Occupational Codes* (Gottfredson, Holland, & Ogawa, 1982). This dictionary provides the Holland Code, in addition to a measure of general educational development (values from 1-6) and a measure of specific vocational preparation (values from 1-9) for each occupation listed in the *Dictionary of Occupational Titles* (1977) provided by the U.S. Department of Labor.

**Latent Variable - Cognitive Complexity.** Four measured variables were chosen to assess cognitive complexity. Three items listed on the Personal Data sheet, high school G.P.A. (HSG), college G.P.A. (GPA) and college class rank (RNK) were utilized as measures of cognitive complexity. In addition, the Total Protocol Rating (TPR) from the *Measure of Epistemological Reflection* [MER] (Baxter Baxter Magolda & Porterfield,
1984; Appendix D) was also chosen as a measure of the latent variable cognitive complexity used in this study.

Complex cognitive structures have been defined as the ability to integrate comparison rules, to relate and compare different systems of interacting variables, and for generating complex relationships (Schroder, Driver, & Streufert, 1967; p.22). Cognitively complex individuals are also said to have highly developed abilities to integrate and differentiate among stimuli presented (Bodden & Klein, 1973; Cochran, 1983). These definitions of cognitive complexity closely fit the expectations faculty and administrators in post-secondary education have for graduates of their programs. The results of an increasing ability to integrate, differentiate, use integrated comparison rules, and generate complex relationships would result in high academic achievement and increased cognitive development. While there is an admitted bias for those who seek a college education in this definition of cognitive complexity, this investigation is designed to examine the career decision making of college students. Therefore, the operational definition of cognitive complexity used in the study includes the academic measures of high school grade point average, college grade point average, and college class rank. In addition, the Total Protocol Rating from the Measure of Epistemological Reflection is included as a component of the operational definition, because a high correlation between the TPR and the mental operations described in the definition of cognitive complexity would be expected.

The MER was developed "as a method of assessing development on the Perry [1970] scheme"...(Taylor & Porterfield, 1983, p. i). (See the review of literature chapter for a Baxter Magolda's detailed description of the Perry scheme.) A theoretically important aspect of the instrument lies in the requirement of a production response, rather than a recognition response. The concurrent development of a rating manual offers another significant benefit over previous attempts to measure intellectual development.
The MER requires respondents to produce narrative responses to several questions related to each of six domains considered to be important in assessing cognitive level. The domains include: (1.) decision making, (2.) the learning process, (3.) the role of the instructor, (4.) the role of peers in gaining knowledge, (5.) the relationship of evaluation to gaining knowledge, and (6.) the nature of truth or knowledge. One page is devoted to each domain. Assessment of each domain begins with a question that sets the focus for the respondent's thinking about the topic. Following the topic question, three or four specific probe questions elicit the respondent's justification for her/his thinking within the domain (Baxter Magolda, 1987). The unit of analysis used for scoring is the respondent's reasoning structure or the explanation of her/his thoughts, not the content of the response.

Reasoning structure includes:
(a.) reasons for preferences chosen or ideas expressed
(b.) evidence/support/opinions provided for or against a preference chosen or ideas expressed.

The content of responses for each question provides clues to Perry position and can be utilized as starting points in position assessment. However, the reasoning structure must serve as the sole basis for final assignment to a position. (Taylor & Porterfield, 1984, p. ii).

**MER Scoring.** Scores derived from the MER are coded in terms of categories that correspond to Perry's model of intellectual development. However, while Perry's model includes nine positions, the MER assesses only five positions. Baxter Magolda and Porterfield (1983) hold that the Perry positions of intellectual development, beyond level five are to be included under the category of relativism. The justification for this is based on a belief that no changes to cognitive structures occur as the individual develops to higher levels of reasoning. Categories are scored as: Dualistic, Positions One and Two; Transitional, Positions Three and Four; and Relativistic, Position Five.

A respondent is viewed as holding only one overall position within a domain, although the respondent may be at one intellectual level on one domain and at different level
of intellectual development in another domain. Each domain was rated individually and scored 1, 2, 3, 4, or 5. Individual Total Protocol Rating (TPR) was developed as a mathematical mean of the six individual domain scores. The pages of each individual protocol were separated and then grouped by domain prior to rating. Raters then scored the responses one domain at a time. The scoring process required by the authors of the MER was chosen to circumvent problems of bias that may arise if a rater scored the complete instrument from one individual. By scoring each domain separately, the rater avoids any tendency for the rating of one domain to affect the rating of another domain within the same individual protocol. In addition, the MER authors require each protocol to be rated by two certified raters. Individual MER scores utilized in the data analysis for the current report were derived from the mathematical mean of the TPR values provided by each of the two raters.

**MER Rater Certification.** In addition to providing an assessment tool for rating intellectual development, the authors of the MER also provide a method for learning the rating procedures independently. A rating manual provides justifications for the reasoning structures and examples of the qualitative differences across the levels of intellectual development for each domain considered. The Rater Certification Program for the MER was developed to be completed through use of a self-instruction rating manual and the meeting certification criteria for a standard set of protocols. The entire process can be accomplished without the need for expensive on site training with the authors. After learning the process and practicing with sample protocols, completed certification materials are mailed to an author of the instrument. Those raters reaching .80 correlation with expert raters for the sample of completed protocols receive certification credentials. In this investigation, each participant's MER responses were rated by two certified raters.

**MER Validity.** Construct validity data for the *Measure of Epistemological Reflection* have been based primarily on the educational level of respondents. Means for
the original sample of college students "revealed increased complexity (higher Perry score) with each level of education" (Baxter Magolda & Porterfield, 1985, p. 347). In addition, the range of mean scores across domains, within each class rank, was narrow. Findings revealed: Freshmen, 2.06 to 2.62; Seniors, 3.00 to 3.43; Grad Students Under 30, 2.95 to 3.93; and Grad Students Over 30, 3.23 to 4.08 (Baxter Magolda & Porterfield, 1985). Four studies of college students revealed significant differences on the basis of educational level at the .0001 statistical level. Nevertheless, it is also true that three similar studies revealed no significant differences on the basis of educational level (Personal Communication; Baxter Magolda, October, 1988). However, a study comparing ratings from structured interviews designed to assess intellectual development, and the ratings from MER protocols revealed a very high correlation, $r = .93, p < .0001$ (Personal Communication; Baxter Magolda, 1988).

Concurrent validity of the MER was assessed by comparison with the Measure of Intellectual Development [MID] (Moore, 1982). The Pearson product-moment correlations for the MER and the MID were unexpectedly extremely low, $r = .11$ and $r = .04$, for two samples. However, the MID revealed very little variance across level of education; these MID means did not increase with level of education as expected. Also, the analysis of variance for MID scores indicated no significant differences by level of education (Baxter Magolda & Porterfield, 1985). Based upon these findings, the MER was interpreted to be a more effective indicator of intellectual development in terms of the Perry model than the MID (Baxter Magolda & Porterfield, 1985).

**MER Reliability.** Reliability estimates of the MER have been established in terms of internal consistency and in terms of inter-rater reliability. Cronbach's alpha coefficient for the original validation study sample ($N = 155$) indicated a moderately high degree of internal consistency at $r = .76$ (Baxter Magolda & Porterfield, 1985). Inter-rater
reliability on cross-sectional samples \((N = 752)\) was revealed to be \(r = .80\) (Baxter Magolda, 1987).

**Latent Variable - Problem Solving Skill.** Three items were utilized as measured variables which indicated the latent variable, Problem Solving Skill. The three subscale scores from The Problem Solving Inventory [PSI] (Heppner & Petersen, 1982) were the items employed. The indicator variables for Problem Solving Skill were Problem-Solving Confidence (CNFD), Approach-Avoidance Style (APAV), Personal Control (CTRL).

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The Problem Solving Inventory [PSI] was used to provide the measures of the respondent's self-appraised problem solving skill (Heppner & Petersen, 1982). This inventory was developed "to assess an individual's perception of his or her own problem-solving behaviors and attitudes" (Heppner, 1988, p. 1). The PSI Manual defines problem solving, after Anderson's (1980) definition, as "any goal-directed sequence of cognitive operations employed for the purpose of adapting to internal/external demands or challenges" (Heppner, 1988. p. 1). Heppner and Petersen (1982) designed the PSI to reflect an individual's awareness and evaluation of personal problem solving skills. Problem solving refers here to personal problems, such as dealing with depression, inability to get along with friends, choosing a vocation, or deciding whether or not to seek a divorce (Heppner, 1988). The PSI is offered in contrast to measures utilized in laboratory research designed to assess problem solving of formal problems (Heppner & Petersen, 1982), such as anagrams, arithmetic problems, and the prisoner's dilemma. "The PSI has been used primarily as a research tool in the investigation of the relationship between problem-solving appraisal and a range of cognitive, affective, and behavioral variables related to coping" (Heppner, 1988).
**PSI Scoring.** The PSI is a 35-item instrument in which respondents rate the items on a six-point Likert scale from Strongly Agree (1) to Strongly Disagree (6). The results of a factor analysis revealed three scales (Heppner & Petersen, 1982). The scales and the number of items in each are: (a.) Problem-Solving Confidence (CNFD), 11 items; (b.) Approach-Avoidance Style (APAV), 16 items; (c.) Personal Control (CTRL), 5 items. Three items are described as research items and are omitted from the scoring. A Total PSI score, based on 32 items, provides a single, general index of problem solving self-appraisal. A low score on the PSI indicates a positive self-appraisal of problem-solving ability. Mean Total PSI scores for males \((N = 402)\) and females \((N = 498)\) are 87.9 and 88.3 respectively, with standard deviations of 18.6 and 18.9 (Heppner, 1988). However, in the present study, scores were transformed for a more substantively meaningful result from the statistical analysis. In this research, higher PSI scores were used to indicate a positive self-appraisal of problem solving ability.

**PSI Validity.** The PSI Manual provides data on concurrent, discriminant and construct validity. Concurrent validity was based on correlations of student's scores from the three separate scales, CNFD, APAV, CTRL, the Total PSI score, and their level of satisfaction with their skill, as rated on a nine point Likert scale. These correlations were found to be statistically significant at the .0001 level (Heppner & Petersen, 1982).

Discriminant validity data is offered in relationship to measures of intelligence and social desirability. Scale scores and Total score for the PSI were not significantly correlated to Verbal, Quantitative, and Total scores on a scholastic achievement test, the SCAT, (Heppner & Petersen, 1982), nor to WAIS-R scores (DeClue, 1983). Although, the PSI Manual also reports that Neal (1983) found a statistically significant \((p < .0001)\), though moderate, correlation \((r = -.28)\) between the PSI scores and SAT Total, Verbal, and Math scores (Heppner, 1988). Heppner (1988) offers these results as evidence that the PSI is not simply another form of an intelligence test. The PSI Manual also provides
evidence that PSI scale and Total scores were not mere measures of social desirability. Except for the Personal Control scale \((r = -.24, p < .05)\), PSI scores did not correlate with scores on the Crowne and Marlowe (1964) Social Desirability Scale (Heppner, 1988).

Heppner (1988) reports construct validity data in the PSI Manual in terms of comparisons between the PSI and the Rotter Internal-External Locus of Control Scale (Rotter, 1978), the Unusual Uses Activity Scale, Form A, Cardboard Boxes (Torrance, 1966), the Myers-Briggs Type Indicator [MBTI] (Myers & McCaully, 1985) and the first three stories of the Means-Ends Problem-Solving Procedure [MEPS] (Platt & Spivack, 1975). Reported correlations between all PSI scores and the Rotter I-E Scale (1978) were statistically significant. The Personal Control scale was reported to be moderately correlated with Fluency \((r = -.27)\) and Flexibility \((r = -.34)\) from the Unusual Uses Activity Scale \((p > .02\) for both scales). The PSI Manual also reports no statistically significant correlations between PSI scores and MBTI scores, except for the significant relationship between PSI Personal Control scale and MBTI Thinking-Feeling scale \((r = .25, p < .05)\). Unexpectedly, correlations between the MEPS and the PSI were not statistically significant \((p's > .05)\). Heppner (1988) interprets these data as suggesting that the two measures purporting to measure problem solving, the PSI and the MEPS, are measuring different aspects of the personal problem solving process. Appraisal of one's skills for personal problem solving in life and measurement of one's ability to conceptualize the means for solving a hypothetical problem presented in a laboratory are viewed as different skills. Based on these reports, problem solving skill is viewed as having a low relationship to a measure of creativity, and to be relatively unrelated to personality type as measured by the MBTI. And while the PSI does seem to be related to an internal locus of control, the PSI offers more than a measure of locus of control, in that PSI scores correlated more highly with a self-rating of problem solving skill than did the Rotter I-E
Scale. The preceding information about the estimates of validity of the Problem Solving Inventory was obtained from Heppner's (1988) PSI Manual.

PSI Reliability. The PSI Manual offers reliability estimates in terms of internal consistency and test-retest reliability. Cronbach alpha coefficients from three samples indicates a high degree of internal consistency. The coefficients range from $r = .73$ to $r = .90$ for the three PSI scales, and from $r = .90$ to $r = .91$ for the PSI Total score. Data from three samples also offer estimates of test-retest reliability. The testing occasions were separated by two weeks, three weeks, and two years. The resultant coefficients range from $r = .44$ to $r = .88$ for the three PSI scales, and from $r = .60$ to $r = .89$ for the PSI Total score (Heppner, 1988). The lowest scores indicate data from the sample tested at the two year interval. Estimates of the reliability of the PSI are relatively high.

Latent Variable - Career Decision Making. Four measures were chose as indicator variables for the latent variable career decision making in the structural equation model. Two indicators were obtained by means of two six point Likert scale items on the Personal Data sheet. Comfort with Current Career Choice (CFT) and Commitment to Current Career Choice (CMT) were assessed by the participant's response to one item for each measure. The two subscales from the Career Decision Scale (Osipow, Carney, Winer, Yanico & Koschier, 1976) provided the remaining indicators of career decision making. These subscales are the Certainty Scale (CRTY) and the Indecision Scale (INDC). (The copyrighted Career Decision Scale can be obtained from the publisher, Psychological Assessment Resources, Odessa, Florida.)

The Career Decision Scale [CDS] (Osipow, et al.; 1976) was used to provide an estimate of career indecision. Although originally designed for use in educational and vocational counseling, investigators frequently choose the CDS as an instrument to assess career decision making in research projects. The usefulness of the CDS for both counseling and research seems to be in keeping with the stated intent of the developers of
the scale. The CDS Manual offers that "The scale is intended as a rapid reliable instrument for surveying high school and college students about their status in the career decision-making process" (Osipow, 1987, p. 4).

**CDS Scoring.** The scale consists of eighteen items describing various aspects of educational and vocational decisions. Responses to these items are recorded on a four point Likert scale; scale anchors are: Exactly Like Me (4), and Not At All Like Me (1). The nineteenth item, an open ended statement, presents space for an idiosyncratic description of the respondent's decision making, if not sufficiently described by other responses. Scores are recorded for two scales, a Certainty Scale (2 items) and an Indecision Scale (16 items). Raw scores are recorded, as are percentile ranks obtained from tables presented in the CDS Manual. Percentile rank data for college students and high school students are available by grade level and sex. The manual also presents percentile rank data for adults in continuing education, and non-traditional, in terms of age, female college students.

High percentile scores (85th percentile or greater) on the Certainty Scale indicate certainty in career choice and academic major. Scores on the Certainty Scale at the 15th percentile or less are considered to indicate a significant level of uncertainty about selecting a career and (or) a major. High Indecision Scale percentile scores (85th percentile or greater) indicate a serious level of indecision regarding a choice of career and (or) academic major. Conversely, Indecision Scale scores at the 15th percentile indicate little indecision in selecting a career and (or) a major. The CDS Manual reports mean scores for college students by sex as: Male Indecision Scale, 26.83; Female Indecision Scale, 26.88; Male Certainty Scale, 6.19; Female Certainty Scale, 5.87. Reported mean scores by college class are: Freshman Indecision Scale, 28.38; Sophomore Indecision Scale, 28.75; Junior Indecision Scale, 25.90; Senior Indecision Scale, 25.14; and Freshman Certainty Scale, 6.48; Sophomore Certainty Scale, 5.84; Junior Certainty Scale, 6.37; Senior Certainty
Scale, 6.28; The inverse relationship between the two scales scoring are said to yield
several patterns which indicate a need for further assessment and intervention in counseling
situations.

It was necessary for the current analysis that all scales offer information in a
mathematically similar format. Therefore, the items from the Indecision scale were scored
in a reverse direction. In the current research, this transformation yielded information
about the participants in a manner which allowed the numerical values for all the data to be
in a substantively similar direction for application of the structural equation modeling
procedure.

CDS Validity. The Career Decision Scale Manual reports the results of a large
number of studies said to offer validity data in terms of comparison with other instruments
measuring indecision, treatment outcome, relationship to other personality variables, and
relationship to descriptive variables (Osipow, 1987, p. 8). In addition, results of a factor
analysis are included in the manual.

Comparison of the CDS with other instruments measuring indecision. The CDS
Indecision scores correlated significantly with Assessment of Career Decision Making
scores in the expected direction ($r = -.265, p < .004$). The manual also reports Slaney's
(1980) findings that CDS scores differentiated respondents who had a "first" choice career
from those who had a "first" choice and some alternative careers. The CDS was also found
to differentiate those who had made choices from those who had no "first" choice. The
CDS Manual also reports the work of several researchers from two different studies in
comparing the CDS to Crites' Career Maturity Inventory [CMI]. Westbrook, Simonson,
and Arcia (1978) concluded that the Attitude Scale of the CMI and the CDS have more in
common with each other than they do with other instruments. Lange (1980) also reported a
significant relationship between the CDS and the CMI.
Treatment outcome and the CDS. The *Career Decision Scale* has often been utilized as a measure to assess career intervention outcome. Data from a series of studies reported by Osipow, Carney, and Barak (1976) showed that the CDS was sensitive to changes in individuals who received various treatment interventions intended to reduce career indecision. Interventions such as residential career exploration (Taylor 1979), residential career planning (Sutera, 1977), and career exploration courses (Carney, 1977a, 1977b) also provided evidence that the CDS was able to measure changes in the level of career indecision in college students, based on pre- and post-test scores. The CDS manual also lists nineteen additional references which found the CDS effective in indicating change in career decision after treatment (Osipow, 1987).

Relationship of the CDS to other personality variables. In terms of personality variables, the levels of career indecision as measured by the CDS differentiated groups as a function of locus of control (Cellini, 1978; Jones, 1979), and as a function of locus of control and fear of success (Taylor, 1979).

Relationship of the CDS to descriptive variables. Inconsistencies have been reported in studies examining the relationship of descriptive variables and CDS scores. Older students were found to have greater levels of decidedness in two studies (Niece & Bradley, 1979; Osipow, 1978). Yet others found no significant differences on the basis of age of respondents (Hartman, 1980; Limburg, 1980). Using sex as a variable, males have been found to have lower levels of indecision than females in two investigations (Gordon & Osipow 1976a; Westbrook, Cutts, Madison, & Arcia, 1980), while one study revealed lower levels of indecision in females (Taylor, 1979a), and others found no sex differences (Cellini, 1978; Limburg, 1980; Niece & Bradley, 1979; Osipow, Carney, & Barak 1976; Sutera, 1977). The CDS Manual reports the results of normative data samples as evidence of the declining indecision scores by sex, age, and grade level for high school students at a
significant level. However, while scores declined for the college student sample, nonsignificant differences were revealed.

Structural Aspects of the CDS. In an attempt to examine structural aspects of the construct of career decision, a factor analysis of Indecision Scale items was performed (Osipow, Carney, & Barak 1976). Four factors were identified: (a.) Lack of Structure, (b.) external barriers to preferred choice, (c.) approach-approach problems, (d.) personal conflict in decision making. Lack of consistency in additional factor analysis studies have been found leading the author to suggest caution in using factor scores (Osipow, 1987).

CDS Reliability. Test-retest correlations from two studies are cited as evidence of reliability. Retest correlations of .90 and .82 were found for the Indecision Scale in two separate samples of college students (Osipow, Carney, and Barak; 1976). In this study, item correlations ranged from .34 to .82, with most of the correlations between .60 and .80. Other researchers assessed test-retest reliability for the Certainty and Indecision Scales over a six week period (Slaney, Palko-Nonemaker, & Alexander, 1981). Findings from this research showed item correlations between .19 and .70, and .70 correlation for the total CDS scores.

Data Collection Procedures

Instruments were administered to the undergraduate student volunteers from the introductory psychology class in data collection sessions which included from seven to twenty respondents. Each individual provided data during a single session lasting up to two hours. The researcher remained present to answer any questions that arose during the completion of the instruments.

An instrument packet and a pen was presented to each respondent. The packet included a (1.) a printed Information Sheet [IS] describing important aspects of the investigation; (2.) a coded Consent Form [CF]; (3.) a Personal Data Sheet [PDS] sheet
for collecting descriptive information; (4.) the Measure of Epistemological Reflection [MER] (Baxter Magolda & Porterfield, 1984); (5.) the Problem Solving Inventory [PSI] (Heppner & Petersen, 1982); and (6.) the Career Decision Scale [CDS] (Osipow, Carney, Winer, Yanico & Koschier, 1976).

At the beginning of each data collection session, the volunteers were given information regarding the importance and the purpose of the study. Procedures used to protect the participants' confidentiality were also described, as well as the participant's right to withdraw consent at any time. Participants were asked to sign a coded consent form indicating voluntary participation in the study. These consent forms, attached to the instrument packets, were removed prior to data analysis, thus preserving anonymity of the participants in all analyses. No deception was involved, therefore no formal debriefing was considered necessary.

Participants were instructed to read and completely fill out each of the instruments. The time needed to complete the instruments varied from 45 minutes to one hour and 45 minutes. Most students completed the data collection instruments in one hour and 15 minutes. The coded Consent Form and the Information Sheet were attached to the outside of the packet, and later removed. The other items were presented in the order stated previously. Since it was believed that, fatigue resulting from the length of the MER could cause respondents to use less care on that instrument, it was presented early in the sequence. In the interest of offering less demanding instruments later in the session, the potential problem of response bias was deemed of lesser importance in this project. The decision not to use a random order sequence for the presentation of the instruments could have effected the results, especially if fatigue caused participants to use less care in responding to the Likert scaled item used in the last instrument.
Data Analysis Procedures

This study was performed to gather information about the relationships among parental educational and occupational measures, cognitive complexity, problem solving skill, and career decision making. Structural Equation Modeling was the method of statistical analysis chosen to examine these relationships. In order to carry out the analysis, a theoretical model of the relationships among the latent and measured variables involved in career decision making was defined as depicted in Figure 1. Based on the model, a series of equations were generated, and from these equations, parameter matrices were developed for both the latent and the measurement models. Table 1 presents the structural equations from which the matrices were developed. (The matrices are available from the author.)

LISREL VI Analysis. Sophisticated computer software designed to handle the complex procedures of iterative matrix algebra was needed to compare the covariance structure of the measurement model to the proposed causal model. The LISREL VI computer program by Jöreskog and Sörbom (1984) was utilized for the statistical analysis. The covariance structure of the model provided by the maximum likelihood procedure was compared to the observed covariance matrix from the sample data to determine "goodness of fit" according to indices provided by the LISREL VI computer program. In order to apply the LISREL VI program, it was necessary to specify the model first through developing matrices for the latent variables, for the variables measuring the endogenous latent variables, and for the variables measuring the exogenous latent variables. Based on these matrices, formatting commands were specified in accordance with the rules determined by the LISREL VI authors (Jöreskog and Sörbom, 1984).

Following the LISREL VI application, and after an examination of the modification indices provided, modifications to the structural and/or measurement components of the model were made in an attempt to improve "fit". Only where such modifications were
Table 1

Structural and Measurement Equations for Model of Cognitive Complexity, Problem Solving and Career Decision Making

<table>
<thead>
<tr>
<th>Equation</th>
</tr>
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<tbody>
<tr>
<td><strong>Structural</strong></td>
</tr>
<tr>
<td>1. CGC = γ₁(M₀) + γ₂(FA) + ζ₃</td>
</tr>
<tr>
<td>2. PSS = β₂₁(CGC) + ζ₂</td>
</tr>
<tr>
<td>3. CDM = β₃₁(CGC) + β₃₂(PSS) + γ₃₂(FA) + ζ₁</td>
</tr>
<tr>
<td><strong>Measurement</strong></td>
</tr>
<tr>
<td>X₁ = λ₁(EDM) + δ₁</td>
</tr>
<tr>
<td>X₂ = λ₂(GEM) + δ₂</td>
</tr>
<tr>
<td>X₃ = λ₃(SVM) + δ₃</td>
</tr>
<tr>
<td>X₄ = λ₄(EDF) + δ₄</td>
</tr>
<tr>
<td>X₅ = λ₅(GEF) + δ₅</td>
</tr>
<tr>
<td>X₆ = λ₆(SVF) + δ₆</td>
</tr>
<tr>
<td>Y₁ = λ₇(RNK) + ε₁</td>
</tr>
<tr>
<td>Y₂ = λ₈(HSG) + ε₂</td>
</tr>
<tr>
<td>Y₃ = λ₉(GPA) + ε₃</td>
</tr>
<tr>
<td>Y₄ = λ₁₀(MER) + ε₄</td>
</tr>
<tr>
<td>Y₅ = λ₁₁(CNFD) + ε₅</td>
</tr>
<tr>
<td>Y₆ = λ₁₂(APAV) + ε₆</td>
</tr>
<tr>
<td>Y₇ = λ₁₃(CTRL) + ε₇</td>
</tr>
<tr>
<td>Y₈ = λ₁₄(CFT) + ε₈</td>
</tr>
<tr>
<td>Y₉ = λ₁₅(CMT) + ε₉</td>
</tr>
<tr>
<td>Y₁₀ = λ₁₆(CRTY) + ε₁₀</td>
</tr>
<tr>
<td>Y₁₁ = λ₁₇(INDC) + ε₁₁</td>
</tr>
</tbody>
</table>

CGC=cognitive complexity, PSS=problem solving skill, CDM=career decision making, EDM=mother's achieved level of education, GEM=general educational development expected for mother's occupation, SVM=specific vocational preparation expected for mother's occupation, EDF=father's achieved level of education, GEF=general educational development expected for father's occupation, SVF=specific vocational preparation expected for father's occupation, RNK=college class rank, HSG=high school G.P.A., GPA=college G.P.A., MER=total protocol rating (Measure of Epistemological Reflection), CNFD=confidence, APAV=approach-avoidance, CTRL=personal control, CFT=level of comfort w/ career choice, CMT=strength of commitment to career choice, CRTY=certainty, INDC=Indecision.
theoretically justified and substantively meaningful were paths added or removed. As is expected with the LISREL VI techniques, several modifications of the model were necessary; however, only the final model is contained in this report. After each application of the LISREL VI procedure, successive changes were made until the maximum fit was achieved, maximum to the extent possible without compromising the theoretical or substantive integrity.

**MER Rating Reliability.** Scores for the *Measure of Epistemological Reflection* were provided by two raters hired by the investigator. They were selected from a list of certified raters provided by one of the authors of the MER. These judges had recently earned certification through the rater training program developed by Baxter Magolda and Porterfield (1982). Scores obtained from the two raters were compared in terms of both interrater agreement and interrater reliability. For these tests of reliability, scores were rounded in order to assess modal position agreement that each judge assigned to each participant. The most stringent test of reliability represents the degree to which the two raters assigned the same rating to a particular respondent. Measures of interrater agreement included:

a.) -percentage of exact agreement on individual domain scores;
b.) -percentage of exact agreement on Total Protocol Ratings;
c.) -chi-square tests of significance to determine the level of exact agreement beyond chance for each domain (Lawlis & Lu, 1972; as recommended by the authors of the MER);
d.) -T value calculated to indicate the strength of agreement.

Reliability of the ratings provided by the judges in terms of the degree to which the two sets of scores were similar were also assessed. Measures of interrater reliability included:

a.) -Pearson product moment correlation for Total Protocol Ratings;
b.) -standard intraclass correlation with between judges variance included as error (Tinsley & Weiss, 1975; as recommended by the authors of the MER);
c.) -intraclass correlation with adjustment for anchor point differences when there is more than one judge (Winer, 1971). Reliability results were derived from statistical information provided by SAS and SPSS-X computer programs.

Descriptive Statistics. Finally, descriptive information about the sample was obtained by means of SAS statistical package. Data are presented describing the total sample, the group whose data was analyzed, and the respondent group eliminated due to missing information. In addition to the descriptive information, t-test and chi-square tests for independence of two groups were performed in order to determine the presence of significant differences between the data analysis group and the elimination group that occurred. These results are also included in the report.
CHAPTER IV
RESULTS

This chapter presents a report of the results from the test of a causal model of career decision making, by means of the structural equation modeling procedure. The results presented are based on data gathered from 152 undergraduate students enrolled in an introductory psychology class at the Ohio State University during Spring and Summer of 1989. Data were collected from a sample of 199 students. However, information critical to the structural equation model was missing from data supplied by 47 of the respondents, and thereby necessitated elimination of their data from the analysis. Therefore, descriptive information is provided for each of the two sub-samples, as well as the total sample. Data are also offered to compare the group of respondents included in the analysis to the group of respondents eliminated. Tables included present means and standard deviations, for interval measures, and modes, frequencies, and percentages, for nominal measures for each of the measures used as an indicator variable.

Also included in this chapter are findings related to the reliability of the ratings obtained by means of the Measure of Epistemological Reflection (MER). The MER was employed as one of the measurement variables for the latent variable, cognitive complexity. The MER authors require the judgment of two trained raters for each protocol. The use of two raters necessitated assessing the reliability of these two sets of scores. The inclusion of reliability data offers a view of the consistency with which the raters judged the participants' written MER responses.
The findings reported from this test of the model were generated by complex statistical manipulations performed by the computer program LISREL VI developed by Jöreskog and Sörbom (1984). The primary purpose for using the program was to assess the fit between a proposed model of the causal relationships among the variables and the specific data gathered from a population sample. The results are offered in this chapter of a statistical test of the causal model for the relationships among the variables Mother, Father, Cognitive Complexity, Problem Solving Skill, and Career Decision Making.

Description of the Sample

Data was collected from 199 respondents. This sample consisted of 101 males (50.8%) and 98 females (49.2%). The average age of the total sample was 21.01 years. 152 undergraduate students, 77 men (50.7%) and 75 women (49.3%) were included in the analysis of the structural equation model, using the LISREL VI statistical package (Jöreskog and Sörbom, 1984); the average age of these participants was 20.40 years. A sub-sample of 47 students was eliminated from the LISREL VI analysis as a result of omitting one or more items required for the analysis. This group included 24 males (51.1%) and 23 females (48.9%), whose average age was 23.02. Both groups were overwhelmingly Caucasian, 93.8 percent of the data analysis group and 90.9 percent of the eliminated group. Students in their first year of college were also overrepresented in the two groups: data analysis group, 52 percent; eliminated group, 75 percent. All data from one individual was omitted; this respondent decided during the data collection session to withdraw from the study. Descriptive data gathered from the respondent group is presented in Table 2.

A comparison between the data analysis group and the group of respondents eliminated from the analysis was performed using the t-test and chi-squares test for independent groups. Chi-square procedures were applied to nominal measures, and these
### Table 2

Descriptive Information for Respondents

<table>
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<tr>
<th>Variable</th>
<th>Data Analysis Group</th>
<th>Eliminated Group</th>
<th>Total Sample</th>
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</thead>
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<td>199</td>
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<tr>
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<td>Frequency</td>
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<td>11.4</td>
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<td>9.7</td>
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results are reported in Tables 3, 4, 5, and 6. Table 3 presents frequency data and levels of significance for the variables used to describe respondents, while Tables 4 and 5 gives parental educational and occupational information along with the significance levels. These chi-square tests revealed no significant difference between the groups on the basis of sex, race, EDM, GEM, GEF, or SVF. However, the groups were found to differ significantly with regard to college class rank, SVM, and EDF. Interval variable means were subject to t-tests in order to compare the data analysis group to the eliminated group of respondents. Table 6 lists the means, standard deviations, and the level of significance reached for each of these variables. No significant differences were found between the groups in terms of GPA, MER TPR, CNFD, APAV, CRTL, OR INDC. On the other hand, p-values reached significance for the variables, Age, HSG, CFT, CMT, and CRTY.

Reliability of the Measure of Epistemological Reflection Ratings

The results for both interrater agreement and interrater reliability were obtained for the ratings from Measure of Epistemological Reflection [MER] for the total sample, N = 199.

Interrater Agreement. The use of exact agreement is the most stringent form of interrater agreement when assessing the reliability of two judges. Based on the MER scores provided by each judge, the percentage of exact agreement was determined for the rating from each domain, and for Total Protocol Rating [TPR]. A SAS program generated this information, a cross tabulation of Rater 1 by Rater 2. Cross-tab tables were obtained for each of the six domains and for the TPR. Exact agreement for the domains ranged from 54% to 76%. The TPR data were analyzed after rounding, so that calculations were based on the percentage agreement for the modal overall position of each respondent. The MER was developed to determine the modal level of the cognitive structures used by the respondent. Exact agreement for the TPR was found to be 66%.
Table 3

Results of Chi-Square Tests for Independent Groups: Participant Descriptors
Comparison Between the Data Analysis Group and the Eliminated Group

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Eliminated Group</th>
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<th>p</th>
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<td>Sex</td>
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<td>Females</td>
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<tr>
<td>Race</td>
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<tr>
<td>Caucasian</td>
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<tr>
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<tr>
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Table 4

Results of Chi-Square Tests for Independent Groups: Maternal Descriptors
Comparison Between the Data Analysis Group and the Eliminated Group

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<tr>
<td>Master's degree</td>
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<tr>
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</tr>
<tr>
<td>Mother's General Educational Development</td>
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<td></td>
<td></td>
</tr>
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<td>0</td>
<td>4</td>
<td>ns</td>
</tr>
<tr>
<td>High school</td>
<td>43</td>
<td>11</td>
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<td></td>
</tr>
<tr>
<td>HS or some college</td>
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</tr>
<tr>
<td>College level thinking</td>
<td>58</td>
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<tr>
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<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 6 months, up to 1 year</td>
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<td>4</td>
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</tr>
<tr>
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<td>6</td>
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<tr>
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</tr>
<tr>
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Table 5
Results of Chi-Square Tests for Independent Groups: Paternal Descriptors
Comparison Between the Data Analysis Group and the Eliminated Group

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Table 6

Results of t-test for Independent Groups: Participant Descriptors
Comparison Between the Data Analysis Group and the Eliminated Group

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<td>Comfort w/Decision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.64</td>
<td>3.81</td>
<td>.0002</td>
</tr>
<tr>
<td>SD</td>
<td>1.24</td>
<td>1.53</td>
<td></td>
</tr>
<tr>
<td>Commitment to Decision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.78</td>
<td>4.02</td>
<td>.0035</td>
</tr>
<tr>
<td>SD</td>
<td>1.22</td>
<td>1.57</td>
<td></td>
</tr>
<tr>
<td>Certainty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>6.43</td>
<td>5.43</td>
<td>.0016</td>
</tr>
<tr>
<td>SD</td>
<td>1.54</td>
<td>1.92</td>
<td></td>
</tr>
<tr>
<td>Indecision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>52.20</td>
<td>49.74</td>
<td>ns</td>
</tr>
<tr>
<td>SD</td>
<td>9.24</td>
<td>9.38</td>
<td></td>
</tr>
</tbody>
</table>

No missing data for MER TPR, Problem Solving Confidence, Approach-Avoidance, Personal Control, Comfort w/Decision, Commitment to Decision, Certainty, or Indecision.
Results of a chi-square to determine the level of exact agreement beyond chance for each domain and for the TPR were obtained in the manner suggested by Lawlis and Lu (1972):

\[ x^2 = \frac{(N_1 - Np - .5)^2}{Np} + \frac{[N_2 - N(1-p) - .5]^2}{N(1-p)} \]

where 
- \( N \) = the number of individuals being rated 
- \( N_1 \) = the number of observed agreements 
- \( N_2 \) = the number of observed disagreements 
- \( k \) = the number of judges 
- \( n \) = the number of points on the scale 
- \( p \) = the probability of \( k \) judges achieving agreement on an individual by chance, or equal to the number of possible agreements divided by the number of possible combinations of \( k \) ratings \( (p = \frac{n}{n^k}) \)

Using this formula, chi-square values for the domains ranged from 124.26 to 386.27, while the for the TPR, it was 265.26. The results for all chi-square values revealed exact agreement to be significantly greater than chance, \( df = 1, N = 199, p < .001 \). The interrater exact agreement data obtained can be seen in Table 7.

Utilizing the same definition for \( N, N_1, \) and \( p \) as in the previous formula, the indicator of the strength of agreement for each domain ratings and for the TPR was calculated thus:

\[ T = \frac{N_1 - Np}{N - Np} \]

(Tinsley & Weiss, 1975). \( T \) values for the MER domains were found to range from .40 to .70, and for the TPR \( T = .58 \). Table 7 presents the values of \( T \) obtained for each domain and for TPR. If the observed agreement were equal to chance, \( T \) value would be 0. On the
Table 7

Exact Agreement by Domain and Total Protocol Ratings Between Two Raters for the Total Sample

<table>
<thead>
<tr>
<th>Domain</th>
<th>% Agreement</th>
<th>$\chi^2$</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>54%</td>
<td>144.80</td>
<td>.43</td>
</tr>
<tr>
<td>Two</td>
<td>67%</td>
<td>284.28</td>
<td>.60</td>
</tr>
<tr>
<td>Three</td>
<td>74%</td>
<td>365.66</td>
<td>.68</td>
</tr>
<tr>
<td>Four</td>
<td>76%</td>
<td>386.27</td>
<td>.70</td>
</tr>
<tr>
<td>Five</td>
<td>67%</td>
<td>271.06</td>
<td>.59</td>
</tr>
<tr>
<td>Six</td>
<td>52%</td>
<td>124.26</td>
<td>.40</td>
</tr>
<tr>
<td>TPR</td>
<td>66%</td>
<td>256.56</td>
<td>.58</td>
</tr>
</tbody>
</table>

For all chi-square values, $df=1$, $N = 199$, $p < .001$

Table 8

Analysis of Variance Used to Assess Interrater Reliability Between Two Raters of the Measure of Epistemological Reflection

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>ss</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between People</td>
<td>40.5065</td>
<td>198</td>
<td>.2046</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within People</td>
<td>13.0256</td>
<td>199</td>
<td>.0655</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Measures</td>
<td>5.5503</td>
<td>1</td>
<td>5.5503</td>
<td>147.0098</td>
<td>.0000</td>
</tr>
<tr>
<td>Residual</td>
<td>7.4753</td>
<td>198</td>
<td>.0378</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonadditivity</td>
<td>1.14411</td>
<td>1</td>
<td>1.1441</td>
<td>35.4908</td>
<td>.0000</td>
</tr>
<tr>
<td>Balance</td>
<td>6.3342</td>
<td>197</td>
<td>.0322</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>53.5321</td>
<td>397</td>
<td>.1348</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Grand Mean = 2.6380

Alpha = .8155 Standardized Item Alpha = .8357
other hand, were interrater agreement perfect, T value would be 1. Therefore, T values obtained indicate moderate strength on exact agreement.

**Interrater Reliability.** Reliability of the ratings provided by the judges, in terms of the degree to which the two sets of scores were, similar were also assessed. This is a means of expressing the degree to which the one individual being rated is similar to other rated individuals, even though the absolute numbers used to express the relationship differ among the judges. Several measures of interrater reliability were obtained.

Using the SAS statistical package, a Pearson product moment correlation of the Total Protocol Ratings was found to be \( r = .72, p > .0001 \). Based on the mean square values from a two-way ANOVA table, generated by the SPSS-X statistical package, measures of intraclass correlation were derived. Table 8 offers this ANOVA data. Assuming that the mean difference in the ratings of the judges should be regarded as rater error, a formula that includes between judges variance as error would be most appropriate. The formula given in Tinsley and Weiss (1975) for this value of R (where \( k \) is the number of judges) is:

\[
R = \frac{M_{S_B} - M_{S_W}}{M_{S_B} + M_{S_W} (k - 1)}
\]

Using this formula, \( R = .51, (F(199,198) = 147.01, p < .001) \). This method was utilized by the authors of the MER to assess reliability during the development of the instrument (Baxter Magolda & Porterfield, 1988). However, for this investigation, MER position assigned to participants was the result of a mean of the Scores obtained by the two judges. Therefore, the use of method suggested by Winer (1971) provides a more effective means for for calculating interrater reliability in this investigation. Winer suggests a procedure which offers an adjustment for the differences in the anchor points used by judges. This unbiased estimate is given to be:
(4) \[ \hat{\theta} = \frac{\text{MS}_B - m^\prime \text{MS}_{res}}{k m^\prime \text{MS}_{res}} \]

(5) where \[ m^\prime = \frac{(n - 1)(k - 1)}{(n - 1)(k - 1) - 2} \]

(Here \( n \) equals the number of cases or individuals and \( k \) equals the number of judges.)

This formula takes into consideration the differences in each judge's anchor point in assigning scores by subtracting the grand mean for all judges from the sample mean of each individual judge. Thus the mean square of the residuals is more appropriate than the mean square within people in determining reliability. In considering an adjustment for anchor point differences between judges, an \( R = .81, (F(198,197) = 35.49, p < .001) \), was obtained. This obtained value of \( R \) indicates a moderately high level of interrater reliability. This value also lies closer to Cronbach's alpha measure of internal consistency which was found to be .82, as given by the SPSS-X statistical package analysis.

**Measure of Epistemological Reflection** Total Protocol Rating (TPR) means and standard deviations for the two judges were obtained also. These statistics for the total sample \((N = 199)\) were, Judge 1, \( \bar{X} = 2.76; \) SD = .39; and Judge 2, \( \bar{X} = 2.52; \) SD = .29. Means for the LISREL VI sample \((N = 152)\) were, Judge 1, \( \bar{X} = 2.76; \) SD = .40; and Judge 2, \( \bar{X} = 2.52; \) SD = .29. Results for the sub-sample eliminated due to missing date \((N = 47)\) were, Judge 1, \( \bar{X} = 2.73; \) SD = .37; and Judge 2, \( \bar{X} = 2.46; \) SD = .31.

**Indicator Variables**

Three or four measurement variables were chosen as indicator variables for each of the latent variables. Results for these indicator variables, grouped by the latent variable they were chosen to measure, are presented in Tables 9, 10, 11, 12 and 13. Included in these tables are group means and standard deviations for each of the interval data indicator.
Table 9
Descriptive Data for Measured Variables of Latent Variable Mother

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data Analysis Group</th>
<th>Eliminated Group</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieved Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>47</td>
<td>199</td>
</tr>
<tr>
<td>Mode</td>
<td>HS</td>
<td>HS</td>
<td>HS</td>
</tr>
<tr>
<td>Frequency</td>
<td>44</td>
<td>22</td>
<td>66</td>
</tr>
<tr>
<td>Percent</td>
<td>28.9%</td>
<td>46.8%</td>
<td>33.2%</td>
</tr>
<tr>
<td>Max</td>
<td>MS</td>
<td>MS</td>
<td>MS</td>
</tr>
<tr>
<td>Min</td>
<td>Grade School</td>
<td>Grade School</td>
<td>Grade School</td>
</tr>
<tr>
<td>General Educational Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>34</td>
<td>186</td>
</tr>
<tr>
<td>Mode</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Percent</td>
<td>38.2</td>
<td>38.2</td>
<td>36.6</td>
</tr>
<tr>
<td>Max</td>
<td>6</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Min</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Specific Vocational Preparation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>34</td>
<td>186</td>
</tr>
<tr>
<td>Mode</td>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Percent</td>
<td>40.1%</td>
<td>41.2%</td>
<td>39.8%</td>
</tr>
<tr>
<td>Max</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Min</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

No missing data points for these scores from any respondent.
Table 10
Descriptive Data for Measured Variables of Latent Variable Father

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data Analysis Group</th>
<th>Eliminated Group</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Achieved Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>46</td>
<td>198</td>
</tr>
<tr>
<td>Mode</td>
<td>BS</td>
<td>HS/HS/BS</td>
<td></td>
</tr>
<tr>
<td>Percent</td>
<td>26.3%</td>
<td>43.5%</td>
<td>25.3%</td>
</tr>
<tr>
<td>Max</td>
<td>PhD</td>
<td>PhD</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td>Grade School</td>
<td>Grade School</td>
<td>Grade School</td>
</tr>
<tr>
<td><strong>General Educational Development</strong></td>
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<tr>
<td>N</td>
<td>152</td>
<td>26</td>
<td>178</td>
</tr>
<tr>
<td>Mode</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Percent</td>
<td>44.7%</td>
<td>42.3%</td>
<td>43.5%</td>
</tr>
<tr>
<td>Max</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Min</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Specific Vocational Preparation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>26</td>
<td>178</td>
</tr>
<tr>
<td>Mode</td>
<td>7</td>
<td>8</td>
<td>7/8</td>
</tr>
<tr>
<td>Percent</td>
<td>38.8%</td>
<td>38.5%</td>
<td>37.6%</td>
</tr>
<tr>
<td>Max</td>
<td>9</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Min</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

No missing data points for these scores from any respondent.
Table 11
Descriptive Data for Measured Variables of Latent Variable Cognitive Complexity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data Analysis Group</th>
<th>Eliminated Group</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rank</strong></td>
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<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>44</td>
<td>196</td>
</tr>
<tr>
<td>Mode</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Frequency</td>
<td>79</td>
<td>33</td>
<td>112</td>
</tr>
<tr>
<td>Percent</td>
<td>52%</td>
<td>75</td>
<td>93.8%</td>
</tr>
<tr>
<td>Max</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Min</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Missing Data</td>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>High School GPA</strong></td>
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<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>36</td>
<td>188</td>
</tr>
<tr>
<td>Mean</td>
<td>3.22</td>
<td>2.96</td>
<td>3.17</td>
</tr>
<tr>
<td>SD</td>
<td>.53</td>
<td>6.13</td>
<td>.55</td>
</tr>
<tr>
<td>Max</td>
<td>4.8</td>
<td>4.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Min</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Missing Data</td>
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<td>11</td>
</tr>
<tr>
<td><strong>College GPA</strong></td>
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</tr>
<tr>
<td>N</td>
<td>152</td>
<td>34</td>
<td>186</td>
</tr>
<tr>
<td>Mean</td>
<td>2.78</td>
<td>2.71</td>
<td>2.77</td>
</tr>
<tr>
<td>SD</td>
<td>.57</td>
<td>.61</td>
<td>.58</td>
</tr>
<tr>
<td>Max</td>
<td>4.0</td>
<td>3.9</td>
<td>4.0</td>
</tr>
<tr>
<td>Min</td>
<td>1.3</td>
<td>1.0</td>
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</tr>
<tr>
<td>Missing Data</td>
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<td>13</td>
<td>13</td>
</tr>
<tr>
<td><strong>MER TPR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>47</td>
<td>199</td>
</tr>
<tr>
<td>Mean</td>
<td>2.65</td>
<td>2.60</td>
<td>2.64</td>
</tr>
<tr>
<td>SD</td>
<td>.33</td>
<td>.31</td>
<td>.30</td>
</tr>
<tr>
<td>Max</td>
<td>3.92</td>
<td>3.42</td>
<td>3.92</td>
</tr>
<tr>
<td>Min</td>
<td>1.92</td>
<td>2.0</td>
<td>1.92</td>
</tr>
<tr>
<td>Missing Data</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 12
Descriptive Data for Measured Variables of Latent Variable Problem Solving Skill

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data Analysis Group</th>
<th>Eliminated Group</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem Solving Confidence†</td>
<td>152</td>
<td>47</td>
<td>199</td>
</tr>
<tr>
<td>Mean</td>
<td>25.66</td>
<td>25.21</td>
<td>25.56</td>
</tr>
<tr>
<td>SD</td>
<td>7.62</td>
<td>7.41</td>
<td>7.55</td>
</tr>
<tr>
<td>Max</td>
<td>49</td>
<td>40</td>
<td>49</td>
</tr>
<tr>
<td>Min</td>
<td>11</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Approach-Avoidance†</td>
<td>N</td>
<td>152</td>
<td>47</td>
</tr>
<tr>
<td>Mean</td>
<td>42.89</td>
<td>42.53</td>
<td>42.80</td>
</tr>
<tr>
<td>SD</td>
<td>11.37</td>
<td>11.07</td>
<td>11.27</td>
</tr>
<tr>
<td>Max</td>
<td>71</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Min</td>
<td>16</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Personal Control†</td>
<td>N</td>
<td>152</td>
<td>47</td>
</tr>
<tr>
<td>Mean</td>
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<td>17.98</td>
<td>18.19</td>
</tr>
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<td>SD</td>
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<td>4.87</td>
</tr>
<tr>
<td>Max</td>
<td>29</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Min</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

† Scores for this item were mathematically reversed for the analysis.
No missing data points for these scores from any respondent.
Table 13

Descriptive Data for Measured Variables of Latent Variable Career Decision Making

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data Analysis Group</th>
<th>Eliminated Group</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfort w/Decision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>47</td>
<td>199</td>
</tr>
<tr>
<td>Mean</td>
<td>4.64</td>
<td>3.81</td>
<td>4.45</td>
</tr>
<tr>
<td>SD</td>
<td>1.24</td>
<td>1.53</td>
<td>1.36</td>
</tr>
<tr>
<td>Max</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Min</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Commitment to Decision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>152</td>
<td>47</td>
<td>199</td>
</tr>
<tr>
<td>Mean</td>
<td>4.78</td>
<td>4.02</td>
<td>4.60</td>
</tr>
<tr>
<td>SD</td>
<td>1.22</td>
<td>1.57</td>
<td>1.35</td>
</tr>
<tr>
<td>Max</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
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<td>1</td>
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<tr>
<td>N</td>
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<td>47</td>
<td>199</td>
</tr>
<tr>
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<tr>
<td>Indecision†</td>
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<tr>
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<td>49.74</td>
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<tr>
<td>Min</td>
<td>24</td>
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</table>

No missing data points for these scores from any respondent.

† Scores for this item were mathematically reversed for the analysis.
variables, as well as modal, frequency and percentage data for nominal indicator variables. Data are listed in these tables for the group used in the LISREL VI analysis, the group eliminated due to missing information, and for the total respondent group.

**Structural Equation Model**

**Description of the Model.** The model, as depicted in the methodology chapter, presents the path diagram used to test the data gathered. The model suggests that the two exogenous independent variables, Mother (MO) and Father (FA), effect the endogenous dependent variable, Cognitive Complexity (CGC). The model represents the endogenous dependent variables effect on each other by means of directional arrows. As shown, Cognitive Complexity (CGC) effects Problem Solving Skill (PSS) and Career Decision Making (CDM). Problem Solving Skill (PSS) is also represented as having an effect on Decision Making (CDM). The model shows that Career Decision Making was also thought to be directly effected by Father variable.

Included in the model are the indicator variables which were used to measure the latent variables. The latent variable Mother was measured by mother's achieved education level (EDM), mother's general educational development (GEM) needed for her stated occupation, and mother's specific vocational preparation (SVM) needed for performing her current occupation. Measures for the latent variable Father were, his achieved education level (EDM), the general educational development (GEM) needed for his stated occupation, and the specific vocational preparation (SVM) needed for performing his current occupation. The latent variable Cognitive Complexity was measured by three items taken from the Personal Data sheet, high school G.P.A. (HSG), college G.P.A. (GPA) and college class rank (RNK) and by the Total Protocol Rating (TPR) from the *Measure of Epistemological Reflection* [MER] (Baxter Magolda & Porterfield, 1984). Measures of the latent variable Problem Solving Skill were provided by three sub-scales from the *Problem
Solving Inventory (Heppner, 1988): Problem Solving Confidence (CNFD), Approach-Avoidance (APAV), and Personal Control (CTRL). The latent variable Career Decision Making was measured by the sub-scales from the Career Decision Scale (Osipow, Carney, Winer, Yanico & Koschier, 1976): the Certainty Scale (CRTY) and the Indecision Scale (INDC).

Equations representing the structural and the measurement relationships were written in order to define the structural equation model for statistical analysis. Table 1 presents the equations representing the model under investigation. (Figure 1 and Table 1 are presented in the methodology chapter.) These equations form the basis for developing the parameter matrices utilized to define the model for the LISREL VI computer program. LISREL VI utilizes complex iterative matrix algebra to analyze the proposed model.

In order to obtain a LISREL VI analysis, a correlation matrix for all the measured variables must be generated and this information must be included as part of the formatting statements. The correlation matrix for the measurement variables can be found in Table 14. Table 15 provides the formatting statements used to describe the model in LISREL VI program language. The LISREL VI analysis results in a lengthy printout of data for interpretation. Parameter estimates were derived for each pathway in the model and for the error terms. Measures were also derived which indicate the goodness of fit information between the sample data and the proposed model. In addition, the computer printout offers indicators for improving the fit by adding and eliminating pathways in the model. Figure 2 represents the model and the resultant LISREL VI (Jöreskog & Sörbom, 1984) parameter estimates for each path. The figure also gives the error terms and the path values which designate the ability of the indicator variable to measure the latent variable, based on the value assigned for the LISREL VI analysis.
Table 14
Correlation Matrix for Model of Career Decision Making

<table>
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<tr>
<th>Variable</th>
<th>ED</th>
<th>GEM</th>
<th>SVM</th>
<th>EDF</th>
<th>GEF</th>
<th>SVF</th>
<th>RNK</th>
<th>HSG</th>
<th>GPA</th>
<th>MER</th>
<th>CNFD</th>
<th>APAV</th>
<th>CTRL</th>
<th>CFT</th>
<th>CMT</th>
<th>CRTY</th>
<th>INDC</th>
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$N = 152$
Table 15
Formatting Statements for LISREL VI Analysis of the Structural Equation Model

**LISREL Control Cards**

**Data**  \(NI=17\)  \(NO=152\)  \(MA=KM\)

**KM**

[Correlation matrix for all of the measurement variables is to be inserted after the KM card. Values must be typed in the order given by the matrix, beginning with the cell \(y_i\) on \(y_j\). There is no need to maintain the shape of the matrix, as long as the value 1 is included as an indicator of the end of one row in the matrix.]

**ME**

[*]

[Values for each mean for each measurement variable is inserted here, maintaining the order in which the variables are listed in the LABELS statement, \(x\) variables first]

**SD**

[*]

[Values for each standard deviation for each measurement variable is inserted here, maintaining the order in which the variables are listed in the LABELS statement, \(x\) variables first]

**LABELS**

[*]

'EDM' 'GEM' 'SVM' 'EDF' 'GEF' 'SVF' 'RNK' 'HSG' 'GPA' 'MER' 'CNFD' 'APAV' 'CTRL' 'CFT' 'CMT' 'CRTY' 'INCD'

**SE**

7 8 9 10 11 12 13 14 15 16 17 1 2 3 4 5 6

**MODEL**  \(NY=11\)  \(NX=6\)  \(NE=3\)  \(NK=2\)  \(LX=FU,FI\)  \(LY=FU,FI\)  \(BE=FU,FI\)

Ga=FU,FI  TD=DI,FR  TE=DI,FR  PH=DI,FR  PS=DI,FR  C

FI  TD  (5,5)

**VA 1**

LX (1,1)  LX (4,2)  LY (2,1)  LY (5,2)  LY (8,3)

**FREE**

LY (1,1)  LY (3,1)  LY (4,1)  LY (6,2)  LY (7,2)  C

LY (9,3)  LY (10,3)  LY (11,3)

**FREE**

LX (2,1)  LX (3,1)  LX (5,2)  LX (6,2)

**FREE**

BE (2,1)  BE (3,1)  BE (3,2)

**OUTPUT MR TV MI ML SE SS**
CGC=cognitive complexity, PSS=problem solving skill, CDM=career decision making, EDM=mother's achieved level of education, GEM=general educational development expected for mother's occupation, SVM=specific vocational preparation expected for mother's occupation, EDF=father's achieved level of education, GEF=general educational development expected for father's occupation, SVF=specific vocational preparation expected for father's occupation, RNK=college class rank, HSG=high school G.P.A., GPA=college G.P.A., MER=total protocol rating (Measure of Epistemological Reflection), CNFD=confidence, APAV=approach-avoidance, CTRL=personal control, CFT=level of comfort w/ career choice, CMT=strength of commitment to career choice, CRTY=certainty, INDC=Indecision.

Figure 2

Parameter Estimates for Proposed Causal Model of Career Decision Making
Interpretation of Path Weights for Hypothesized Relationships. Based on the b, and g weights obtained from the LISREL VI analysis, the model results indicate a poor fit with the data gathered from the population sample. The results suggest that the variables Mother and Father have no effect on Cognitive Complexity, the value of both gamma weights was 0.000. Nor was the Father variable found influence Career Decision Making, again, a gamma weight of 0.000. The parameter estimates also show that Cognitive Complexity had little influence on either Problem Solving (beta weight of -.196) or on Career Decision Making (beta weight of .068). Finally, Problem Solving Skill was revealed to offer a mild influence on Career Decision Making, the beta weight for this pathway reaching -.329. Respondents with more effective self-appraised problem solving skills exhibited lowered career decision making scores. Based on these results, none of the hypothesized effects were supported. The findings provided by the LISREL VI computer program yielded results indicating a need for additional study in the specification of a model for career decision making in college students.

Goodness of Fit Data. The chi-square statistic confirms this need. This statistic provides the probability level for "obtaining a $\chi^2$ value larger than the value actually obtained given the model is correct" (Jöreskog and Sörbom, 1984; pg. I.38). The chi-square value for this model was found to be significant ($\chi^2 = 192.38$, $df = 177$, $p < .0001$). These significant results indicate acceptance of the null hypothesis, and suggests that the model is not a good fit with the population from which the sample was drawn. In contrast to the most commonly desired outcome for chi-square results, the preferred outcome from the LISREL VI program would be a nonsignificant value for this statistic. Thus, signifying that there is no difference between the proposed model and the data obtained from the sample. Therefore, when the chi-square reaches significance, the null hypothesis, that the model is plausible in the population, must be rejected. Only in instances where the probability exceeds the usual $p < .05$ does the result indicate failure to
reject the null hypothesis (Hayduk, 1988) and thus, to allow interpretation of the model as plausible for the population from which the sample was drawn. The results must be viewed as evidence that "...the differences between the model-implied covariance matrix $S$ and the observed $S$ are small enough to be sampling fluctuation." ..."Note that smaller $\chi^2$ values indicate better fitting models, and that an insignificant $\chi^2$ is desirable,...". (Hayduk, 1988, italics in original text)

Other indicators were also revealed to be less than desired in order to have confidence in the model. The Goodness of Fit Index (GFI) is one such statistic. GFI is defined as the "relative amount of variances and covariances jointly accounted for by the model" (Jöreskog and Sörbom, 1984; pg. 1.41). The Goodness of Fit Index was found to be .874, which is slightly below the .90 recommended as a cutoff for acceptance (Fassinger, 1987). A GFI value closer to 1.0 would allow greater confidence in the specified model. In contrast, the adjusted GFI was .836, which is above the .80 recommended for acceptance (Anderson & Gerbing, 1984). The final indicator of the overall fit between the model and the data is the root mean square of the residuals. "This is a measure of the average of the residual variances and covariances" (Jöreskog and Sörbom, 1984; pg. 1.41). The root mean square (RMS) of the residuals was .096. A RMS value of zero indicates a perfect fit between a proposed model and sample data used to test it. Based on the weak results from this test, the proposed model cannot be considered to be a reliable view of the phenomenon. However, rejection of the null hypothesis of no fit also results in rejection of the alternate hypothesis. Yet there is no test of the the alternate view. So, although the evidence is weak, the model remains potentially plausible and warrants further examination. Goodness of fit data are presented in Table 16.

Modification Indices. The LISREL VI output offers modification indices which indicate those pathways which could be added to the model for an improved goodness of fit index. A modification index value of 9 or greater suggests such a change (Fassinger,
Table 16

Goodness-of-Fit Measures for Model of Cognitive Complexity, Problems Solving Skill and Career Decision Making

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$</td>
<td>192.38*</td>
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<tr>
<td>Degrees of freedom</td>
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</tr>
<tr>
<td>Goodness of Fit Index†</td>
<td>.874</td>
</tr>
<tr>
<td>Root mean square residual††</td>
<td>.096</td>
</tr>
<tr>
<td>Squared Multiple Correlations†</td>
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</tr>
<tr>
<td>RNK</td>
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<tr>
<td>HSG</td>
<td>.612</td>
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<tr>
<td>GPA</td>
<td>.308</td>
</tr>
<tr>
<td>MER</td>
<td>.096</td>
</tr>
<tr>
<td>CNFD</td>
<td>.612</td>
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<td>APAV</td>
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<td>CTRL</td>
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<td>CFT</td>
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<td>Equation 2</td>
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<td>Equation 3</td>
<td>.284</td>
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<tr>
<td>Coefficient of determination†Y</td>
<td>.991</td>
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<tr>
<td>X Equations</td>
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</table>

† values of at least .9 and closer to 1.0 indicate good fit. †† values close to 0.0 indicate best fit.
1987). Two such indices remained in the model presented; however, the justification for omitting these pathways was based on substantive grounds. The data suggests that the indicator INDC may offer a measure for PSS, and that the indicator EDF may measure MO. The model may have been improved by adding the pathway from INDC to PSS, for career indecision could possibly be a measure of problem solving skill; however, adding this path would violate the hypothesized relationships. The suggestion that father's achieved education could be a measure of the variable mother was not tenable. While it may be that education level of a man could correlate with the education of his partner, it would not be substantively correct to use father's education as a measurement for the latent variable Mother. Table 17 presents pathways and obtained values for modification indices greater than 9.0.

In addition to presenting indices for adding pathways which might improve the model, LISREL VI also provides indices that suggest pathways which, if removed, would contribute to an increased chi-square value. These $t$ values should be less than 2.0 to be considered nonsignificant (Fassinger, 1987; Jöreskog and Sörbom, 1984). Pathways that are considered to be nonsignificant may not be necessary in the model. The pathways and $t$ values for these less reliable aspects of the model can be found in Table 17.

**Squared Multiple Correlations.** Squared multiple correlations (SMC) for the measured variables indicate the proportion of variance accounted for by the latent variable for each of these indicator variables. Low SMC values suggest that the indicator variables may offer an inadequate measure of the latent variable (Fassinger, 1987). The SMC values for two of the dependent measurement variables suggest a reasonably good indication of the construct CDM has been revealed (SMC values for CDM indicators: .622-.830), and that the construct PSS has also been adequately measured (SMC values for PSS indicators: .428-.612). However, two of the measurement variables utilized as indicators of the dependent variable CGC were revealed to be rather weak, suggesting
### Table 17

**Indicators of Problems of Fit in the Model of Cognitive Complexity, Problems Solving Skill and Career Decision Making**

<table>
<thead>
<tr>
<th>Measure Pathway</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Modification indices &gt; 9.0*</td>
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<tr>
<td>INDC/PSS</td>
<td>10.47</td>
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<tr>
<td>EDF/MO</td>
<td>10.92</td>
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<tr>
<td>t values &lt; 2.0**</td>
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</tr>
<tr>
<td>RNK/CGC</td>
<td>1.72</td>
</tr>
<tr>
<td>PSS/CGC</td>
<td>-1.532</td>
</tr>
</tbody>
</table>

* Values greater than 9 indicate pathways to be added to the model.
** Values less than 2 indicate pathways that may be omitted from the model.

### Table 18

**Indicators of Weak Relationships Among Measurement Variables for Model of Cognitive Complexity, Problems Solving Skill and Career Decision Making**

<table>
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<tr>
<th>Pathway</th>
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<tr>
<td>RNK/MER</td>
<td>2.235</td>
</tr>
<tr>
<td>MER/SVM</td>
<td>2.077</td>
</tr>
<tr>
<td>CNFD/GEF</td>
<td>2.357</td>
</tr>
<tr>
<td>CNFD/SVF</td>
<td>2.589</td>
</tr>
<tr>
<td>EDM/EDF</td>
<td>6.159</td>
</tr>
<tr>
<td>EDM/GEF</td>
<td>3.972</td>
</tr>
<tr>
<td>EDM/SVF</td>
<td>2.257</td>
</tr>
<tr>
<td>GEM/EDF</td>
<td>3.158</td>
</tr>
<tr>
<td>GEM/GEF</td>
<td>2.788</td>
</tr>
<tr>
<td>GEM/SVF</td>
<td>2.257</td>
</tr>
<tr>
<td>SVM/EDF</td>
<td>3.797</td>
</tr>
</tbody>
</table>

Values over 2 indicate relationships NOT well fitted in the model.
difficulty in the measurement of cognitive complexity (SMC values for CGC indicators: RNK = .002, MER = .096, with GPA = .308, and HSG = .612). Independent variables chosen as measures of MO and Fa were found to be respectable indicators of the constructs, in fact, GEM, the general educational development needed for father's occupation, was revealed to be a perfect measure of FA (SMC values for FA indicators: .576-1.00; SMC values for MO indicators: .479-.628). Squared multiple correlations derived for each equation, however, were revealed to indicate either no predictive value or only weak predictive value for the structural equations (SMC values for equations: 0.0-.306). Table 16 presents the SMC values for the independent and dependent indicator variables, and for the structural equations.

**Coefficients of Determination.** The coefficients of determination produced by LISREL VI can be interpreted as summaries of the squared multiple correlation data (Fassinger, 1987). The coefficients derived for the measured variables shows the strength of the relationship between the indicator and the latent variables. The program failed to produce a coefficient for the \( x \) variables in the model, suggesting that these variables taken together offer no indication of the latent variables. In contrast, the coefficient of determination for the \( y \) variables was found to be .991, which implies that the \( y \) indicator variables jointly provide rather effective measures for the associated latent variables. The coefficient for the structural equations jointly was found to be -0.00, denoting the relationship among the latent variables was not detected. This coefficient of determination of the equations is a generalized measure of the reliability for the whole measurement model (Jöreskog & Sörbom, 1984). The value obtained offers very disappointing information, for despite the indications of fit in some of the results, this value suggests much more work would be necessary to provide a causal model for the relationships among cognitive complexity, problem solving skill and career decision making. Coefficients of determination are presented in Table 16.
Normalized Residuals. Normalized residuals are similar to significance tests for each residual variance. Each normalized residual in a cell crossing two variables that is greater than 2.0 indicate an ill fit between those variables (Fassinger, 1987; Jöreskog & Sörbom, 1984). Results show 11 relationships, of the 136 relationships in this investigation, to have values greater than 2.0. The poorest fit occurs between EDM and EDF, 6.159, indicating that the model does not account for the EDM/EDF relationship sufficiently well. Those values greater than 2.0 range from 6.159 to 2.077. All but one of the relationships indicating a poor fit contains at least one measure of an independent latent variable, MO or FA; seven of the eleven significant relationships from the normalized residual matrix indicate difficulty in fit between two of the measures for MO and FA. Table 18 offers a list of these relationships and the values over 2.0 obtained.
CHAPTER V
DISCUSSION

The present study served to examine the relationships among some of the factors thought to have an influence on the career decision making of college students. The investigation was designed to test a proposed model of the causal relationships among the independent variables Mother and Father, and the dependent variables Cognitive Complexity, Problem Solving Skill, and Career Decision Making. Moreover, this research provided a test of the model by means of the statistical technique, structural equation modeling. Employment of this technique was chosen to extend current knowledge about the relationships among Cognitive Complexity, Problem Solving Skill, and Career Decision Making.

This discussion of the results from the investigation opens by examining the comparability of the data analysis group to the group of respondents eliminated due to missing data. Following this, statements concerning the reliability of the scores from the Measure of Epistemological Reflection, one of the instruments utilized in the study, are offered. The requirement that MER ratings be obtain from two independent judges demands an examination of the reliability of these scores. Subsequent to these comments, results from the structural equation modeling procedure are presented. Throughout the discussion, issues surrounding the statistical techniques used, and implications of these results, in view of previous research, are given attention. Finally, the chapter concludes with a report on the limitations of the study, and a few remarks on recommendations for future research.
Comparison of the Respondent Groups.

The comparison of the respondent group utilized for the statistical analysis, to the respondent group eliminated from the analysis due to missing data, revealed that the groups were similar in many characteristics. No significant differences were revealed in terms of (a.) the percentage of males and females, (b.) race, (c.) college GPA, (d.) mother's achieved level of education, (e.) mother's general education level necessary to her occupation, (f.) father's general education level necessary to his occupation, nor (g.) father's specific vocational preparation. Neither were differences found in (h.) MER total protocol rating, (j.) problem solving confidence, (k.) approach-avoidance with regard to problem solving, (l.) sense of personal control over problems, or (m.) career indecision. However, differences between the two groups were discovered in terms of respondent (i.) age, and on several characteristics that were included in the analysis. The groups differed on (ii.) college class rank, (iii.) mother's specific vocational preparation, and (iv.) father's achieved level of education, (v.) high school GPA, (vi.) comfort with career decision, (vii.) commitment to career decision, and (viii.) certainty about career decision. These differences may be due to important variations in the two groups that had an effect on the outcome of the analysis; they may also be due to artifacts of the data collection procedures. These differences are examined more closely in following section.

The differences in average age of the two groups may be due to the relationship of age to variables critical to the analysis. The relationship of age to high school GPA, one of the variables determining inclusion or exclusion from the analysis, seems to be important. Assuming older respondents would be less likely to remember their high school grade point, and therefore more likely to be eliminated from the analysis, could account for the significant difference in the age of the two sub-samples. In fact, the average age of the respondents eliminated from the analysis due to missing high school grade point average (HSG) was 30.50, a post hoc analysis revealed the average age of those remaining in the
elimination group due omitting information other than HSG was 20.94. Given that the average age for the data analysis group was 20.40 years, there is less reason to believe the data analysis group and the eliminated groups differ systematically in other characteristics on the basis of age. While this differences in age between the data analysis group and the eliminated group may have had an effect on the data analysis, it is unclear what this effect might be. Age itself seems to have had less effect on exclusion from the data analysis, than the effect of age on the omission of HSG. And in fact when the two groups, data analysis respondents and eliminated respondents, are examined in terms of college grade point average (GPA), no apparent differences were found, so level of academic achievement is apparently not an issue. Further examination of the group eliminated because of a missing GPA, showed that the group was evenly divided among what might be viewed as older (28-40) and younger (18-20) sub-groups. Therefore it seems likely that the difference in age between the data analysis group and the eliminated group was due to data collection procedures, and the necessity of high school GPA for the data analysis.

The difference between the data analysis group and the eliminated group on the basis of college class rank (RNK) is not easily explained. The eliminated group gathered a greater number of rank 1 students than were captured in the data analysis group. However, due to the number of cells in the chi-square expectancy table reaching less than five respondents, these results may not be valid. Only three students were eliminated from the analysis on the basis of RNK. But the fact that a first quarter student, by definition has not yet earned a GPA, may have contributed to the higher number of rank 1 students in the eliminated groups. It might also be that first year students whose GPA was below a 2.0 were reluctant to report the item and thus be eliminated, whereas other lower achieving students have left the university before reaching the higher class ranks. Thirteen, of 47, students were eliminated for grade point omission, which may account for the difference in the two groups on the basis of rank. Otherwise, this difference between the groups on the
basis of RNK seems unclear. The effect of the presence of an overrepresentation of first year students in the test of the model cannot be assessed from the results obtained in this investigation.

Differences among the groups on the basis of parental educational and occupational variables also seems unclear. While a respondent was more likely to be eliminated for the omission of GEM, SVM, GEF, or SVF than for any other reason, there seems to be little logic to the fact that SVM and EDF were the only parental measurement variables found to show significant differences between the sub-sample groups. The occupational variables, general educational development and specific vocational preparation or training needed for the occupation, were based on the occupational titles participants wrote on the personal data sheet (PDS) for each parent. Some occupational titles listed offered too little specificity for coding by means of information included in the *Dictionary of Occupational Holland Codes* (Gottfredson, Holland, & Ogawa; 1982) and these respondents were eliminated due to missing data. In addition, mothers and fathers designated as deceased, retired (without any additional information), or unemployed, were also necessarily excluded from the test of the model due missing data. However, there seems to be no plausible explanation for the pattern of findings for these differences between the data analysis group and eliminated group on the basis of these parental educational and occupational variables. The fact that there were no differences between groups on the basis of achieved education for the mother, makes it difficult to explain the significant differences between the groups on the basis of achieved education for the father. Interestingly, there was no case of omission of either the maternal or the parental achieved education item, thus no respondent was eliminated for lack of this information. It is also puzzling that the groups differed on the basis of EDF, but not EDM, differed on SVM, but not SVF. This is especially baffling because the moderate correlations between these variables is the same for each parent when the values are rounded (EDM/SVM, \( r = .47733 \); EDF/SVF, \( r = .48008 \)). The data offer
no indication as to the meaning of the differences between the data analysis group and the eliminated group for these parental occupational indicators. Given the high number of cells in the chi-square expectancy table reaching less than five respondents each for these variables, the results may not be valid. Also, given the lack of a likely explanation for the statistical difference, the finding may be due to systematic errors in the data, rather than true differences in the sub-samples.

The differences between the respondent groups on the basis of comfort with career decision (CFT), commitment to career decision (CMT), and certainty about career decision (CRTY) may have an important impact on results obtained from the structural equation modeling procedure. The results of the t-test, for differences in the variances of these two independent groups, revealed that respondents who were eliminated had group mean values indicating less comfort with, less commitment to, and less certainty about their career decision, than the data analysis group. In contrast, the eliminated group proved to be similar to the data analysis group in terms of the MER-TPR, CNFD, APAV, CTRL, and INDC scores used in the analysis. It could be speculated that were a wider range of values for CFT, CMT, CRTY included in the structural equation model, results from this analysis would differ. A reasonable view might be that those respondents with less comfort, commitment, and certainty with regard to Career Decision Making might use less care in completing questionnaires related to career decisions. Perhaps, anxiety about the topic resulted in the omission of data critical to the analysis more frequently than those respondents more comfortable with, committed to, and certain about their career decisions.

Reliability of Measure of Epistemological Reflection Ratings.

The Measure of Epistemological Reflection (Baxter Magolda & Porterfield, 1988) was chosen as one of the indicator variables for the latent variable Cognitive Complexity. This instrument was devised to measure intellectual development in terms of a model
formulated by Perry (1970). (See the review of literature for a description of Perry's theory of intellectual development.) The MER requires respondents to produce a narrative discourse in response to probe questions, which are then rated by two certified judges. The authors of the MER produced a detailed manual offering information used to determine the respondent's modal intellectual position. Scores were derived for each of six individually rated domains, then a total protocol rating, based on the mean of the domain ratings, was used to assign each participant a modal position of intellectual development in terms of the Perry model.

Each judge employed in this investigation received training from one of the MER authors and had reached the specified level of interrater reliability necessary to become certified as a rater ($r = .80$, between judge and expert ratings, for a specified set of protocols). However, even with the use of specific instructions received during rater training and the availability of a rating manual, which provided examples and justifications for the reasoning structures, assessing the reliability of these subjective ratings was necessary to the investigation. The reliability of the findings obtained from the structural equation model were dependent on measured variables with a high level of generality, rather than scores reflecting idiosyncratic results from the subjective view of a rater.

Use of an instrument which requires judges to rate responses demands consideration of both the level of agreement, and the interrater reliability. Exact interrater agreement represents the degree to which individual raters make exactly the same judgment about the same respondent. Interrater reliability represents the degree to which the ratings by different judges are proportional, when expressed as deviations of their means. This relationship is often expressed in terms of correlational or analysis of variances indices (Tinsley & Weiss, 1975).

In cases of high interrater agreement and high interrater reliability, the means and standard deviations for each judge's ratings from a group of individuals being rated will be
very similar. In cases of low to moderate interrater agreement and high interrater reliability, the means for each judge may differ widely, however, their respective standard deviations will be very similar. This occurs when judges, who have few similar ratings for any individual, have proportionately ordered judgements. High interrater agreement and low to moderate interrater reliability results occur when ratings assigned to the individuals being judged are quite similar, yet because of a restricted range in the ratings, the reliability of the ratings is low. This restricted range occurs when the participants are highly similar in terms of the phenomenon being judged, when the score values have a restricted range, or when the judges use a rating scale improperly. However, when both the interrater agreement and the interrater reliability are moderate or low, the ratings must be considered to be of little or no value. In sum, high interrater reliability alone can not be viewed as an indicator of absolute agreement on the level of a characteristic being judged by the raters. Nor does low interrater reliability necessarily indicate a high level of disagreement among the raters. Both forms of interrater information offer the clearest view of the value of the judges ratings (Tinsley & Weiss, 1975).

The percentage of exact agreement between the two judges employed to rate the MER scores used in this investigation were found to be very similar to the percentages reported in previous studies utilizing this instrument (Baxter Magolda & Porterfield, 1988). The moderate levels of exact agreement indicate an acceptable level of interrater agreement. Interrater reliability results, utilizing the statistical method (Lawlis & Lu, 1972) favored by the authors of the MER were found to be somewhat lower than values obtained in previous studies (Baxter Magolda & Porterfield, 1988). However, based on the recommendation from a statistical consultant (Fred Ruland, personal communication, August 31, 1989), another method of assessing interrater reliability was applied. This method for obtaining a reliability coefficient takes into account differences in the anchor points used by the judges (Winer, 1971). Use of this method of determining interrater reliability was suggested.
based on a visual inspection of the scores, which seemed to indicate one judge rated respondents consistently higher than the other judge. The use of this method resulted in a level of interrater reliability similar to the values reported from other studies using the MER. These findings of moderate interrater exact agreement and relatively high interrater reliability indicate the MER ratings obtained in this study offer valid measures for the measurement of college student intellectual development used to test the model.

**Structural Equation Model.**

Application of the structural equation modeling technique to the proposed model yielded rather disappointing results regarding the causal relationships among the variables Mother (MO), Father (FA), Cognitive Complexity (CGC), Problem Solving (PSS), and Career Decision Making (CDM). These findings result from a data analysis by means of the computer statistical package, LISREL VI produced by Jöreskog and Sörbom (1984).

**Parameter Estimates.** Parameter estimates did reveal Problem Solving Skill had some influence on Career Decision Making. However, Cognitive Complexity was revealed to have almost no influence on either Problems Solving Skill or Career Decision Making. In addition, neither of the variables Mother or Father was found to influence Cognitive Complexity; nor was the Father variable found to have an influence on Career Decision Making. The data gathered in this investigation, appear to offer a mild, though puzzling, indication that effective problem solvers were less able to make career decisions. Findings also suggest that college students' level of Cognitive Complexity had little effect on either Problem Solving Skill or Career Decision Making.

It is difficult to offer an explanation for findings contrary to previous research reports for the relationships between problem solving skill and career decision (Heppner & Krieshok, 1983; Larson & Heppner, 1985; and Phillips, Pazienza, & Ferrin, 1984), between cognitive processes and problem solving skill (Heppner, Reeder, &
Larson, 1983), and between cognitive processes and career decision (Neimeyer, 1988; Nevill, Neimeyer, Probert, & Fukuyama, 1986). Possibly results would have matched the findings from previous reports on career decision making more closely, had the respondents from the eliminated group been included. This group was found to be less comfortable, less committed, and less certain about their career decision. Perhaps the outcome would have differed were a wider range of career decidedness included in the sample.

In addition, findings indicate the Mother (MO) and Father (FA) variables may have been unnecessary to the model, or possibly, were poorly measured, for no support was found for an influence by either parent on Cognitive Complexity, nor for influence by Father on Career Decision Making. These results cannot be explained given the strong influence the family is said to play in career decision making (Holland, 1962; Roe, 1956) and in cognitive development (Bayley & Schaefer, 1964; Brofenbrenner, 1972; Hess & Shipman, 1965; Kagan & Freeman, 1963). Despite the lack of support for the hypothesized causal relationships, the model cannot be viewed as fundamentally wrong on the basis of parameter estimates alone.

Issues in Interpretation of Parameter Estimates. The LISREL IV program provides several indicators useful in assessing the value of the model and its appropriateness in light of other aspects of the data analyzed. While the disappointingly low parameter estimates seem to suggest serious problems in the specification of the model, they cannot be interpreted as indicating a totally unsuitable model. It is not uncommon for structural equation modeling results even in published reports to indicate only weak causal effects among the variables of interest. The judgment of the fit between the model and the population sample data must also rest on standard errors, squared multiple correlations, coefficients of determination, and correlations of parameter estimates (Jöreskog & Sörbom, 1984).
Despite the weak values observed among the latent variables, some progress has been made in the attempt to offer an integrated view of the relationships among cognitive complexity, Problem Solving Skill and Career Decision Making. Results from the LISREL IV analysis of the data gathered in this study show none of the warning signs Jöreskog and Sörbom (1984) state to be indicators of an unsuitable model. They list the following as unreasonable values which indicate no faith in a proposed model: extremely high standard errors, negative squared multiple correlations, negative coefficients of determination, or correlations of parameter estimates that are larger than one in magnitude (p. 1.36). A correlation matrix which the LISREL IV program states to be "not positive definite" is also indicative of an unsuitable model. In such occurrences, warning statements are offered with the numerical results. No such warning statements were obtained in the data analysis presented in this report. Based on these facts, and given the exploratory nature of this investigation, other indicators of the model are worth examining.

Goodness of Fit. An assessment of the overall fit of the model to the data follows the evaluation of the results of the parameter estimates. The LISREL IV program provides three indicators for the goodness of fit between the proposed model and the data obtained from the population sample. The chi-square is the first of these measure of overall fit for the model. The chi-square result obtained in this study was not as desired, the result indicates the sample data does not provide a good fit with the proposed model. Unfortunately, the rejection of the null hypothesis also indicates rejection of the research hypothesis, which may not be necessary.

Chi-square values are often distorted by large sample sizes, which increase power, for a resultant increased probability of rejecting the null hypothesis (Fassinger, 1987). In addition, departures from a multivariate normal distribution of the observed variables also serve to increase the probability of a significant chi-square (Jöreskog & Sörbom, 1984). The chi-square test may not be valid in most cases when using the structural equation
modeling technique (Jöreskog & Sörbom, 1984). Instead of attending to significance levels, the empirical model might be more productively viewed as a tentative model, which approximates the real situation. When a significant chi-square value is obtained, the use of other indices may be examined to assess the fit of the model (Jöreskog & Sörbom, 1984).

The Goodness of Fit Index (GFI) is the second statistic for assessing the overall fit of the model with the data used to test it. While the value for the GFI in the current study was not found to reach the values frequently found in published articles (Cole & Milstead, 1989; Fassinger, 1985), it approached the critical value cited for interpreting the goodness of fit information generated by the LISREL IV program. The root mean square residual (RMS) is the third measure of overall fit. Again the results fail to meet the critical value for acceptance of a good fit. Thus, based on the findings for overall goodness of fit, the population sample appears to fail in matching the proposed the structural equation model.

Issues in Interpretation of Goodness of Fit. In contrast to other statistical techniques, goodness of fit findings for the structural equation modeling procedure cannot be interpreted stringently as suggesting failure of the model. Jöreskog and Sörbom offer the view that the indices of overall fit cannot be used to "express the quality of the model as judged by any other internal or external criteria" (1984, pg. I.41). Even in cases where the overall fit is found to be a good one, there can be relations within the model which were poorly determined; and in instances such as this investigation, measures indicating that the model fails to fit the data well do not indicate what is wrong within the model (Jöreskog and Sörbom, 1984).

LISREL IV generates squared multiple correlation and coefficient of determination values to express the relationships among the measured variables and the latent variables. Squared multiple correlation (SMC) indicates the strength of the relationship for each measured variable separately and for each structural equation separately. The coefficient of determination (CD/x, CD/y, CD/Equations) measures the strength of the measured
variables taken together and the structural equations observed jointly. An examination of
the strength of the relationships within the model could provide useful information.

**Squared Multiple Correlation.** The squared multiple correlations for the equations
indicate that little of the variance in Problem Solving Skill and only some of the variance in
Career Decision Making was accounted for by other latent variables in the model. Both
PSS and CDM were poorly predicted by the model. Also, based on the SMC value for
Equation 3, none of the variance in Cognitive Complexity could be explained by the other
latent variables in the model. Finding such low predictive power among the latent variables
is discouraging; however, even in published reports SMC values usually remain in the low
to moderate range. The use of structural equation modeling for exploratory research often
results in findings which suggest little more than the need for further investigation.

The low predictive value of Cognitive Complexity is surprising given the body of
knowledge on the relationship between Cognitive Complexity and Career Decision Making
using both the career grid methodology (Bodden, 1969; Harren, Kass, Tinsley, &
Moreland, 1979; Krieshok, Arnold, Kuperman, Schmitz, 1986; Neimeyer, 1988;
Neimeyer, Metzler, & Bowman, 1988; Nevill, Neimeyer, Probert, & Fukuyama, 1986;
Oppenheimer, 1966) and other measures of cognitive processes (Harren, Kass, Tinsley, &
Moreland, 1978; Knefelkamp & Slepitza, 1976). It seems likely that CGC was poorly
measured in the model. And in fact, the SMC values for the measurement variables used as
indicators of CGC were the lowest found in the model, only high school grade point and
college grade point offered much predictive value to CGC. RNK and MER-TPR offered
almost no predictive value to CGC. While it was expected that a more subjective measure
of cognitive complexity would offer increased predictive value of Cognitive Complexity,
such was not the case. However, it may be that a problem of restricted range in the MER
TPR scores was at issue in this unexpected finding. Not only the maximum range of MER
values is small, the overrepresentation of first year students could be interpreted as a cause
of further restriction in the range of MER ratings obtained. The problem of restricted range is inherent in the indicator RNK. Given these problems of restricted range and the poor level of predictive values found for these two indicators of the latent variable CGC, it seems clear that alternate measures must be located. In contrast, the SMC values obtained for the indicator variables measuring the latent variables, PSS and CDM, were found to be relatively accurate, leading to the conclusion that individually these indicators served well.

The measurement variables used to indicate the latent variables, MO and FA, also resulted in acceptable SMC values. These SMC values for MO and FA seem difficult to explain in light of the lack of predictive value these latent variables exerted on other latent variables in the model. Considering the body of literature citing the effect of parental influences on career choice, and the effect of family influences on intellectual development, the lack of predictive power for MO and Fa is remarkable result, with no plausible explanation.

**Coefficients of Determination.** The coefficient of determination findings, while somewhat difficult to understand in light of the SMC values, must be viewed as indicating a poor fit between the data and the proposed model. Coefficients of determination for the indicators of the exogenous latent variables, CD/\(x\), reveals that the measurement variables chosen to indicate FA and MO variables, jointly offered no predictive value. No values for CD/\(x\) were generated by the LISREL IV program. Because the SMC data indicated each of the measurement variables individually predicted MO and FA well, the lack of predictive value when taken together seems difficult to explain. Measurement error may, again, be an issue. The coefficients of determination for the indicators of the endogenous latent variables, CD/\(y\), however, indicates that when these measurement variables are considered jointly, prediction for the variables CGC, PSS, and CDM was relatively adequate, which is congruent with the results of the SMC for PSS and CDM, although SMC results for CGC do not fit well with this CD/\(y\) value. Based on the coefficient of determination result for the
equations taken together, the model must be viewed as faulty. When considered jointly, the equations offer no predictive value for the data collected from the population sample.

**Issues in the Use of Structural Equation Modeling.** The use of structural equation modeling has been hailed as the most important development in data analysis for social science in forty years (Robert MacCallum, personal communication, June 3, 1985). The power of the technique, and the potential for discovering causal relationships among variables previously demonstrated to be related, both serve as intoxicating motivators propelling an increasing interest in structural equation modeling. The complexities of structural equation modeling provide a means for discovering more intricate theorized relationships among variables. The strength in the ability of the procedure to handle complex manipulations is, however, offset by the great difficulty in understanding and using the tool. In spite of the complications of the procedure, the potential for clearer perceptions about relationships among psychological characteristics serves as a strong injunction to become more familiar with this powerful, versatile technique.

The use of this statistical technique, as with any other, is not without problems. The tool is costly in terms of time and money. The demand for large samples to submit to analysis is costly in terms of data collection time, and in the expenses for instruments and other materials. The great difficulty that lies in obtaining sufficiently large sample outside of a university setting, where readily available introductory psychology students abound also seems worth mentioning. In addition, the technique requires relatively large amounts of costly computer time, both the time needed for each individual analysis that is run, and because many such runs may be necessary before optimum fit is obtained. Costs may also be added, due to the need for statistical consultants. Especially at the outset, expert opinion and guidance may be necessary to lift the veil on the seeming mysteries of LISREL VI. Increased understanding and time saved during the analysis may be worth the effort and
expense of seeking a statistical consultant with knowledge of structural equation modeling. (This report may serve as a primer to those who wish to become familiar with the technique of structural equation modeling.)

The most troubling caveat in using LISREL VI, lies in the fact that maybe the power of the statistical tool has outstripped the current power in psychological measurement techniques. For while the technique allows the use of all scales of measurement, the use of ratio and interval measures offer greater success with the LISREL VI program. Unfortunately, with the limitations in the instrumentation used to measure the variables, there are limits to the amount of variance that can be explained. Even with a tool as statistically powerful as LISREL VI, much error continues to exist in our understanding of psychological phenomenon.

Limitations

There are many limitations to an investigation of this type. Limitations are related to the exploratory nature of the study, the sampling procedures and sample size, the problems inherent in instrumentation, the restricted range in several measures, and the problems inherent in using the LISREL IV program for the statistical analysis. This investigation was exploratory, and focused on a large number of variables and the relationships among them. Caution must be used in statements about such findings, and few inferences can be made from the test of the proposed model. Nor does it seem wise to make substantive suggestions based on the findings.

Even if strong relationships had been found, aspects of the sample place limits on the ability to generalize these findings to other populations. There is little reason to believe that students enrolled in introductory psychology, which is accepted by all colleges within the university as an option to fulfill the university wide social science requirement, differ in any significant way from the population of students at the Ohio State University.
However, the sample was not randomly drawn; therefore, findings cannot be generalized from this sample to all students at The Ohio State University, nor to other university settings. In addition, the sample size of 152 students out of a student body of over 50,000 further limits the ability to generalize the findings to other groups of students.

The variables of interest in the investigation, Cognitive Complexity, Problem Solving Skill, and Career Decision Making, are subjective qualities that cannot be directly observed. Therefore, the instruments utilized to measure these variables are limited to the extent that the items presented to respondents do actually yield data reflecting the constructs of interest. This is not, however, an uncommon problem in psychology research. Given the current state of psychological measurement, it is assumed that high school grade point, college grade point, college class rank, and the Measure of Epistemological Reflection yields a measure of Cognitive Complexity; that the sub-scales from the Problem Solving Inventory measure self-appraised Problem Solving Skill; and that the responses to the comfort with career decision and commitment to career decision items, and the sub-scales from the Career Decision Scale offer a measure of Career Decision Making. However, findings suggest grave difficulties with several of the measures, which seem to offer little predictive power to the constructs used as latent variables. In addition all data collected relied on self-report by the respondents.

Another limitation of the study lies in the restricted range in several of the measures used. Score values for the Measure of Epistemological Reflection broadest range is from one to five for each of the six domains. The total protocol rating, however, of statistical necessity would be narrower, because it is the mean of the six domain ratings. Further, the expected range for MER total protocol ratings for undergraduate students lies between 2.0 and 3.5. Problems of restricted range were also present in the measures of college class rank (1-4), stated parental education level from the Personal Data Sheet (1-7), and, the parental general educational development (2-6 in this sample) and specific vocational
preparation level (3-9 in this sample). These limits in range present problems in the data analyses, which depend on variances and covariances.

The limitations inherent in using the LISREL VI technique present more serious difficulties in interpreting the findings. The power of the structural equation modeling technique is not obtained without cost. This tool demands the use of large samples. The consensus on the number needed is not clear. The range given as the "rule of thumb" varies from 5 participants per measured variable, when normally distributed, to 30 participants per measured variable (Fassinger, 1987). The most commonly cited ratio is 10:1. The ratio for current study of approximately 9:1 may have contributed to the less than satisfying findings.

Recommendations.

It is difficult to offer practitioners suggestions based on the results from this study. The lack of a causal relationship for Father and Mother on Cognitive Complexity, and for Father on Career Decision Making is particularly inexplicable given the body of data available which has shown strong relationships between these constructs. The weak inverse causal relationship of Cognitive Complexity on Problem Solving Skill, and on Career Decision Making also remains inexplicable, given that these relationships have also been established in the literature. Failure to discover a causal effect among variables previously shown to be related remains disappointing and difficult to explain.

Recommendations here are of necessity limited to suggestions for further research and some considerations for that undertaking. Obviously, due to the demands of the structural equation modeling statistical procedures, replication with a larger sample is recommended. Developing a simpler model may also yield more satisfying results upon which more complex models could be built. With fewer variables, stronger findings may result even with sample size similar to that utilized in this study. Differences and
similarities due to the effect of sex may also be examined with a much larger sample, which would allow for the examination of a separate model for each sex. Replication would allow exploration of the possible causal link between the inverted score from the Indecision subscale from the *Career Decision Scale* on Problem Solving Skill which was indicated by the Modification Indices offered by the LISREL VI program.

The need for more an effective measurement of Cognitive Complexity in the model may yield more satisfying results. The investigator has gained sympathy for Bodden, Winer, Neimeyer and other colleagues who are reluctant to give up on a tool in which they have a strong interest. These results have not shaken a faith in a production measure of cognitive complexity. However, the restriction in range of results obtained by a measure of intellectual development based on the Perry scheme, and the high cost inherent in the rating process, lead to the conclusion that a more effective means for measuring this construct must be found.
CHAPTER VI
SUMMARY

The impact of decision making has been viewed as critical to human development (Tyler, 1978) and making a career decision has been seen as important to mental health (Erickson, 1963). Most individuals make an early career decision after high school graduation. For many the first career decision is made in the form of choosing an academic major in college. Yet some individuals, confronted with making a career choice, experience great difficulty. When students are unable or resistant to making such a decision, parents and professionals in institutions of higher education become concerned.

Research findings can offer academic advisers, faculty members, career specialists, and counseling psychologists more effective means for interventions when working with students undecided about a career. An examination of the literature reveals a diversity of approaches to examining the career decision making process. Studies show that students with more effective self-appraised problem-solving skills are more effective in career decision making processes (Krieshok & Heppner, 1983; Larson & Heppner, 1985; Larson, Heppner, Ham & Dugan, 1988; Phillips, Pazienza, & Ferrin, 1984).

Some have attempted to assess possible differences in cognitive processes involved in career decision making through a measure of cognitive complexity. Much of the research on cognitive complexity in career decision utilizes a career grid methodology based on Kelly's (1955; 1963) work with the Interpersonal Role Construct Repertory Grid (Bodden, 1970; Bodden & Klien, 1972; Neimeyer, 1988; Nevill, Neimeyer, Probert, & Fukuyama, 1986; Oppenheimer, 1966; Winer, Cesari, Haase 1979). Others have used non-grid measures of cognitive processes in career decision making (Harren, Kass,
Evidence presented in the report builds a case for discarding the grid methodology as contributing little substantive information to the understanding of career decision making. Instead, the use of a theoretically based measure of cognitive level which requires respondents to produce a narrative response to probe questions is advocated as a means for measuring the thought processes involved in career decision making.

Other investigators have explored relationships between problem solving skill and cognitive attributions (Heppner, Hibel, Neal, Weinstein, & Rabinowitz, 1982), and problem solving skill and various measures of personality characteristics deemed to be measures of cognitive content and cognitive process (Heppner, Reeder, & Larson, 1983). While the relationships among career decision making, more general problem solving skill, and cognitive processes have been examined in various paired combinations, the investigation reported here examined the three variables together, with the addition of parental educational and occupational variables.

The primary purpose served by this study was to test a causal model of the relationships among parental educational and occupational influences, cognitive complexity, self-appraised personal problem solving skill and career decision making. The use of structural equation modeling was employed to carry out this purpose. An additional goal of the research was to apply a measure of cognitive complexity, which requires a written subjective response from respondents, as a means for adding to an understanding of the cognitive processes used in career decision making and in more general personal problem solving. Furthermore, several demographic variables were examined for the purpose of describing the characteristics of the group of undergraduate college students from whom the data was collected.

This report presented the results of an investigation which examined the relationships among parental variables, cognitive variables, self-appraised problem solving
skills, and career decision making, utilizing the LISREL VI statistical package (Jöreskog and Sörbom, 1984). These latent variables were entered into a structural equation model through the measured variables. Cognitive Complexity, was assessed by (1.) the Measure of Epistemological Reflection (Baxter Magolda & Porterfield, 1984), a device to assess intellectual development as described in Perry's (1970) model; and by (2.) High School Grade Point; (3.) College Grade Point; and (4.) College Class Rank. The measures of self-appraised Problem Solving Skill were the subscales from the Problem Solving Inventory (Heppner, 1988): (a.) Problem Solving Confidence; (b.) Approach-Avoidance; and (c.) Personal Control. The latent variable, Career Decision Making, was assessed by the subscales from the Career Decision Scale (Osipow, Carney, Winer, Yanico, & Koschier, 1976): (i.) Certainty; and (ii.) Indecision; by a Likert scale score item for (iii.) Comfort with Current Career Choice; and by a Likert scale score item for (iv.) Commitment to Current Career Choice. The exogenous latent variables Mother and Father were measured by (A.) Achieved Level of Education as reported by the student; (B.) General Education Level; and (C.) Specific Vocational Preparation. Values for these last two measures were obtained from the Dictionary of Holland Occupational Codes (Gottfredson, Holland, & Ogawa, 1982), based on each parent's occupation as listed by the respondents on the Personal Data Sheet. Demographic data were collected by means of a Personal Data Sheet prepared for this investigation.

Data were collected from 199 undergraduate students in an introductory psychology class. Due to missing data, 47 of the respondents were eliminated from the statistical analysis. Data analysis was performed on the information from the 152 undergraduate students (77 males and 75 females) that remained.

It was hypothesized that educational and occupational aspects of the mother would causally and directly effect cognitive complexity, and that educational and occupational aspects of the father would causally and directly effect cognitive complexity and career
decision making. Further it was hypothesized that cognitive complexity causally and
directly effects problem solving skill and career decision making. The final hypothesis
stated that problem solving skill causally and directly effects career decision making.

Results from the application of the LISREL VI package showed disappointingly
low parameter path weights for the hypothesized relationships. The beta path weights
among the variables were revealed to range from -.329 to .068 indicating little support for
the hypotheses, while the gamma path weights were found to be 0.00. The $x^2$ value was
found to be significant suggesting that the model was not representative of a good fit with
the sample drawn. Results also showed the Goodness of Fit Index to be .874, where .90
indicates acceptable fit. However, rejection of the null hypothesis also results in rejection
of the alternative hypothesis without any test of the alternative view. Therefore, despite
weak support for the model, it remains potentially plausible.

In addition, the Measure of Epistemological Reflection was found to contribute
only a modestly as a measure of cognitive complexity. College Class Rank was also found
to provide a less than satisfactory contribution to the measurement of cognitive complexity.
The limited information added to the measurement of cognitive complexity by these
variables was interpreted to be a result, at least in part, of the restricted range in the values
obtained, both in terms of the numerical values for the measures and in terms of the limited
array of values available in a sample of primarily first year college students.

The weak evidence of fit between the proposed model and the sample data was
interpreted to be caused by restrictions of range in several of the measurement variables and
the high proportion of first year college students in the sample, and also by the large
number of variables in relationship to the number of respondents. Differences between
those students included in the data analysis and those students eliminated from the data
analysis were speculated to have caused a further restriction of range in terms of career
decision making, which may in turn have contributed to the weak findings. Individuals
eliminated from the analysis because of missing data were found to be significantly less comfortable with, less committed to, and less certain about their career decision than the data analysis group. Had students exhibiting a broader range of career decidedness been included in the structural equation model, the hypothesized relationships might have received more support.
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APPENDIX A

INSTRUCTIONS TO THE PARTICIPANTS
AN INTRODUCTION TO RESEARCH ON INFORMATION PROCESSING, PROBLEM SOLVING AND CAREER DECISION MAKING

REASONS FOR COMPLETING THE STUDY: As you are probably aware, making a decision about a career is an important step toward entry into adulthood. A college education is a common preparation for a career. At some time during the freshman or sophomore year, college students are encouraged to choose an academic major and to follow a program of courses which will lead to graduation, and later to entry into the job market. Some students have little difficulty choosing their academic major and a career. However, some young people remain uncertain about what to major in, and about what they would like to do after taking college courses. Many people are interested in finding ways to help students make these decisions. Information gathered in this study will increase understanding of the career decision making process, and ultimately lead to more effective assistance to students making these decisions. Whether you have already decided on your major, are currently considering several choices, but are not yet certain about a major; or feel completely undecided at this time, your responses are important to this study.

WHAT THIS STUDY INVOLVES: You will be asked to fill out four forms. One form requests personal information to describe your current career decision and something about your family background. Two others are rather short and request only quick responses from you; one refers to your general problem solving style and the other is related to your career decision making. An additional form presents questions and statements about learning in college and requests that you respond by writing out your thoughts. The time involved to complete the questionnaires will be about one and one-half hours.

BENEFITS FROM YOUR PARTICIPATION: The benefits to you would be the knowledge that you helped answer some important questions about the process of college student's career decision making. In addition, if you are interested in feedback about your responses to the questionnaires, you may later schedule another appointment with the investigator. You may also request information about the results from the data analysis. By participating you gain some understanding of the process that social scientists use to increase their understanding of a topic. Finally, by participating you may gain some understanding of your own decision making and your learning style.

POSSIBLE PROBLEMS THAT MIGHT OCCUR: It is not believed that you will experience any problems as a result of completing the questionnaires. However, a few participants may feel some discomfort as they fill out the questionnaires. Many people feel some stress as they consider their future academic major or career. If this is the case, you can be assured that the investigator will be available to support you. The second problem that might occur would be related to possible errors that could occur in completing the paper work needed for you to get course credit for your participation. If this occurs, every effort will be made to correct any error, should one occur, if you telephone the contact person named at the end of this form.

WHAT HAPPENS TO THE INFORMATION: The information obtained in this study will be kept strictly confidential. The sheets linking your name and personal code will be stored in a locked file cabinet, and the information will be processed with only the code number to protect each person's privacy. Each questionnaire has only a code number, your name will not be on any of the questionnaires. Then the responses will be submitted to a statistical analysis, in order to summarize biographical data such as age, sex, and class rank, and to answer the research questions. All information from the questionnaires will be grouped together and reported anonymously.

ISSUES ABOUT PARTICIPATION: Should you feel unusually disturbed at any time, you may be excused without any negative consequences to you. Participation in this research is voluntary and you may withdraw from the study at any time by informing the researcher, the research assistant, or by telephoning the contact person, Lori Schrock, 292-5303.

Please feel free to ask questions you might have about any aspect of this study.
APPENDIX B

CONSENT FORM
THE OHIO STATE UNIVERSITY

Protocol No.__________

CONSENT FOR PARTICIPATION IN
SOCIAL AND BEHAVIORAL RESEARCH


Samuel H. Osipow, Ph.D., or his authorized representative, has explained the purpose of the study, the procedures to be followed, and the expected duration of my participation. Possible benefits of the study have been described as have alternative procedures, if such procedures are applicable and available.

I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Further, I understand that I am free to withdraw consent at any time and to discontinue participation in the study without prejudice to me.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date:_______________ Signed: ______________ (Participant)

Signed:__________________________________________
(Samuel H. Osipow, Ph.D.)

Signed:__________________________________________
(Diane J. Prosser, M.S.)

Witness:__________________________________________
PERSONAL DATA

Personal Code ____________________________________________ Today's Date _______________________

Date of Birth ___________________ Sex/Gender (Please Circle One): Female Male

Social Security Number _______ _______ Race _____________________________

Date Entered Ohio State: Quarter _____ Year _____

Class Rank (Please Circle One): Freshperson Sophomore Junior Senior Master's Doctoral

High School G.P.A. __________ Current College G.P.A. __________

College Major ___________________________________________

Intended Occupation _______________________________________

Please indicate the level of comfort you feel with where you are in the process of making an occupational choice.

1 2 3 4 5 6
Very Uncomfortable Very Comfortable

Please indicate the strength of your commitment to your current occupational choice.

1 2 3 4 5 6
Completely Undecided Completely Decided

Mother's Job ____________________________________________ Father's Job ______________________________________

Full or Part Time (Please Circle One) Full or Part Time (Please Circle One)

Mother's Education:

___ grade school
___ high school diploma
___ some college
___ college degree
___ master's degree
___ two year degree-nursing,
     technical, or associate degree
___ doctoral degree

Father's Education:

___ grade school
___ high school diploma
___ some college
___ college degree
___ master's degree
___ two year degree-nursing,
     technical, or associate degree
___ doctoral degree
APPENDIX D

MEASURE OF EPISTEMOLOGICAL REFLECTION
MEASURE OF EPISTEMOLOGICAL REFLECTION

INSTRUCTIONS: The questionnaire that follows has to do with your perspective on learning in college. Each of the questions on the following pages asks for your opinion or choice on a given subject, and the REASONS why you have that particular perspective or opinion. We are interested in understanding your perspective as fully as possible. Please give as much detail as you can to describe how you feel about each question. Feel free to use the backs of pages if you need more space.

Thank you!

PLEASE WRITE YOUR RESPONSES IN INK

NAME_________________________________
AGE________________
SEX (circle)  MALE  FEMALE
COLLEGE MAJOR__________________________________
FATHER'S JOB____________________________________
MOTHER'S JOB____________________________________
DATE___________
CLASS RANK (circle one)
Freshman
Sophomore
Junior
Senior
First year master's
Second year master's
Ph.D Candidate
P.D.


Code #__________________________
(for office use only)
THINK ABOUT THE LAST TIME YOU HAD TO MAKE A MAJOR DECISION ABOUT YOUR EDUCATION IN WHICH YOU HAD A NUMBER OF ALTERNATIVES (E. G., WHICH COLLEGE TO ATTEND, COLLEGE MAJOR, CAREER CHOICE, ETC.). WHAT WAS THE NATURE OF THE DECISION?

WHAT ALTERNATIVES WERE AVAILABLE TO YOU?

HOW DID YOU FEEL ABOUT THESE ALTERNATIVES?

HOW DID YOU GO ABOUT CHOOSING FROM THE ALTERNATIVES?

WHAT THINGS WERE THE MOST IMPORTANT CONSIDERATIONS IN YOUR CHOICE? PLEASE GIVE DETAILS.
DO YOU LEARN BEST IN CLASSES WHICH FOCUS ON FACTUAL INFORMATION OR CLASSES WHICH FOCUS ON IDEAS AND CONCEPTS?

WHY DO YOU LEARN BEST IN THE TYPE OF CLASS YOU CHOSE ABOVE?

WHAT DO YOU SEE AS THE ADVANTAGES OF THE CHOICES YOU MADE ABOVE?

WHAT DO YOU SEE AS THE DISADVANTAGES OF THE CHOICES YOU MADE ABOVE?

IF YOU COULD GIVE ADVICE TO ANYONE ON HOW BEST TO SUCCEED IN COLLEGE COURSE WORK, WHAT KIND OF ADVICE WOULD YOU GIVE THEM? TALK ABOUT WHAT YOU BELIEVE IS THE KEY TO DOING WELL IN COLLEGE COURSES.
DURING THE COURSE OF YOUR STUDIES, YOU HAVE PROBABLY HAD INSTRUCTORS WITH DIFFERENT TEACHING METHODS. AS YOU THINK BACK TO INSTRUCTORS YOU HAVE HAD, DESCRIBE THE METHOD OF INSTRUCTION WHICH HAD THE MOST BENEFICIAL EFFECT ON YOU.

WHAT MADE THAT TEACHING METHOD BENEFICIAL? PLEASE BE SPECIFIC AND USE EXAMPLES.

WERE THERE ASPECTS OF THAT TEACHING METHOD WHICH WERE NOT BENEFICIAL? IF SO, PLEASE TALK ABOUT SOME OF THE ASPECTS AND WHY THEY WERE NOT BENEFICIAL.

WHAT ARE THE MOST IMPORTANT THINGS YOU LEARNED FROM THE INSTRUCTOR'S METHOD OF TEACHING?

PLEASE DESCRIBE THE TYPE OF RELATIONSHIP WITH AN INSTRUCTOR THAT WOULD HELP YOU TO LEARN BEST AND EXPLAIN WHY.
DO YOU PREFER CLASSES IN WHICH THE STUDENTS DO A LOT OF TALKING, OR WHERE STUDENTS DON'T TALK VERY MUCH?


WHY DO YOU PREFER THE DEGREE OF STUDENT INVOLVEMENT/PARTICIPATION THAT YOU CHOSE ABOVE?


WHAT DO YOU SEE AS THE ADVANTAGE OF YOUR PREFERENCE ABOVE?


WHAT DO YOU SEE AS THE DISADVANTAGE OF YOUR PREFERENCE?


WHAT TYPE OF INTERACTIONS WOULD YOU LIKE TO SEE AMONG MEMBERS OF A CLASS IN ORDER TO ENHANCE YOUR OWN LEARNING?
SOME PEOPLE THINK THAT HARD WORK AND EFFORT WILL RESULT IN HIGH GRADES IN SCHOOL. OTHERS THINK THAT HARD WORK AND EFFORT ARE NOT A BASIS FOR HIGH GRADES. WHICH OF THESE STATEMENTS IS MOST LIKE YOUR OWN OPINION?

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

IDEALLY, WHAT DO YOU THINK SHOULD BE USED AS A BASIS FOR EVALUATING YOUR WORK IN COLLEGE COURSES, AND WHO SHOULD BE INVOLVED IN THE EVALUATION?

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

PLEASE EXPLAIN WHY YOU THINK THE RESPONSE YOU SUGGESTED ABOVE IS THE BEST WAY FOR EVALUATING STUDENTS’ WORK IN COLLEGE COURSES.

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________
SOMETIMES DIFFERENT INSTRUCTORS GIVE DIFFERENT EXPLANATIONS FOR HISTORICAL EVENTS OR SCIENTIFIC PHENOMENA. WHEN TWO INSTRUCTORS EXPLAIN THE SAME THING DIFFERENTLY, CAN ONE BE MORE CORRECT THAN THE OTHER?

WHEN TWO EXPLANATIONS ARE GIVEN FOR THE SAME SITUATION, HOW WOULD YOU GO ABOUT DECIDING WHICH EXPLANATION TO BELIEVE? PLEASE GIVE DETAILS AND EXAMPLES.

CAN ONE EVER BE SURE OF WHICH EXPLANATION TO BELIEVE? IF SO, HOW?

IF ONE CAN'T BE SURE OF WHICH EXPLANATION TO BELIEVE, WHY NOT?