ACADEMIC AND NON-ACADEMIC CHARACTERISTICS OF SUCCESSFUL AND NON-SUCCESSFUL COLLEGE SCIENCE STUDENTS

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Date

To the Associate Vice President for Research
and Dean of Graduate Studies:

I am submitting herewith a dissertation written by Mary Ann Yantis entitled "Academic and Non-academic Characteristics of Successful and Non-successful College Science Students." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Vocational-Technical Education.

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DEDICATION

This research is dedicated to my students, past, present, and future. They are the sustaining force behind my continued love of teaching and the desire to become a better educator.

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ABSTRACT

Academic and Non-academic Characteristics of Successful and Non-successful College Science Students

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This study examined the relationship between selected academic and non-academic variables and academic success of college science students. Subjects were 45 volunteers who completed the research questionnaire, and 19 of these subjects were interviewed for additional descriptive information related to their learning experiences in their college science classes.

The non-academic variables of self-esteem, self-concept of ability, and social support were found to be related to science student success. The academic variables of cumulative science course grade point average, Texas Academic Skills Program test math scores, and Texas Academic Skills Program test reading scores were found to be related to science student success. There were no differences found between minority and non-minority students with respect to any of the research variables. The best set of predictor variables for success in college science students consists

of: (a) Texas Academic Skills Program test reading scores, (b) number of hours employed per week, (c) total loss score, (d) cumulative grade point average, (e) number of miles commuted per week to attend class, (f) loss quality score, and (g) loss quantity score.

These findings have implications for college science course educators and administration. An effort should be made to support and to enhance student reading skills. Since student losses were shown to be related to lower grades in science courses, an effort should be made to identify student losses early, so that prompt intervention may be offered. Available support services should be widely communicated and promoted to all students and those services expanded, where necessary. Faculty should engage in activities which promote positive self-concept of ability and positive self-esteem in students. Colleges also should continue to make financial aid available for needy students.

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CHAPTER I

INTRODUCTION

Academic success is a subject of interest to higher educators generally. The desired outcome for all students is that they understand the information presented and be able to apply that knowledge in appropriate ways.

Institutions of higher education presently are faced with documenting their "institutional effectiveness" by a variety of means. One of those ways is to support that their mission of educating adult learners is indeed occurring within their institution.

Rationale

The identification of characteristics of successful and non-successful students in science courses has significant implications for improving institutional effectiveness. Faculty may be able to identify when early intervention is needed for a student having difficulty and begin early assistance. Faculty and administration may be able also to identify strong students early and thus capitalize on student strengths.

The identification of such factors may have even greater significance for the student who is at a disadvantage due to race, educational background, or cultural background. Improving the success of minority students on predominantly White campuses has been the focus of college and university administrators for many years. Jones (1992), reports that an alarming gap continues to exist between the numbers of Black and White students who complete their degree within a reasonable time. A national study of 1,980 high school graduates revealed that although 52% of White high school students who entered college had received their bachelor's degree by 1986, only 26.6% of Blacks and Hispanics had done so (Magner, 1989). Many institutions of higher education are attempting to reverse this trend by actively recruiting minority students as well as attempting to identify factors that may increase the success of these students. Additional research with the focus of identifying both academic and non-academic factors affecting student success is urgently needed to support this higher education effort.

Despite these efforts, however, a significant gap continues to exist between the percent of minority individuals in the general population and the percent of minority individuals represented in professional scientific fields such as nursing (Fagin, 1992). The nursing profession traditionally has included only minimal numbers of individuals from culturally diverse backgrounds (Allen, Nunley, & Scott-Warner, 1988).

Gaining admission to programs such as schools of nursing may be not only competitive, but it may be difficult or next to impossible for a minority student who may be educationally, financially, or socio-culturally impoverished. A low Grade Point Average (GPA) in the prerequisite science courses is often a major factor preventing minority students from being accepted into science programs. Astin (1990) found inequalities affecting disadvantaged students when using standardized educational scoring measures such as GPA and standardized college admission tests. African-Americans, Hispanics, and poor students tend to receive lower scores on these standardized measures than other groups.

Problem Statement

The identification of factors which may impede success for students is an important area for educational research. This study focused on prerequisites for success of students who were enrolled in selected science courses at one large community college in the southern United States.

Purpose

The purpose of this study was to identify academic and/or non-academic variables which influence success in selected college-level science courses. The study examined the relationships among demographic characteristics, selected academic variables, and non-academic factors. The academic factors were total GPA, prior and current science course GPA, and Texas Academic Skills Program (TASP) Test scores, while the non-academic factors included self-esteem, self-concept of ability, and perceived social support.

Research Questions

This research was guided by the intention to determine answers to the following five research questions:

1. Is there a relationship between success of students in science courses and selected non-academic variables of self-esteem, self-concept of ability, and perceived social support?

2. Is there a relationship between success of students in science courses and the academic variables of cumulative science course GPA, total GPA, and TASP scores?

3. Do ethnic groups of students in science courses differ significantly in their scores on measures of self-esteem, self-concept of ability, social support, TASP

scores, GPA in prior or current science courses, or total GPA?

4. Do the demographic characteristics, other than ethnicity, which describe minority students differ from those which describe non-minority students in science courses?

5. What combination of factors are the best predictors of success for all students, minority students, and non-minority students in science courses?

Definition of Terms

For the purposes of this research, the following operational definitions were utilized:

1. Students--any person, age 18 or older, who has taken the TASP exam, and is currently enrolled in Anatomy and Physiology I, Anatomy and Physiology II, Chemistry, and/or Microbiology at one community college campus in the southern United States.

2. Academic variables--factors indicating academic ability; for the purpose of this research, the following three concepts are considered academic variables:

a. TASP scores--the numerical scores received on the reading, math, and writing sub-scales of the Texas Academic Skills Program Test.

b. Total GPA--a score which represents the numerical average of all college-level courses taken at the currently enrolled institution, by a specific student.

c. Cumulative science course GPA--a numerical score which represents the average of all college-level science courses that a student has taken at the currently enrolled institution, prior to the semester in which the study is conducted.

d. Current science course GPA--a numerical score which represents the grade, on a 4-point scale, that the student received in the currently enrolled science course. When students were enrolled in more than one of the selected science courses, a numerical average of the grades received in the courses was used.

3. Student success--a numerical score of 3.0 or higher, on a 4-point scale, representing a B average in the currently enrolled science course. If the student was currently enrolled in more than one of the selected science courses, an average GPA for the courses was recorded. This score was chosen because students often are required to have a 3.0 or higher in their science courses to be considered for admission to professional schools such as nursing or medicine.

4. Non-academic variables--psychosocial and socio-demographic factors, which are identified by the literature

as being related to educational achievement. Major sociodemographic variables to be considered in this study are: (a) age, (b) ethnicity, (c) gender, (d) employment status, and (e) previous education. For purposes of this research, the following three psychosocial factors are included and operationally defined as follows:

a. Self-esteem--a personally constructed global evaluation of self, that is constructed out of interactions with the environment (Beane & Lipka, 1990). For this research, this concept was operationally defined as a numerical score received on the Rosenberg self-esteem scale.

b. Self-concept of ability--the description of the self with reference to a specific task, which reflects both realistic and illusory perceptions (Beane, 1991). For this research, this concept was operationally defined as a numerical score received on the revised Brookover self-concept of ability scale.

c. Social support--Kahn (1979) defined social support as "interpersonal transactions that include one or more of the following: the expression of positive affect of one person toward another; the affirmation of endorsement of another person's behaviors, perceptions, or expressed views; the giving of symbolic or material aid to another" (p. 85). For this research, this concept was operationally defined as numerical scores received on the support sub-scale of the Norbeck social support questionnaire.

Limitations

The following limitations were identified for the study:

1. Research was conducted at one community college campus in the southern U.S., thus limiting the ability to generalize the results of the study to other populations.
2. The researcher was of White ethnicity, but interviewed students of diverse ethnicities.
3. Research subjects were volunteers.

Assumptions

This research was based on the following assumptions:

1. Students will volunteer to complete the questionnaire and be interviewed.
2. Students who volunteer will, in fact, complete their commitment.
3. Students will be able to accurately rate themselves on tools which assess the three psychosocial non-academic variables.
4. Students will provide accurate demographic and personal information on the demographic questionnaire and during the interviews.

CHAPTER II

REVIEW OF THE LITERATURE

This study was concerned with the identification of academic and non-academic characteristics of successful and non-successful college students in science courses. A review of the literature was conducted in order to determine the scope of previous research on the topic and to better define the research questions. The following areas were addressed in the review of the literature: (a) academic variables, and (b) non-academic variables. The two types of non-academic variables specifically addressed were sociodemographic characteristics and psychosocial factors.

Academic Variables

Most commonly, colleges and universities evaluate a student's potential for success in terms of traditional measures such as scores received on the Scholastic Assessment Test (SAT), the American College Test (ACT), and high school grade point averages. Several recent studies of nursing students have included academic variables in their design. Ochsner (1992), studied 166 nursing students enrolled at one southern community college in the United

States in an effort to identify an improved nursing school admission process. She found the significant indicators of nursing student success to be general education course GPA, cumulative science course GPA, and reading skills. In this study, single course GPAs were not as strong as cumulative GPAs in predicting success, with the explanation that cumulative GPAs measure performance over time, while one-time course grades can be influenced by many transitory factors.

Allen, Higgs, and Holloway (1988) studied 296 generic baccalaureate nursing students to determine predictors for at-risk students as well as predictors for student success. Of 40 potentially predictive variables, they found that preadmission cumulative GPA and prerequisite course GPA were the strongest and most consistently predictive variables for success. Tracey and Sedlacek (1985) found SAT scores predictive of GPAs for both Black and White students, but not especially predictive of continued enrollment for either ethnicity.

Although standardized tests are generally considered reliable predictors of success for non-minority students, there is some controversy as to whether the SAT and ACT tests have some cultural biases. Schmeiser and Ferguson (1979) found differences in performance on standardized tests among ethnic groups. They attributed those differences to several factors: (a) culturally biased content, (b) technical features of the test, (c) cognitive skills measured, and (d) socio-cultural characteristics.

Rami (1993) studied 128 African American nursing students who had graduated from baccalaureate nursing programs in the southern United States, and found that low ACT scores were not necessarily related to academic failure for minority students. The variables of age, ACT scores, and microbiology GPA were found to have a negative relationship with student success as measured by passing the National Council Licensing Examination for nursing (NCLEX-RN). The variables of student score on the Mosby test of nursing knowledge and the nursing school's comprehensive exams made the largest individual contribution to predicting success. The results of this study also showed a 95% accuracy rate for predicting success on the national licensure exam.

Other cognitive variables have been found to be related to student success. Ballantine (1989) found that the average reading level of Black and Hispanic students was 4 years lower than White students. Allen, Higgs, and Holloway (1988) found the personal variables of verbal fluency, thought organization, and self-regard to be significantly related to college student success in nursing courses.

At the community college at which this research was conducted, neither SAT, ACT, nor high school GPAs were available, but Texas Academic Skills Program (TASP) test scores were available for a portion of the students. The TASP Test was mandated in the spring of 1987 by Texas Education Code (TEC) 51.306, and provides information about the reading, mathematics, and writing skills of students entering Texas public colleges and universities. As part of the TASP program, colleges and universities are required to offer their students advisory and support services related to the TASP Test. Remedial activities are required for students who do not pass one or more sections (reading, mathematics, and writing) of the TASP Test. The scores on each section range from 100 to 300, with 220 as the minimum score needed to pass in each area. The reading section consists of approximately 40 multiple-choice items based on reading passages. The passages are taken or adapted from college-level texts and other college-level reading materials. The mathematics section consists of approximately 50 multiple-choice items. The writing section consists of a writing sample assignment to which the examinee constructs a response, as well as approximately 40 multiple-choice items associated with written passages. The passages are adapted from college-level texts and other college-level reading materials.

Validity addresses the degree to which an instrument measures what it is intended to measure. The TASP skills and item specifications were developed and approved by committees of Texas faculty in community colleges and universities. The skills were validated in surveys of Texas educators, skills were finalized for testing by the test development committees, and the committees reviewed and validated test items. The test items were pilot tested in Texas and finalized by the committees based on pilot test results. Independent panels of Texas higher education faculty reviewed and revalidated the items and provided input to the Texas Higher Education Coordinating Board and the State Board of Education for use in setting passing standards (TASP Technical Summary, 1994).

Reliability concerns the extent to which a measure consistently produces the same result under similar conditions. For the TASP test, an overall test reliability estimate is provided by the Kuder-Richardson index of homogeneity (KR-20). This measure is reported in the range of 0.00 to 1.00, with a higher number indicating a greater level of reliability. The reading section of the TASP test has a KR-20 reliability of 0.81 - 0.85, the mathematics section of the test has a KR-20 reliability of 0.86 - 0.91, and the writing section of the test has a KR-20 reliability of 0.87 - 0.89 (TASP Technical Summary, 1994). Students who have received credit for at least 3 semester hours of college-level work prior to fall 1989, are deaf or blind, or who have met qualifying standards on the ACT, SAT, or Texas Assessment of Academic Skills (TAAS) test are exempt from being required to take the TASP (Texas Higher Education Coordinating Board, 1994).

Non-academic Variables

Most educators agree that academic success depends on more than intellectual or academic ability. There are a variety of sociodemographic and psychosocial factors that may influence academic performance. In fact, some of these factors may even determine the opportunity to attempt performance; for example, the percentage of minorities in nursing and in other college science programs is far lower than the American population in general. The specific non-academic variables discussed in the section on sociodemographic factors includes: (a) age, (b) gender, (c) ethnicity, (d) marital status, (e) course load, and (f) previous experience. Psychosocial factors to be discussed include: (a) self-esteem, (b) self-concept of ability, and (c) social support.

Sociodemographic Factors

Age

Research has generally supported that there are declines in performance measurements related to cognitive abilities of older learners. This age-related variance has been measured and studied in a variety of ways.

Zacks, Hasher, Doren, Hamm, and Attig (1987) assessed the usefulness of a general capacity model of cognitive functioning for predicting age differences in processing critical information in text. The sample for this study consisted of 48 college students (mean age = 20.4 years) and 48 older adults (mean age = 73.2 years). Passages that either explicitly stated or implied, in either a predictable or unpredictable manner, a fact central to understanding were read to each subject. No age differences were obtained in the recall of explicit central facts, but the younger adults out-performed the older adults when these facts had to be inferred. This age deficit in targeted recall was interpreted in terms of effects that occurred primarily at encoding rather than during long-term storage or at retrieval due to the absence of age differences in the explicit condition. It, thus, seems that young adults are taxed only by difficult inferences, whereas the resources of older adults are taxed by both easy and difficult inferences.

Zacks et al. (1987) proposed that a decline in the amount of information held in working memory can account for the difficulty older adults have with unexpected inferences. Generating these requires the listener to have available information from both the passage and general knowledge. In adults with reduced capacity, this load could easily exceed the amount that can be held in working memory.

An experiment was conducted by Craik and McDowd (1987) in which young (mean age = 20 years) and elderly (mean age = 72 years) adults performed cued-recall and recognition tests while carrying out a choice reaction-time task. An analysis of co-variance, with recognition performance as the co-variate, showed a reliable age decrement in recall. It was therefore supported that older individuals perform more poorly on recall tasks than they do on recognition tasks. Performance on the secondary task (reaction time) showed that recall was associated with greater resource "costs" than was recognition and that this effect was amplified by increasing age.

Gick, Craik, and Morris (1988) investigated age-related differences in working memory using a working memory task. Eighteen young subjects with a mean age of 21.9 years, and eighteen older subjects with a mean age of 68.1 years, volunteered to participate in the research. A series of sentences was presented to each subject, with the task being to judge whether each statement was true or false and, then, to recall the final word from all the sentences. Task complexity was manipulated by varying the number of sentences presented on each trial, thereby varying the memory load. Pacing was varied either by giving subjects unlimited time to study each sentence or by imposing a time limit of 8 seconds. The results showed a substantial age-related decrement in working memory performance. Increases in sentence complexity did affect older subjects more than younger subjects, but neither set size nor division of attention were found to have a differential effect on the two age groups. These findings support that not all sources of task difficulty or types of complexity are equal.

Salthouse (1993) tested 405 adults between the ages of 19 and 84 years of age with a series of instruments designed to measure the following four concepts: (a) memory, (b) cognition, (c) motor speed, and (d) perceptual speed. As in the previous research, this study also found considerable age-related differences. The average performance of adults in their 60s and 70s was between one and two standard deviations below that of adults in their 20s and 30s for each of the composite variables. These results clearly indicate that increased age is associated with slower performance on many speeded tasks and with lower levels of performance on certain memory and cognitive tasks.

Nunn (1994) studied adult learners' locus of control, self-evaluation and learning temperament as a function of age and gender. A total of 759 subjects, between the ages of 17 and 65 who were enrolled in degree programs at public and private post-secondary educational institutions participated in this study. Results showed older students to be more positive in their self-concepts, were more internally oriented, perceived less anxiety in learning, were oriented more to goals and achievement, preferred less physical movement in learning, wanted more formal learning methods, were less impulsive, and perceived themselves to be more abstract in their thinking. Younger students, on the other hand, were less positive about themselves, more externally oriented, appeared more anxious about learning, had less achievement orientation, wanted more movement in learning, preferred an informal learning approach, and were more concrete in their thinking. Students in the age group from 17 to 24 years were lower in their self-concept as learner evaluations than older students.

Research, thus, does support that there are age-related differences in cognitive abilities. The next question that one must consider is: "How do these differences affect discriminators of educational success?"

Oshsner (1992) in her study of 166 nursing students, did not find that age was significantly related to student success as measured by successful completion of the NCLEX exam. Allen, Higgs, and Holloway (1988) also found that student age was not predictive of success in their study involving the identification of predictive factors of success for 296 nursing students. It, thus, appears that there are differences in cognition between younger and older learners, but that older adults are able to compensate and equal performance, as measured by success, of younger learners.

Marshall (1989) studied attrition of students from nursing school. She found that age was the most distinguishing demographic variable, with students who remained in the program having a mean age of 27.8 years, while students who left the program had a mean age of 33.5 years. It was hypothesized that the older students had a higher attrition rate due to increased family responsibilities and because they had difficulty assuming the student role.

<u>Gender</u>

There are differences in science course success between male and female students, and these differences apparently begin at an early age. By the time children in the United States reach the seventh grade, half declare no interest in science, with the disinterest especially pronounced among girls (Office of Science and Technology Policy, 1991). At the same time, girls' and boys' performances on standardized tests of science achievement begin to diverge, with girls falling behind boys (Mullins & Jenkins, 1988).

Although this gender difference has been attributed to several factors, there is concern that the disparity may be due to the method of measurement (Bolger & Kellaghan, 1990). That is, that there may be something about standardized tests that put females at a disadvantage. Conventional science achievement tests are typically multiple-choice tests. When this method of measurement is used, females tend to perform more poorly than males (Murphy, 1992). The reason for this female disadvantage is unclear, but one explanation is that males are more willing to take risks than females and to guess on multiple-choice tests (Hanna, 1986). Linn et al. (1987) found that this was especially true on tests in specific content domains of science, such as biology or chemistry.

The emphasis of traditional achievement on the recall of basic content is thought to put females at a further disadvantage (Champagne & Newell, 1992). For example, on the National Assessment of Educational Progress assessments for the years 1981-1982, there were consistent gender differences among 13- and 17-year-olds on science items that stressed specific knowledge in particular content areas. Interestingly though, gender differences were absent on items that involved analytic processes and multistep reasoning such as designing experiments and drawing conclusions. Apparently, the "female disadvantage" on science tests disappears when emphasis is focused on problem solving, reasoning, and critical thinking.

Young and Fraser (1994) investigated gender differences in science achievement in Australian schools. The subjects in this study included 4,259 10-year-old students, 4,917 12-year-old students, and 1,073 year-12 students. This study focused on biology, physics, and chemistry science content areas. Results in biology and physics achievement revealed statistically significant sex differences favoring boys in both content areas for all age groups, except year-12 biology students. Statistically significant sex differences in chemistry achievement also were found among year-12 chemistry students favoring boys.

Another factor that may be related to gender differences in science performance may be teacher actions, which convey important information to students. Researchers continue to find that teachers spend more instructional time with male students than with female students. Data from the National Project on Women in Education (1978) indicated that teachers give boys up to eight times the amount of instruction given to girls. Sadker and Sadker (1985) note that female students receive less attention from the teacher in all four categories of teacher interactions that they recorded, including: (a) disapproval, (b) praise and approval, (c) instruction, and (d) listening. Kelly (1988) estimated that over a child's education, teachers spend approximately 1800 more hours with male students than with female students. Studies by Jones and Wheatley (1990) and Kahle (1990) also concluded that girls receive less individualized attention than do boys.

Shepardson and Pizzini (1992) examined female teachers' perceptions of the scientific ability of their students. They found a gender effect indicating that teachers at both lower and upper elementary levels perceive boys to be stronger than girls on cognitive intellectual skills, defined as "analyzing, synthesizing, hypothesizing, evaluating, interpreting and questioning," and girls to be stronger than boys on cognitive process skills, characterized by "observing, measuring, communicating, graphing, manipulating equipment and materials, and recording" (pp. 149-150).

Evidence exists that college classrooms often continue similar patterns of gender discrimination. Sadker and Sadker (1994) have documented in their research that behaviors of college faculty include the following: (a) calling on more male students, (b) standing next to male students in the classroom and providing eye contact when they speak but not doing this to female students, (c) responding more extensively to the comments of male students than to female students' comments, (d) addressing the class as if female students were not in the class, (e) coaching male students to give more elaborated answers but not providing this encouragement to female students, and (f) providing longer wait time after male students have been called on. Researchers have determined that "these faculty behaviors cause female college students to withdraw from class discussion, change majors, and even leave the institution" (Maasland, 1994, p. 23).

Sadker and Sadker (1994) also found in their research at the college level that faculty are particularly unaware of and unsympathetic toward gender discrimination in schools. They found that not only do faculty conduct little research on this problem, but they have developed few programs to work with teachers on gender equity.

College and graduate programs of study are often difficult for both men and women. Research supports that these educational efforts may be especially stressful for female students. Mallinckrodt and Leong (1992) studied 440 graduate students to identify sources of social support, gender differences, and role conflicts. Women in this study reported significantly more stress, more symptoms of stress, and significantly less support from their academic departments and family environments than did men. They experienced their academic departments as providing less flexible curriculum, providing fewer tangible supports, and poorer quality relationships with other students than did the male subjects.

Females may be thus caught in a cycle leading to continued poor science performance. Their differential classroom treatment, lower science test scores, as well as increased levels of stress are thought to undermine their self-perceptions of competence which may lead to their disinterest in science and unsuccessfulness in science courses (Oakes, 1990).

Ethnicity

Minority students are clearly under-represented in specific science-focused programs of study. Fagin (1992) reports that the percentage of Blacks enrolled in nursing schools in the United States in the fall of 1991 was 9.1%, but the percentage in the population at large is more than 12% for Hispanics and Asians. She also stated that nursing enrollments are even less representative. Rawls (1991) supports that the ethnic composition of students in schools of medicine in the U.S. also shows similarly small numbers of minority students. Recent statistics appear to show a shift in that trend for Asian-American minority students. Between the years of 1980 and 1990, the number of Asian-American students in college increased from 286,000 to 555,000, a 94% increase, as compared with an 8.5% increase for White students during the same time period ("The Nation's Students," 1992).

McNairy (1987) projected that Blacks and Hispanics will comprise between 25% to 30% of the United States population by the year 2020. However, figures from the United States Bureau of Labor Statistics indicate that, in the year of 1987, only 7.7% of registered nurses were Black. Rawls (1991) states that of the 4.5 million people working in the United States as scientists or engineers, only 4.4% represent ethnic minorities. This rate is alarming, considering that these groups are among the fastest growing portions of the U.S. population and also represent close to 40% of the work force.

Additional data support the idea that, once admitted, minority students have a high attrition rate from institutions of higher education. The number of minority enrollees in schools of nursing in the year 1989 was four times higher than the number of minorities that graduated that spring (Fagin, 1992). Tracey and Sedlacek (1987) have studied extensively the difference in academic success between Black and White students in higher education. They have found that, in general, attrition rates are much higher for Blacks than Whites, especially when the Black students attend predominately White institutions.

One factor apparently hindering minority students from gaining admission to science-based programs is their low GPA in the required prerequisite courses. At one southern community college, in the spring semester of 1994, there were 575 students enrolled in the following four science courses: (a) Anatomy and Physiology I, (b) Anatomy and Physiology II, (c) Chemistry, and (d) Microbiology. These four courses are required as part of the nursing curriculum and the GPA in these courses is utilized as a primary weighting factor in nursing school acceptance at this college. During this spring semester, the mean GPA for 453 non-minority students taking one or more of the above listed science courses was 2.872, while the mean GPA in the same courses was 2.316 for the 120 minority students (Tarrant County Junior College, 1994). Such differences in science course GPA may be a major reason for so few minority students being accepted into nursing or other professional science programs.

At one large community college in the southern United States, for the Fall of 1992 nursing school class, 459 students applied, and 105 were accepted. In the group that <u>applied</u>, 20 were Hispanic, 32 were Black, 374 were White, 1 was Native American, and 9 were Asian. The accepted group included 3 Hispanic, 3 Black, 98 White, 1 Native American, and 1 Asian. These numbers represent acceptance percentage rates of: 15% for Hispanics, 9% for Blacks, 26% for Caucasians, 100% for Native Americans, and 11% for Asians. The male/female ratio of applicants, was 87 males and 352 females, with 22 of the males and 83 of the females being accepted. This represents a percentage of acceptance for males at 25.28% and 23.58% for females (Tarrant County Junior College, 1994).

There have been some efforts to implement programs to assist minority students in being more successful in science programs. Several nurse educators reported improved rates of success for minority nursing students on the national licensure exam after academic intervention that included major curriculum revision, remedial courses, and intensive tutoring (Hussey & Wieczorek, 1991; Merritt, 1991). Schools of nursing in Chicago and New York improved the licensure exam pass rates of minority students from 33 to 100% and 37 to 94%, respectively, after intervention (Hussey et al., 1991). Other research supports that for the culturally diverse student to be successful, group support meetings, peer support, and tutorial services to correct academic deficiencies are crucial to academic success (Holtz & Wilson, 1992).

Several additional variables have been identified that contribute to minority students' success in college. These variables include positive self-esteem, understanding and managing racism, pragmatic self-evaluation, identifying long- rather than short-term goals, access to a supportive, mentoring individual, experience in a leadership position, and participating in community service (Sedlacek, 1987).

In their research regarding the relative effects of cognitive versus noncognitive variables for grade achievement and persistency (inclination to stay on target to complete a task or chosen goal) in college students, Arbona and Novy (1990) found ethnic differences. They found that "for White students, academically related variables are the best predictors of grades, whereas the noncognitive variables are the best predictors of persistence" (p. 428). Specifically, these two researchers found that the noncognitive variables that contribute to persistency among White students are: (a) preference for long-term goals compared to short-term goals, (b) family support for college plans, and (c)participation in extracurricular activities and community activities while in high school.

Conversely, they found that the seven noncognitive variables mentioned by Sedlacek (1987) were not particularly predictive of college grades or persistence among African-American and Mexican-American students. Instead, their study showed that high academic ability and goal commitment seem to be the best predictors of academic achievement and persistency for African-American and Mexican-American students.

These findings differ from previous findings by Tracey and Sedlacek (1987) and Valencia (1994) that indicated that certain noncognitive variables (positive self-concept, realistic self-appraisal, and academic familiarity), do predict persistence and academic success among African-American and Mexican-American students.

Rodgers (1991) studied minority student success in predominantly White schools of nursing. She found predictors of success for Black students to be self-concept of ability and high school GPA, and predictors for other minority students to be high school GPA. For the total sample, which included 117 White students, 40 Black students, and 33 other minority students, predictors of success were SAT scores, self-concept of ability and self-esteem scores.

Asian American students generally have higher academic achievement than other minority students. They have higher achievement scores, lower dropout rates, and higher college entrance rates than other students (Hsia & Peng, 1995).

Peng and Wright (1994) studied data from over 25,000 students involved in the National Education Longitudinal

Study of 1988 to identify possible reasons for this level of academic achievement. They found that Asian American students were more likely to live in an intact two-parent family, to spend more time doing homework, and to attend more lessons outside of school. Also, Asian American parents had higher educational expectations for their children, although they did not directly help their children in school work more than other parents.

Fuertes, Sedlacek, and Liu (1994) found that academic as well as non-academic variables are important and indicative of Asian-American students' success in college. SAT scores, particularly in math and verbal areas were found significantly related to success, as were the non-cognitive variables of positive self-concept and confidence in their ability to negotiate the social demands of the college environment.

Many factors related to student ethnicity appear to be related to student success. These findings suggest the importance of research that looks at additional factors that affect performance across ethnic groups.

Marital Status

The family environment is an important source of social support, but may also be a source of additional stress. Research regarding the relationship between marital status and academic success is mixed.

Allen, Higgs, and Holloway (1988) did not find a significant relationship between nursing student success and marital status. There was no difference in success between married, single, or divorced students. Ryland, Riordan, and Brack (1994) found that students who were not able to persist in the completion of college courses were much more likely to live alone than students who were successful in course completion. They state that living alone may imply less social support for these students.

Research supports that female married students may be at a comparative disadvantage to male married students. Female students report significantly poorer marital adjustment than do male students. This may be due to gender role socialization, where women typically provide their partners with more social support than they receive from them (Mallinckrodt & Leong, 1992). A survey of law and medical students found that 31% of the men, but only 19% of the women, described their spouses as moderately or very supportive (Clark & Rieker, 1986).

Part-time vs Full-time Status

Research related to course load revealed mixed results as it related to science success. Allen, Higgs, and Holloway (1988) in their study of factors affecting nursing student success, did not find number of hours worked or course load to be significantly related to student success.

Ryland, Riorland, and Brack (1994) in their study of factors affecting persistence/attrition of high-risk students, found that nonpersisting students devoted nearly 8 hours more per week to employment than persisting students. In addition, Ballantine (1989) found ethnic variations in course load in that more Black students than White students pursue higher education on a part-time basis.

Previous Education

Allen, Higgs, and Holloway (1988) studied 296 nursing students to identify factors which were predictive for student success. They found that previous experience as a nurse's aid or a licensed practical nurse was not significantly related to nursing program outcomes.

Psychosocial Factors

Numerous psychosocial factors may influence academic performance. A review of the literature has identified three primary factors in this category to be:

1. Self-esteem
2. Self-concept of ability
3. Social support

Self-esteem

Self-esteem is what many of us define as "feeling good about ourselves." It can be defined as the level of satisfaction that individuals attach to their descriptions of themselves (Black, 1991). Psychologists call it "global self-esteem" or "global self-concept." This general valuing of self is fundamental to human functioning.

Black (1991) conducted an extensive review of more than 100 publications about self-esteem and found that more than 10 terms are used to approximate the meaning of self-esteem. These include self-worth, self-image, self-concept, and self-awareness. The imprecise terminology contributes to confusion, misunderstanding, and misapplication of findings regarding this concept.

Global self-esteem is a rather fixed and stable psychological state, not too amenable to change (Moeller, 1994). Generally, self-esteem is formed by about the age of 5 and is shaped primarily by one's home and family, with schools having less impact. Marsh (1989) reported that self-concept declines with age from early preadolescence to middle adolescence, levels out, and then increases through late adolescence and early adulthood. Nunn (1994) also found that older age students were more positive in their self-evaluation than younger students. Moeller (1994) proposed that global self-concept in early adolescence may decline because it is dependant more on nonacademic factors, such as social activities.

Self-esteem is viewed as a strong motivational force for individuals, including students. The desire to maximize the self and to avoid negative feelings is a major motive of human beings. Feelings of self-worth are correlated with psychological well-being and are characterized by a sense of self-acceptance, intrinsic worth, positive feelings of self, self-satisfaction, and self-confidence (Rosenberg, 1989).

Schools have the power to enhance or hinder students' self-esteem through policies and practices, curriculum and instruction, institutional climate, and teacher personality characteristics. The factors in a school which most affect student self-esteem include climate, grouping, decision-making systems, and systems of reward and punishment (Moeller, 1994).

The minority student on predominately White college campuses may be confronted with special self-esteem problems which have the potential to affect academic performance. Sedlacek (1987), reports that non-cognitive factors such as decreased self-esteem, racism, student perceptions of academic ability and social isolation may play a role in explaining academic success of minority students.

The research is mixed regarding the relationship of global self-esteem to academic achievement. Rodgers (1991) found a positive relationship between levels of global self-esteem and academic success for the combination of minority and non-minority subjects in her study. It is interesting to note that when minority student data was isolated in this study, self-esteem was not found to be a significant predictor. Allen, Higgs, and Holloway (1988) found that self-regard subscores were significantly related positively to nursing school GPA and negatively to noncompletion of the nursing program. Sedlacek (1987) in his longitudinal studies with minority students found that positive self-concept and realistic self-appraisal of academic ability were highly correlated with grade point average at all points in a student's academic career.

Conversely, Moeller (1994) in an analysis of almost 1,500 students, found neither global self-esteem nor academic self-concept affected educational attainment. Research by Demo and Parker (1984) revealed no association between academic achievement and overall self-esteem. The evidence, thus, remains unclear as to the effect that global self-esteem has on academic success.

Self-concept of Ability

In addition to having global feelings of self-esteem, we also have feelings about ourselves in specific areas. The term "academic self-concept" is used in the literature to refer to one's view about their academic competence in a specific knowledge area (Moeller, 1994). Brookover (1964) describes self-concept of ability as the individual's assessment of his or her ability to learn in the school context. There is clear evidence for the separation of academic self-concept from general self-concept (Marsh, Byrne, & Shavelson, 1988; Marsh, Walker, & Debus, 1991). Academic self-concept may vary significantly from area to area. For example, math and verbal self-concepts have been found to be nearly uncorrelated in numerous studies (Marsh, 1986, 1990; Marsh, Walker, & Debus, 1991).

Accuracy of academic self-concept refers to the amount of agreement between self-assessment of academic ability and independent external criteria such as teacher ratings of academic performance or achievement test scores (Connell & Hardi, 1987). Eshel and Kurman (1994) found that both academic self-concept and accuracy of perceived ability were significantly associated with academic achievement. They compared students who underestimated their ability to students who overestimated their ability. They found the accuracy of perceived ability and actual attainment were significantly related for overestimators but not for underestimators. In their study, self-concept of ability appeared to be highly resistant to negative teacher feedback in the form of grades. It was also found that the larger the gap between perceived ability and teacher ratings of scholastic performance, the lower the students' academic attainment. Possible reasons given for this difference in perceived and demonstrated ability included: (a) the inability of less intelligent students to comprehend cues pertaining to grading criteria, or (b) parents and teachers telling students that they can do better, implying that their ability is higher than it actually is.

The exact influence that academic self-concept has on academic performance in high school and college is not clear. What is clear from various studies is that global self-concept does not cause academic achievement, but academic achievement in a certain area may increase self-concept. In an analysis of almost 1,500 students, neither global self-esteem nor academic self-concept affected educational attainment 5 years after high school graduation. Contributing heavily to later educational achievement were high school performance, actual academic ability, and socioeconomic status (Moeller, 1994).

Self-esteem is personally constructed out of interactions with the environment. Students of differing cultural backgrounds, thus, might respond differently from non-minority students on tests of self-concept of ability. Beane (1991) found it interesting that while young people in South Korea and Japan score higher than those in the United States on international comparison tests in mathematics, the U.S. students come out on top in measures of self-esteem related to math competency. One explanation for this observed difference was that it is culturally impolite in

Oriental cultures to say that one can do well, even if one thinks that is so.

Academic self-concept is actually a self-assessment of relative, rather than absolute competence. Generally, students who are gifted, as a group, have a strong self-concepts both in academic and social areas as measured by self-concept inventories. It is interesting to find evidence that highly gifted learners and gifted girls may have less positive self-concepts than other gifted students. There also appears to be a slight temporary reduction in self-esteem for students who relate most often with peers of equal or superior ability in special programs (VanTassel, Olszewski-Lubilus, & Kulieke, 1994). This response has been termed the "Big-Fish-Little-Pond-Effect" (BFLPE) by Marsh and Parker (1984). As discussed above, students form their academic self-concepts by comparing their academic performance against other students in their own classroom, rather than against some larger reference point such as national standards. A statistically significant small negative relationship (about -.20) exists between the average academic skill level of one's school and academic self-concept when skills are held constant. For two students of equal skills, the BFLPE would predict a lower academic self-concept for the student in the school with higher achieving students.

Age also may play a role in self-concept of ability. Nunn (1994) in his study of 759 adult learners, found that students between the ages of 25 to 30 years had lower levels of self-concept as a learner than younger or older students. Marsh (1989) found that self-concept declined during early adolescence, but increased from late adolescence through early adulthood.

Self-concept in specific areas may affect specific academic outcomes. Caon and Treagust (1993), in a study of 197 college students in science courses, found that students in the "unsuccessful" group of students (received grades below credit level) perceived the course to be either "much too difficult" or "somewhat difficult" for their science background. Most (83%), of this group of students who did not receive credit for the course, thought that the course was much too difficult. The middle and highly successful students thought much higher of their academic ability. In the low group, 60% agreed with the statement that they had never been good at science, as did 34% of the middle group. Only 18% of the highest group had a negative self-image in science. Additionally, unsuccessful students in this study were not convinced of the relevance of the science course to their career goals.

Okun and Fournet (1993) investigated the effect of semester GPAs on the perceived validity of grades and whether this varied with academic self-esteem. They found that in subjects with high semester GPAs, high academic self-esteem subjects perceived their grades to be more valid than low academic self-esteem subjects. Among subjects with low semester GPAs, grades were perceived as less valid by high, as opposed to low, academic self-esteem students. The authors felt that by discounting the validity of poor semester grades, high academic self-esteem students were able to maintain a positive view of their student identity.

Social class standing may also have an influence on self-concept of ability levels. VanTassel et al. (1994) found significant differences in self-concept of ability related to students being members of advantaged or disadvantaged groups. Even when given high levels of gifted program support, the disadvantaged students still showed significantly lower perceived academic and social self-competence than their more advantaged peers. They also expressed a feeling of less support by significant others in their environment.

Research is mixed regarding gender and its relationship to academic self-concept. Marsh (1989) found that gender differences in specific domains of self-concept were typically consistent with gender stereotypes. Across different domains there were some gender differences favoring girls but more favoring boys. Global measures of self-concept typically favored boys, although the differences were usually small. Boys were found to have higher math self-concepts whereas girls had higher verbal and school self-concepts. Research by Hattie (1992) reported self-concept differences favoring males for general, physical, and math self-concept and differences favoring females for verbal self-concept. Marsh (1993) did not reveal gender differences in self-concept of ability in either general, math, or verbal domains.

<u>Social Support</u>

Social support is defined as a person's perception of whether and to what extent an interaction or relationship is helpful. Social support is further defined as including emotional, informational, and tangible support. Emotional support refers to attachment, reassurance, and a sense of being able to confide in and rely on another person. Informational support includes giving information and problem-solving advice as well as providing feedback about how one is performing. Tangible support involves the provision of direct aid or services (Marshall, 1989).

The opposite of support is dissupport. Malone (1988) used this term and defined dissupport as emotional assault, criticism, misinformation, and resource consumption. Social dissupport comes from relationships that consume a person's resources to the point of being harmful to functioning and health. These injurious relationships may be hard to eliminate, especially if they involve relatives or coworkers. Social support can be conceptualized as one end of a continuum and social dissupport as the other end. As a student's social network becomes less supportive, the ability to function diminishes and the student's grades may fall or they may drop out completely. Conversely, increased social support should improve functioning and result in higher student success rates.

Kahn (1979) described social support as "interpersonal transactions that include one or more of the following: the expression of positive affect of one person toward another; the affirmation or endorsement of another person's behaviors, perceptions, or expressed views; the giving of symbolic or material aid to another" (p. 85). Norbeck et al. (1981) used this definition as a portion of the conceptual basis for the development of the Norbeck Social Support Questionnaire, and thus focuses on affect, affirmation, and aid as major components of the tool.

Numerous research efforts support the importance of social support in academic success. Marshall (1989) found that students who were successful in school had significantly more people in their social network and these people had greater impact on their lives than students who were unsuccessful. Parents, spouses, and children were listed almost equally by both successful and unsuccessful students. It is interesting to note that only successful students listed classmates as part of their social network, and fewer unsuccessful students listed instructors as having an impact on their lives. Successful students also listed more instances of emotional, informational, and tangible support in this study than did dropout students. Cooper and Robinson (1991) studied the relationship of mathematics self-efficacy beliefs to mathematics anxiety and performance. They found that perceived support from parents and support from teachers had statistically significant relationships to the level of mathematics self-efficacy expectations and to the level of career self-efficacy expectations.

Some research supports gender differences related to social support. Wohlgemuth and Betz (1991) studied 115 college students to determine the relationship between gender, stress and social support. The women in this study (n=65) reported significantly more negative stressful events, more physical symptomatology, more socially supportive behaviors being done on their behalf, and more satisfaction with the support that they received from their friends than did the men. The women also reported significantly larger perceived social support networks. No gender differences were found for scores of satisfaction with perceived social support received from family, or for total satisfaction with perceived social support.

Mallinckrodt and Leong (1992) found that female students reported significantly more stress, had more symptoms of stress, and significantly less support from their academic departments and family environments than did male students. They found that women were more likely to report inadequate financial resources and lower quality of leisure time, as well as less communication and cohesion support in their family social system.

Preferred sources of academic social support may vary according to ethnicity and degree of acculturation. Solberg, Choi, Ritsma, and Jolly (1994) found that Asian-American college students who expressed lower identification with the majority group were more likely to indicate preferences for seeking help from a variety of sources within the university, including student organizations affiliated with ethnic groups, church groups, other registered student organizations, and minority student affairs offices more than the more aculturated Asian-American students. Atkinson, Whiteley, and Gim (1990) found that for Asian-American students with minority identification, their preferred sources of support were family and friends outside of the university.

Summary

This chapter has presented a review of the literature with an emphasis on academic achievement in the sciences. Included are pertinent research and discussion of the concepts of academic success, and influencing factors among academic variables and non-academic variables, including both sociodemographic and psychosocial factors. Application of these findings guided the design of the present study.

CHAPTER III

METHODOLOGY

A modified descriptive survey design was utilized to gather data concerning college-level students and their success in college science courses. Slavin (1992) defines survey research as "research directed at determining the level of some variable for a particular population, usually by sampling a relatively small but representative group from among a much larger population" (p. 254). This study was modified in order to examine relationships among variables and between sample sub-groups.

Setting

The present study was conducted at one campus of a state-supported community junior college in a metropolitan area of one southern state. This community college has an enrollment of approximately 28,000 students on three campuses.

Subjects

Research subjects were solicited from all students who had taken the TASP exam, were 18 years of age or older, and were currently enrolled in one or more of four basic science courses at one southwestern community college. After asking all students to participate, a total of 162 subjects was obtained, who met the research subject criteria and who were in one of 21 sections of the four identified science classes. Although 162 subjects accepted the questionnaire, only 45 returned a completed instrument. Thus, the return rate for the study was 21.6%.

Protection of Human Subjects

The researcher's committee read and approved the Prospectus for this study, and determined that the research fell under Level 2 of the Guidelines for Human Subject Review. This section pertains to research involving minimum risks to the subjects and not utilizing minors as subjects. Subsequently, permission to conduct the study was obtained from the Human Subjects Review Committee, who determined that their requirements for protection of the individual subjects' rights would be met by the design for informed consent (see Appendix A). Finally, written permission to conduct this study was obtained from the university (see Appendix B).

Subjects were informed of the purpose of the study by means of a verbal explanation at the time at which their participation was solicited (see Appendix C). All subjects consenting to participate by completing a research questionnaire were asked to read and sign a two-page written consent document that was enclosed with the research tool. These consent forms were signed and returned by each subject with the completed research tool. An extra copy of the consent form was included with instructions that it was to be retained by the subject. To ensure confidentiality, subjects were asked to return the research form in a pre-addressed envelope provided by the researcher. Subjects were informed that all questionnaires would be shredded at the end of data analysis.

Instruments

Several instruments were used in this study. They included three scaled instruments, a demographic questionnaire, and an interview protocol.

Rosenberg Self-esteem Scale

This scale, developed in 1965, purports to measure a basic feeling of self-esteem. It is one of few scales developed to measure a single dimension, global self-regard, and is the most widely used tool to measure self-esteem (Gecas, 1982). Wylie (1974) states that Rosenberg explicitly chose items that seemed to him to have face validity, in addition to an acceptable reproducibility value, which gave him a basis for inferring unidimensionality of the scale.

It consists of 10 items to which the subject responds on a 4-point scale from "strongly agree" to "strongly disagree." Reliability coefficients from 0.85 to 0.92 and validity correlations ranging from 0.56 to 0.83 with similar measures have been reported (Rosenberg, 1979). It is particularly significant that this tool is reported to have such a high reliability with so few items, since reliability is often a function of test length. However, Rosenberg (cited in Robinson & Shaver, 1973) presented considerable data about construct validity of this tool. A strength of the scale is its brevity, which makes its use appealing with a completion of time of less than 5 minutes.

The 10-item scale uses a Likert-type scoring system with responses ranging from strongly agree to strongly disagree on a four point scale. Items 1, 3, 4, 7, and 10 are reverse scored. For each item respondents are assigned a score ranging from 1 (strongly agree) to 4 (strongly disagree). For this scale, a respondent can obtain a score ranging from 10 to 40 (see Appendix D).

<u>Brookover Self-concept of Ability Scale: General</u>

This form is an 8-item tool which measures a student's perception of their academic ability (Brookover, 1964). This scale was developed in order to study the relationship between self-concept of ability and school success. The original scale was designed for junior high school and high school age students. A general form has been used with post-high school students. This general tool consists of 8 questions in a multiple choice format with five possible answers for each of the eight questions. Each answer is assigned a numerical score of from 1 to 5, for the lowest to highest self-concept responses respectively. For this general scale, a respondent can obtain a score ranging from 8 to 40. Reliability coefficients from 0.79 to 0.82 have been reported. Brookover (1987) states that in excess of 200 people have requested permission to use the tool. In Brookover's study, scores on the Self-concept of Academic Ability Scale had a correlation of .50 with mean school grades. It was discovered that the scores changed from time to time, raising some issues of reliability, which the author attributes to perceived changes in evaluations of the student's ability by parents, friends, and teachers, as well as changes in student grades. This point would certainly be one to keep in mind in this study with college students.

A revised form of this scale was used, with 4 items regarding expectations of ability adapted and added from <u>Brookover Self-concept of Ability Scale: Secondary</u>. The resulting scale thus consisted of 12 items, the 8 general scale items and the 4 additional secondary scale items. Response choices of the revised instrument asked the respondent to evaluate his or her academic ability in comparison to others by ranking it on a 5-point scale. For each item respondents are assigned a score ranging from 1 to 5, with items 1, 3, 4, 5, 6, 7, 8, 9, 10, and 12 reverse scored. For this scale a respondent can obtain a score range of from 12 to 60 (see Appendix E).

Norbeck Social Support Questionnaire

This scale is a short, self-administered, 9 item questionnaire which taps three major components: (a) functional aspects, (b) network, and (c) loss. Affect, affirmation, and aid are the functional aspects assessed. Number in the network, duration of relationships and frequency of contact are the network properties measured. Loss is assessed in terms of categories of persons lost and the amount of support lost. This tool was based on the conceptual definition of social support proposed by Robert Kahn (1979), who defined social support as "interpersonal transactions that include one or more of the following: (a) the expression of positive affect of one person toward another, (b) the affirmation or endorsement of another person's behaviors, (c) perceptions, or expressed views, and (d) the giving of symbolic or material aid to another" (p. 85). Therefore, affect, affirmation, and aid are proposed as the three components of supportive transactions.

Research by Norbeck, Lindsey, and Carrieri (1983) established normative scores for employed adults to be: (a) affect--Mean of 73.49, Standard Deviation of 36.25, (b) affirmation--Mean of 66.06, Standard Deviation of 32.33, (c) aid--Mean of 62.35, Standard Deviation of 32.24, and (d) total functional--Mean of 201.90, and Standard Deviation of 95.87. In the initial development research, Norbeck et al. (1981) tested 135 nursing students, and found that the test-retest reliability of the instrument was .89 and the internal consistency was .88. Evidence for concurrent validity was determined by correlating the scale with the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960), which purports to measure social support. A positive correlation of .54 was obtained. Additional work is needed to establish construct validity.

Because of the multidimensionality of the social support concept, a special format was developed to present a complex task in a simplified form to respondents for self-administration. This format consists of a series of half-pages that are visually aligned with the subject's personal network list. After listing up to 20 network members, respondents are directed to turn to the first half-page. On that and each succeeding half-page, two questions are presented and numbered spaces for ratings correspond horizontally with the entries on the network list. In each question, the respondent is asked to rate each of their network members on a Likert-type scale.

The test-retest reliability for each of the functional items and network property items ranges from .85 to .92. Analysis for internal consistency resulted in .89 or above for each of the three functional properties of social support. Correlations among the three network property items ranged from .88 to .96 and for the three loss items from .54 to .68 (Norbeck, 1983).

For each of the persons listed in the respondent's personal network, 9 questions are answered. For questions 1 through 6, a 0 to 4 scale is used, with the minimum score for each of these questions being 0, and the maximum score being 4 times the number listed in the network. For questions 8 and 9, a 1 to 5 scale is used, with the minimum score for each of these questions being identical to the number of people listed in the network, and the maximum being 5 times the number listed in the network. Question 9 is answered slightly differently, with either a Yes or No response. For respondents answering Yes to question number 9, they then are asked to further identify loss in terms of the number of sources lost and the amount of support no longer available. These answers are given in a multiple choice format (see Appendix F).

<u>Demographic Questionnaire</u>

A short, 2-page survey questionnaire was developed by the researcher to assess personal and demographic information. It was based on relevant literature and on the personal experience of the researcher (see Appendix G).

<u>Interview Protocol</u>

A series of open-ended questions and optional probes was developed by the researcher to guide the interviews conducted with a sub-sample of study participants. These questions were developed through a review of the literature and reflections of experiences of the researcher as a college educator (see Appendix H).

Research Questions

This research was guided by the intention to determine answers to the following five research questions:

1. Is there a relationship between success of students in science courses and selected non-academic variables of self-esteem, self-concept of ability, and perceived social support?

2. Is there a relationship between success of students in science courses and cumulative science course GPA, total GPA, TASP scores?

3. Do ethnic groups of students in science courses differ significantly in their scores on measures of self-esteem, self-concept of ability, social support, TASP scores, GPA in science courses, or total GPA?

4. Do the demographic characteristics, other than ethnicity, which describe minority students differ from those which describe non-minority students in science courses?

5. What combination of factors are the best predictors of success for all students, minority students, and non-minority students in science courses?

Research Design

The design of this study was that of a modified descriptive survey that used both qualitative and quantitative data. This research defined and compared groups of varying characteristics and enriched the resulting description strength through qualitative interviews with sub-samples.

Procedures

After obtaining college and faculty approval, students who were enrolled in selected science courses on one college campus and had taken the TASP test, were asked to participate by completing the research tool. The researcher was given permission by each of the instructors who taught one or more sections of the four target science courses, to address students either at the beginning or end of class and ask for their participation in the research. During the semester in which the research was conducted, a total of 21 sections were offered for the four target science courses. Over a period of 3 weeks, the researcher approached all 21 sections of these classes. A written statement was read by the researcher, outlining the purposes of the research, the requirements, criteria of subjects, and possible risks that subjects might have if they participated as a volunteer subject. All subjects who consented to participate were given a research packet at the time in which they volunteered in class. This packet consisted of copies of an introductory letter, which thanked the subjects for their participation and instructed them on the completion of the two consent forms, and the research tool. The instrument was completed out of class, and returned with one of the signed consent forms to either the instructor of the class or the science department office. They, then, were delivered to the investigator by means of campus mail.

Students were given 3 weeks to complete the tool and return to the researcher. At the end of that time, only 38 tools had been returned. Faculty in each of the 21 classes were sent a letter from the researcher that asked them to remind their students that had taken a questionnaire to return it as soon as possible. The subjects were given an additional 2 weeks, during which time, 7 additional tools were returned, for a total of 45. All of these were complete and usable.

A random sample of 20 students was identified by computer generated list, from those students returning the completed instrument. An attempt was made to contact these students for the purpose of scheduling an interview with the researcher at a convenient time. Open-ended interviews were then accomplished with all consenting students from the random sample who were able to be contacted. Twelve of the original 20 students were contacted by phone and agreed to meet for interviews. Of the remaining 8 students, 6 were not able to be contacted and 2 were not able to meet for an interview. Replacement sampling and recruitment was conducted until a total of 19 interviews were completed.

Quantitative, face-to-face, interviews were conducted using an open-ended questionnaire and probes developed by the researcher. The purpose of these interviews was to identify additional factors that may be related to science course success and to further enhance explanatory dynamics.

Statistical Analysis

Descriptive statistics were used to describe the sample and sub-sample, and stepwise multiple regression was used to identify significant sets of variables. Multiple regression is a statistical method for understanding the effects of two or more independent variables on a dependant variable. Regression analysis provides a mechanism for researchers to make predictions about phenomena. Use of more than one predictor (independent) variable in the regression equation can often improve the precision of the predictions.

CHAPTER IV

RESULTS

The purpose of this study was to examine the relationships among selected academic variables (SAT scores, current science course GPA, and cumulative science course GPA) and non-academic factors (self-esteem, self-concept of ability, and social support) and academic success (current science course GPA) for college-level students in science courses. Questionnaires were used to obtain data regarding demographics and scores on the non-academic factors. Subject permission was obtained to access college records for academic data. Additional data were obtained by means of interviews in an attempt to further identify significant factors affecting success of college students in science courses. The results of the data analysis are presented in this chapter. The first section describes the characteristics of the subjects. The second section discusses the statistical analysis for each of the research questions and integrates additional information obtained by means of subject interviews.

Description of Sample

There were 45 students participating in this research. They represented a wide range of ages and a variety of ethnic groups.

Age

The youngest participant in this study was 18 years of age, and the oldest 49 years of age. The mean age was 29 years, the median age was 31 years, and the most common age was 22 years. It is interesting to note that the average age of subjects in this sample is identical to the average age of all students enrolled at the community college at which the research was conducted.

Gender and Ethnicity

There were 7 males (15.6%) and 38 females (84.4%) in the sample (see Table 1). Subjects were ethnically diverse, with 2 Asians (4.4%), 1 Black (2.2%), 40 White (88.9%), 1 Native American (2.2%), and 1 Hispanic (2.2%). This represented 88.9% non-minority and 11.1% minority subjects. Of the subjects, 21 (46.7%) were married, 20 (44.4%) were single, and 4 (8.9%) were divorced.

Table 1

Number of Subjects by Race/Ethnicity and Gender

Race/Ethnicity	Male	Female	Total
Black	0	1	1
White	6	34	40
Native American	0	1	1
Asian American	1	1	2
Hispanic	0	1	1
Column Totals	7	38	45

Employment

A total of 36 subjects (80%) were employed and 9 subjects (20%) were not employed (see Table 2). The subjects who were employed worked from 4 to 60 hours per week, in a variety of areas of employment. There were 6 subjects employed in the medical field, 3 were teachers, 1 worked in sanitation, 7 were in retail sales, 9 worked in office/clerical positions, 7 worked in restaurants, 1 had a work study position, 1 was a delivery person, and 1 worked for a utilities service. The average number of hours worked per week was 23 hours, with the most common amount of employment being full-time at 40 hours per week.

Table 2

Employment of Subjects by Race/Ethnicity

Ethnicity	Employed	Unemployed	Total
Black	1	0	1
White	32	8	40
Native American	1	0	1
Asian American	0	2	2
Other	1	0	1
Column Totals	35	10	45

Break in Education

Subjects were all at least high school graduates, with 2 having 13 years of education, and 8 having 14 years of education. Only 6 students had experienced no break in education since high school, while 39 had experienced a break (see Table 3). One significant finding was that only younger students, the oldest being 21 years of age, reported no break in education. This pattern is consistent with younger students remaining at home and continuing their education. The breaks in education did not appear to be related to yearly income, 9 subjects with incomes in excess of $60,000 per year had a break in education.

Table 3

Break in Education by Age

Age Range	Break in Education	No Break in Education
18-19	2	4
20-29	14	2
30-39	17	0
40-49	6	0
Column Totals	39	6

Income

Subjects reported yearly family incomes which ranged from \$3,000 to \$130,000 per year, with the average income being \$41,000 per year and the median income being \$35,000 per year. Several subjects ($\underline{n}$=18) received financial aid in amounts of between \$300 and \$2100 per semester.

Profile Summary

The modal student in this study was a 22-year-old White female who was employed full-time in an office/clerical position. She was pursuing her degree, most often in nursing, after a post-high school break in education.

Findings

The results of the study are organized according to the research questions identified at the onset of the investigation. The research question is stated, a null hypothesis is formulated, and, then, statistics are given supporting a research decision.

Research Question 1

Is there a relationship between success of students in science courses and selected non-academic variables of self-esteem, self-concept of ability, and perceived social support?

Null Hypothesis: There is no relationship between success of students in science courses and the selected non-academic variables of self-esteem, self-concept of ability, and perceived support.

In order to answer the first identified research question, backward multilinear regression analysis was used. With 45 subjects in the study, the process of elimination was accomplished with each set of data until equations with less than 9 variables were identified and R^2 was maximized. Equations with less than 9 variables were needed as multiple regression requires no fewer than 5 subjects per variable in the prediction equation; thus, sample size of 45 limits predictor variables to 9 or fewer. Ensuring assumptions were not violated was further accomplished by examination of scatterplots of residuals. Scatterplots which approached nearly a normal curve supported the conclusion that assumptions were not violated.

This hypothesis was investigated by means of backward multilinear regression analysis against the dependent variable of present science GPA, and independent variables representing non-academic factors of self-esteem, self-concept of ability, and social support. They included these scores: (a) Rosenberg score, (b) Brookover score, (c) loss quality score, (d) loss quantity score, (e) loss score (if loss occurred or not), (f) frequency score for loss, (g) affect score, (h) affirmation score, (i) aid score, (j) duration score, (k) number of support score, (l) total loss score, and (m) total functional social support score.

Backward multiple regression was accomplished, and yielded a number of significant equations with less than 9 predictor variables. These equations were evaluated for efficiency (i.e., minimizing the number of predictors while maximizing the amount of explained variance [$\underline{R}^2$]). It was concluded that the 7-variable equation was most efficient. The 7 predictor variables included the following: (a) Rosenberg score, (b) Brookover score, (c) loss quality score, (d) loss quantity score, (e) aid score, (f) total loss score, and (g) total functional social support score.

At this point, R^2 was .32894, with a significant F of .0280 and a F of 2.59. Thus, approximately 1/3 of the variance in the dependent variable, student success, was explained by this equation. An equation with only 6 independent variables resulted in a reduction of R^2 to .28405 and the loss of the Rosenberg scores as a variable. Results are presented below for the regression equation of 7 independent variables (see Table 4).

Table 4

Regression Equation Results for Hypothesis Number 1

Variables in Equation	Statistics for Equation	
Rosenberg, Brookover, loss quality, loss quantity, aid, total loss, total functional social support	Multiple R	.57354
	R^2	.32894
	Adjusted R^2	.20199
	Standard Error	11.67161
	F	2.59099
	Significant F	.0280

As indicated in Table 4, data analysis revealed that the Calculated F value exceeded the critical F value, thus the null hypothesis was rejected, $p \leq .05$, and it was concluded that there are significant relationships between self-esteem (Rosenberg), self-concept of ability (Brookover), and social support (sub scales of Norbeck), and success of students in science courses (course GPA). The seven non-academic variables explained 32.89% of the variance in science course GPA.

Examination of the beta coefficients for the seven variables (see Table 5), indicates that the greatest contributor to prediction of science success is total loss, followed by loss quality. Rosenberg is the least effective of the 7 predictors, and, of course would be the next to be eliminated in continued regression procedures.

Table 5

Regression Equation Variables for Hypothesis Number 1

Variable	B	SE B	Beta	T	Sig T
Rosenberg	-.682	.433	-.265	-1.575	.124
Brookover	1.413	.412	.581	3.426	.001
Loss quantity	-21.653	8.917	-.864	-2.428	.020
Loss quality	-23.941	10.603	-2.508	-2.258	.030
Total loss	20.223	8.393	5.648	2.409	.021
Aid	-.351	.213	-1.066	-1.650	.107
Total Functional	.125	.071	1.127	1.756	.173

It was concluded that there are significant and meaningful effects of the psychosocial variables of self-esteem, self-concept of ability, and social support on achievement in science courses.

Research Question 2

Is there a relationship between success of students in science courses and the academic variables of total GPA, cumulative science course GPA, and TASP scores?

Null Hypothesis: There is no relationship between current science course GPA and the academic variables of total GPA, cumulative science course GPA, and TASP scores.

This hypothesis was investigated by means of backward multiple regression, with the process beginning with the five academic variables of: (a) cumulative science course GPA, (b) cumulative overall GPA, (c) TASP writing scores (d) TASP reading scores, and (e) TASP math scores. The dependant variable in the equation was the current science course GPA. Backward regression was continued to the point at which three academic variables remained (see Table 6).

Table 6

Regression Equation Variables for Hypothesis Number 2

Variable	B	SE B	Beta	T	Sig T
Cum. Science GPA	.704	.144	.606	4.89	.000
TASP Math	-.129	.064	-.231	-2.01	.051
TASP Reading	.182	.828	.272	2.20	.034

Data analysis revealed significant relationships among academic variables and success of students in science courses. With an *F* of 14.758 and a significant *F* of .0001, the null hypothesis, thus, was rejected. TASP reading scores, TASP math scores, and cumulative science course GPA accounted for 54% of the variance in current science course GPA (see Table 7).

Table 7

Regression Equation Results for Hypothesis Number 2

Variables in Equation	Statistics in Equation	
Rosenberg, Brookover, loss quality, loss quantity, aid, total loss, total functional social support	Multiple *R*	.738
	R^2	.544
	Adjusted R^2	.507
	Standard Error	9.296
	F	14.758
	Significant *F*	.0001

It was concluded that there are significant and meaningful relationships among the academic variables of cumulative science course GPA, TASP math score, TASP reading score, and success of students in science courses.

Research Question 3

Do ethnic groups of students differ significantly in their scores on measures of self-esteem, self-concept of ability, social support, TASP scores, GPA in prior or current science courses, or total GPA?

Null Hypothesis: There is no difference between scores of measures of self-esteem, self-concept of ability, social support, TASP scores, GPA in prior or current science classes or GPA for different ethnic groups of students in science courses.

This hypothesis was investigated by means of *t*-tests, looking for significant differences between group means of minority and non-minority groups for each of the specified variables. Due to a sample size of 45 subjects, consisting of 5 minority subjects and 40 non-minority subjects, a Levene test was done for each comparison between variables to check for equal variances. Equal variances were found in all of the comparisons except for the *t*-test between minority and non-minority subjects on their self-esteem scores. Accordingly, *t*-tests for the dependent variables were calculated using pooled variance except for the examination of the self-esteem scores, in which separate variance was utilized. Table 8 gives the statistical results for the *t*-tests for independent groups of minority and non-minority students in science courses.

Data analysis revealed no significant differences between minority and non-minority students for any of the identified research variables. It was concluded that there were no significant differences between minority and non-minority students enrolled in science courses.

Table 8

T-test Results for Hypothesis Number 3

Variable	Minority X	Minority SD	Non-Minority X	Non-Minority SD	t-value	Significance Level
Self-concept of ability	50.0	2.45	46.3	5.51	1.49	.143
Self-esteem	33.0	2.55	33.3	5.34	-.26*	.797*
Number of support sources	10.4	3.51	12.6	5.67	-.86	.394
Affect	72.2	32.03	86.2	44.18	-.68	.499
Affirm	59.8	29.46	77.6	39.30	-.97	.336
Aid	60.6	30.60	74.1	40.66	-.72	.478
Total Support	192.6	90.26	237.6	120.78	-.80	.427
Duration of Support	45.0	21.26	56.4	26.15	-.93	.357
Frequency	39.4	15.04	49.9	22.34	-1.02	.313
Loss	.60	.55	.48	.51	.52	.608
Loss Quantity	1.8	1.79	1.4	2.40	.34	.739
Loss Quality	1.4	1.67	1.1	1.35	.50	.622
Total Loss	3.6	3.78	3.0	3.68	.36	.722
TASP Reading	270	17.51	269	20.13	.08	.934
TASP Math	268	11.68	256	24.96	1.02	.315
TASP Writing	252	16.43	250	28.90	.17	.866
Cumulative GPA	3.14	4.72	3.10	6.48	.15	.882
Current GPA	2.8	10.95	2.52	13.40	.44	.662
Science GPA	3.26	1.02	2.68	1.15	1.06	.293

* = variances not equal, statistics for unequal t-tests used.

Little confidence should be placed in these results, however, due to the small sample size (N=45) and the even smaller sub-sample of minority students (N=5). With such a small group of minority students, many factors could be responsible for the observed similarities or differences. With 2 Asian-American students in the minority group, their scores possibly could have skewed the results, especially with the t-tests concerning academic variables. With only 2 Asian-Americans, 1 African-American, 1 Mexican-American, and 1 American Indian, the sample is not sufficiently large to make any generalizations regarding these ethnic groups of students.

It is of interest to note that significance was approached (2-tail significance level of .143) with self-concept of ability scores. The minority students had a mean score on the Brookover scale of 50, while the non-minority students had a mean score of 46. This finding, although not significant, may indicate a trend toward supporting the findings of Rodgers (1991) and Fuertes, Sedlacek, and Lin (1994), who found that, for minority students, self-concept of ability scores were significantly related to science success.

Research Question 4

Do the demographic characteristics, other than ethnicity, which describe minority students differ from those which describe non-minority students in science courses?

Null Hypothesis: There is no difference in demographic characteristics, other than ethnicity, between minority and non-minority students in science courses.

This hypothesis was investigated by means of Chi-square tests of variables expressed as nominal or ordinal data and by means of *t*-tests for variables expressed as interval and ratio data. Variables examined by means of Chi-square test included: (a) employment status, (b) financial aid, (c) marital status, (d) break in education, and (e) gender. The findings are presented in Table 9.

Table 9

Chi-square Results for Hypothesis Number 4

Variable	X^2	DF	Significance
Employment	.000	1	1.0
Financial Aid	.937	1	.33
Marital Status	2.96	2	.23
Break in Education	.216	1	.64
Gender	.965	1	.77

There were no significant dependent relationships with minority/non-minority status and any of the above demographic characteristics of the sample. Thus, we can conclude that minority students do not differ from non-minority students in science courses either in gender, employment, financial aid, marital status, or break in education.

Demographic variables examined by means of t-test included: (a) age, (b) number of persons living in residence, (c) number of adults in household, (d) number of children in household, (e) miles commuted per week, (f) hours per week of employment, (g) amount of financial aid, (h) yearly family income, (i) highest grade of school completed, and (j) number of college hours in which currently enrolled. A Levine's test was done prior to each t-test and equal variances between groups were found for all variables, thus the t-tests for equality of equality of means were calculated by a pooled variance formula. The results are presented in Table 10.

Data analysis revealed no significant differences with the exception of hours enrolled. The minority students were enrolled in an average of 14.4 hours of college classes, while the mon-minority students were taking an average of only 9.5 college hours. As each college hour taken reflects an average of 3 hours of class work-related study time outside of class, these figures may actually reflect many more hours than initially apparent in college-related studies each week. The small sample size again may be

Table 10

T-test Results for Hypothesis Number 4

Variable	Minority		Non-Minority		t-value	Significance Level
	X	SD	X	SD		
Age	23.6	5.60	29.7	8.60	-1.55	.129
No. in Res.	3.8	2.28	3.58	1.58	.29	.777
No. Adults	2.6	2.07	2.1	.93	.97	.338
No. Child	1.0	1.41	1.48	1.45	-.69	.492
Miles Commute	120	61.24	110	112.48	.18	.855
Hrs. Employ.	18	16.05	24	15.21	-.79	.434
Hrs. Enroll.	14.4	5.46	9.5	4.08	2.43	.019
Amt. Fin. Aid	380	8.50	381	6.00	-.01	.996
Yr. Income	50K	29.58	40K	25.62	.72	.474
Hi. Grade	12.2	.45	12.4	.81	-.60	.549

responsible for the failure to identify additional significant findings.

In summary, although few significant demographic differences were found, the minority students in this study were slightly younger, worked fewer hours per week, were enrolled in more college courses, and lived in families with slightly higher yearly incomes than the non-minority students. These statistics are not the norm for the minority student presently enrolled at the institution at which the research was conducted. These data may reflect that the minority subjects who volunteered and completed this survey questionnaire possessed characteristics that were different from the average minority student.

Research Question 5

What combination of factors are the best predictors of success for all students, minority students, and non-minority students in science courses?

Due to the small number of minority subjects in the sample, the researcher only looked at the combined group of students in science courses, including both minority and non-minority students. Thus, the research question that was investigated was: What combination of factors are the best predictors of success for students in science courses?

Null Hypothesis: No subset of factors will yield a significant multilinear association with current science course GPA.

In order to answer this research question, the predictor variables were grouped into one of the following three categories: (a) academic variables, (b) socio-demographic variables, and (c) psycho-social variables. Grouping was done in order to reduce the number of independent variables to be considered, at one time, due to the fact that with only 45 subjects, only 9 variables can be used as predictors without violating the assumptions of this test. Investigation was initiated by means of three preliminary multilinear regression analyses, one for each group of predictor variables, in order to identify subsets of best predictors from each of the groupings. The dependent variable for each regression analysis was the students' current science course grade point average. The three preliminary regression equations resulting from examinations of the three preliminary groupings are discussed separately below, and, then, the final analysis which combines the three subsets of best predictors is discussed.

Identification of Best Subset of Dependent Variables. The first step in this analysis was to enter academic predictor variables into a backward elimination regression procedure. A total of four predictor variables were entered; these included: (a) cumulative GPA, (b) TASP math scores, (c) TASP writing scores, and (d) TASP reading scores. This procedure generated equations which were examined for efficiency and significance. The most efficient and significant equation was selected, then checked for non-violation of assumptions by examination of a histogram of residuals. The resulting histogram approximated a normal curve and, thus, the equation was considered not to be in violation of the assumptions for the procedure. The selected regression equation, its statistics, and results of analysis of variance to test the significance of the regression equation are presented in Table 11.

Table 11

Results of Regression Analysis with Academic Predictor Variables

Part A: Prediction Equation

Variables in Equation	B	Beta	Regression Statistics
Cumulative GPA	.623	.293	Mult. R = .550
TASP Reading Score	.238	.356	R^2 = .302
(Constant)	-58.08		Adj. R^2 = .266

Part B: ANOVA of Regression

Source of Variance	DF	Mean Square	F-Statistic
Regression	2	1065.50	8.45
Residual	35	126.13	p = .009

Data analysis revealed that cumulative GPA and TASP reading scores were the most significant academic predictor variables. An equation formed with these two variables, their raw coefficients and the constant can predict 30% of the variance in current science grade. When tested through analysis of variance for significance of the regression equation, an F statistic of 8.45 (p=.009) was obtained.

Since a significant and efficient subset of variables was obtained through the regression procedure, further analysis was undertaken to clarify the relationship between the predictor variables and the dependent variable. The students were divided into two achievement groups: one group included the students who received current semester science course grades equal to or less than 2.9 GPA and the other group included the students who received current science course grades equal to or greater than 3.0 GPA. These numerical values were selected because students who score less than 3.0 (B) in pre-requisite science classes are rarely successful in their attempts to gain entry into advanced science/medical programs of study. *T*-tests of independent means were then conducted to determine if these two achievement groups were significantly different on each of the predictor variables. Table 12 presents the *t*-test results for the two predictor variables.

Table 12

T-test Results for Academic Predictor Variables

Predictor Variable	Achievement Group	Mean	*T*-Value	*DF*	2-tailed Significance
TASP Reading	$\leq$ 2.9	258.7	-3.48	39	.001
	> 3.0	278.0			
Cum. GPA	$\leq$ 2.9	2.76	-3.75	41	.001
	$\geq$ 3.0	3.40			

Both TASP reading and cumulative GPA were significantly different for the two achievement groups. The higher achievement group, having a grade of B or better, had a TASP reading score of almost 20 points higher than the lower achievement group, having a grade of C or less. The higher achievement group also had a higher cumulative GPA by more than one-half (.64 points) of a letter grade.

<u>Identification of Best Subset of Psychosocial Variables</u>. The second step in this analysis was to enter the 13 psychosocial variables into a backward elimination regression procedure. The 13 psychosocial variables included in the beginning equation included: (a) total loss scores, (b) Rosenberg scores, (c) Brookover scores, (d) loss quality, (e) loss quantity, (f) aid scores, (f) total functional support scores, (g) frequency scores, (h) loss scores, (i) affirmation scores, (j) affect scores, (k) duration scores, and (l) number of support systems scores. Again, the dependent variable of current science course GPA was utilized.

No equation generated by the analysis which had more than nine variables was considered due to violation of the assumptions for this parametric test because of the small sample size. Beginning with equations that had 9 or less psychosocial predictor variables, each equation was assessed for efficiency and significance.

It was determined that the 7-variable equation was the most significant and efficient equation, with the seven variables accounting for 33% of the variance in the dependent variable. The results obtained in this analysis are presented in Table 13.

Table 13

Results of Regression Analysis with Psychosocial Predictor Variables

Part A: Prediction Equation

Variables in Equation	B	Beta	Equation Statistics
Total Loss	20.223	5.64	Mult. R = .573
Rosenberg	-.683	-.266	R^2 = .329
Brookover	1.413	.582	Adj. R^2 = .202
Loss Quality	-23.942	-2.508	
Aid	-.352	-1.066	
Loss Quantity	-21.654	-3.864	
Total Functional Score	.125	1.127	
(Control)	-24.398		

Part B: ANOVA of Regression

Source of Variance	DF	Mean Square	F-Statistic
Regression	7	2470.730	F = 2.591
Residual	37	136.227	p = .028

The seven variables identified above accounted for 33% of the variance in current student science scores. A histogram plotting the residuals of the 7-variable equation approximated a normal curve, thus the equation was considered not to violate assumptions of the procedure.

T-tests of independent means of the two achievement groups, then, were conducted to clarify effects of the predictor variables. The results of these *t*-tests are presented in Table 14.

Table 14

T-test Results for Psychosocial Predictor Variables

Predictor Variable	Achievement Group	Mean	*T*-Value	DF	2-Tailed Significance
Brookover	≤ 2.9	45.3	-1.34	41	.188
	≥ 3.0	47.5			
Rosenberg	≤ 2.9	32.9	-.50	41	.622
	≥ 3.0	33.7			
Aid	≤ 2.9	82.9	1.3	41	.200
	≥ 3.0	67.2			
Total Functional	≤ 2.9	256.2	.90	41	.374
	≥ 3.0	223.8			
Loss Quantity	≤ 2.9	1.84	.75	41	.455
	≥ 3.0	1.29			
Loss Quality	≤ 2.9	1.16	-.02	41	.984
	≥ 3.0	1.17			
Total Loss	≤ 2.9	3.42	.37	41	.714
	≥ 3.0	3.00			

No significant differences between the two groups of students for any of the psychosocial variables were identified when the predictor variables were examined in isolation. Therefore, the significance registered in the regression equation represents the cumulative effect of the individual variables and their interactions with each other.

Identification of the Best Subset of Demographic Variables. The third step of this analysis was to enter the 16 identified sociodemographic predictor variables into a backward multiple regression equation. The 16 demographic variables included: (a) age, (b) gender, (c) ethnicity, (d) employment status, (e) type of employment, (f) receipt of financial aid, (g) amount of financial aid, (h) hours employed/week, (i) yearly family income, (j) highest grade completed, (k) number of adults in household, (l) number of children in household, (m) number of people in residence, (n) presence of any break in education, (o) number of hours of course work taken this semester, and (p) number of miles commuted to attend class each week. Again, the dependent variable for this equation was current science course GPA and equations with more than nine variables were not considered due to the possibility of violation of the assumptions because of the sample size. Beginning with equations of nine or fewer sociodemographic variables, each regression equation was assessed for efficiency and significance.

It was determined that the 5-variable equation was the most significant and efficient equation. The results obtained in this analysis are presented in Table 15.

Table 15

Results of Regression Analysis with Demographic Predictor Variables

Part A: Prediction Equation

Variables in Equation	B	Beta	Equation Statistics
Financial Aid	7.943	.300	Mult. R = .512
Highest Grade Completed	4.354	.269	R^2 = .262
Miles Commute	-.036	-.292	Adj. R^2 = .157
Age	.635	.407	
Hrs. Employ/Wk.	-.236	-.263	

Part B: ANOVA of Regression

Source of Variance	DF	Mean Square	F-Statistic
Regression	5	357.723	F = 2.489
Residual	35	143.740	p = .050

The five demographic variables accounted for 26% of the variance in current student science scores. A histogram plotting the residuals of the 5-variable equation approximated a normal curve; thus, the equation was accepted. As indicated by the Beta coefficients, the predictor variables contributing the most to the regression equation were age, financial aid, and miles commuted. The students who were older and who received more financial aid were more likely to do well in the science courses. An inverse relationship was noted between the miles commuted per week to attend class and course grade, with students who had longer commutes making lower science course grades.

T-tests were examined for each of the five predictor variables to clarify the relationships of predictor variables with membership in the achievement groups of successful and unsuccessful students. The results of these t-tests are presented in Table 16.

Table 16

T-test Results for Demographic Predictor Variables

Predictor Variable	Achievement Group	Mean	T-Value	DF	2-Tailed Significance
Financial Aid	≤ 2.9	.286	-.147	43	.150
	≥ 3.0	.500			
Hi Grade	≤ 2.9	12.3	-.92	43	.364
	≥ 3.0	12.5			
Miles Commuted	≤ 2.9	131.8	1.15	42	.256
	≥ 3.0	94.5			
Age	≤ 2.9	25.9	-2.44	43	.010*
	≥ 3.0	31.8			
Hours Employ/ Week	≤ 2.9	22.7	-.17	43	.864
	≥ 3.0	23.5			

* = significant finding

When examined individually, only one of these variables yielded a significant t-test, the variable of student age. The high achievement students had a mean age of 31.7 years, while the less successful students had a mean age of 25.9 years (2-tailed significance of .019). Although not attaining a significant *t*-value, it is interesting to note that the less successful students commuted almost 40 more miles to class each week than the more successful students (132 miles vs. 94 miles). Both groups of students were employed approximately the same number of hours per week (22.7 vs. 23.5 hours), but the higher achieving students received, on the average, almost twice as much financial aid.

Identification of the Final Subset of Overall Variables. The final step in the analysis consisted of a final regression equation which included all significant predictor variables that had been identified in one of the preceding three steps. The predictor variables that were entered in this final regression equation were: (a) age, (b) total functional support score, (c) TASP reading score, (d) hours employed per week, (e) receipt of financial aid, (f) total loss score, (g) TASP math score, (h) Brookover score, (i) Rosenberg score, (j) TASP writing score, (k) cumulative GPA, (l) highest grade completed, (m) miles commuted to class per week, (n) loss quality score, (o) loss quantity score and (p) aid score. These were entered into a backward regression equation with current science course GPA as the dependent variable.

All generated equations having nine or fewer predictor variables were examined for efficiency and significance. It was determined that the 7-variable equation was the most efficient and significant, explaining 52% of the variance in current science grades. The results obtained in this analysis are presented in Table 17.

Table 17

Results of Final Regression Analysis

Part A: Prediction Equation

Variables in Equation	B	Beta	Equation Statistics
Reading	.232	.346	Multiple R = .703
Hours Employ/Week	-.361	-.417	R^2 = .494
Total Loss	17.377	4.928	Adjusted R = .405
Cumulative GPA	.803	.371	
Miles Commuted/Week	-.023	-.198	
Loss Quality Score	-22.430	-2.370	
Loss Quantity Score	-17.423	-3.181	
(Constant)	-53.174		

Part B: ANOVA of Regression

Source of Variance	DF	Mean Square	F-Statistic
Regression	6	578.498	F = 5.535
Residual	34	104.512	p = .0004

The seven variables accounted for 49% of the variance in current science grades. A histogram plotting the residuals of the 7-variable equation approximated a normal curve. As indicated by the Beta coefficients, the predictor variables contributing the most to the regression equation were related to loss of social support. Entry of cumulative GPA and TASP reading scores into the equation supported the importance of considering academic scores in predicting success of students in science courses.

T-tests were examined for each of the seven predictor variables to look at their individual relationships with achievement groups of successful students and unsuccessful students in science courses. The results of these *t*-tests are presented in Table 18.

All relationships, except that with loss quality and hours employed per week, were in the expected directions. Successful students (GPA $\geq$ 3.0), in science courses, were found to have TASP reading scores that were on the average, 20 points higher, than the group of less successful science students (GPA $\leq$ 2.9) and their cumulative GPA was higher by 0.6 points or half of a letter grade. Less successful students commuted an average of 37 miles more per week to attend classes and reported higher scores on the quantity of loss that they had experienced in the past year than more successful students in science courses.

Care should be used in interpreting the results of the regression equation. It must be noted that the significance of the regression equation is due to all of the variables

Table 18

T-test Results for Overall Predictor Variables

Predictor Variable	Achievement Group	Mean	T-Value	DF	2-Tailed Significance
TASP Reading	≤ 2.9	258.7	-3.48	39	.001*
	≥ 3.0	278.0			
Hours Employed per week	≤ 2.9	22.7	-.17	43	.864
	≥ 3.0	23.5			
Total Loss	≤ 2.9	3.4	.37	41	.714
	≥ 3.0	3.0			
Cum. GPA	≤ 2.9	2.76	-3.75	41	.001*
	≥ 3.0	3.4			
Miles commuted per week	≤ 2.9	131.8	1.15	42	.256
	≥ 3.0	94.5			
Loss Quality	≤ 2.9	1.16	-.02	41	.984
	≥ 3.0	1.17			
Loss Quantity	≤ 2.9	1.84	.75	41	.455
	≥ 3.0	1.29			

* = significant findings

acting in concert, rather than each of the variables acting independently.

Interview Data

In an effort to enrich the data obtained, additional descriptive information was obtained from a sub-set of the research subjects by means of face-to-face personal interviews. A computer list of random subject names was generated from the names of all subjects who agreed to be interviewed. From that list, a total of 19 subjects were able to be contacted and interviewed personally by the researcher. Subjects were interviewed regarding their study habits, perceptions of classroom environments, and facilitators and barriers to their science achievement. A list of the structured interview questions is presented in Appendix D.

Students reported that the things that helped them do well in their science classes included: (a) the tutorial lab, (b) using study guides, (c) teachers made learning fun, (d) textbook was easy to read, (e) attending classes regularly, (f) practice tests, (g) repetition, (h) study groups, and (i) good teachers. Barriers that were identified as being a hindrance to learning included: (a) home distractions, (b) no previous experience with the subject, (c) working full time with little time to study, (d) fear of not being successful, (e) having multiple roles such as employee, parent, student, spouse, and so forth, (f) no support from significant other, (g) covering large amounts of information during one class period, (h) having different professors for theory and for lab, and (i) low self-esteem.

Students reported that they prepared for science class by reading the text, reviewing notes, using flash cards, re-writing the class notes, highlighting the text, and doing the assigned homework. They prepared for science classes much the same as they prepared for other types of classes, but with more time allowed for study.

Students studied for science classes primarily in formal settings such as sitting at a desk or kitchen table, with bright lights, and with a quiet background. The majority preferred to study alone, except when preparing for a major test. At those times, they found it beneficial to study with one or two other students who could quiz them verbally over the information.

The students identified commitment, being organized, energetic, perfectionistic, having an interest in the subject, having a desire to succeed, being determined/ perseverant, being competitive, goal-oriented, and self-confident, as personal characteristics that they felt helped them do well in science classes. Factors they identified that were personal characteristics that the students felt kept them from doing well in science classes included: (a) being easily distracted, (b) not being good at setting priorities, (c) having poor study habits, (d) having test anxiety, (e) procrastination, (f) having a mental block to math, (g) being reluctant to talk to the instructor, and (h) being easily frustrated.

They thought that the instructors were outstanding, possessing an abundance of positive characteristics such as patience, knowledge of subject matter, being approachable, having clear expectations, being interesting and fun, and explaining complex topics in simple terms that were easy to understand. The students related that it was confusing when they had different lab and theory instructors and information was presented in the lab before it was presented in theory class. In this situation, it was assumed that they had the knowledge necessary to perform lab experiments and exercises, when in fact, they did not.

Every student interviewed could readily see how their present science course was going to be helpful with their career goal, and all felt that they had total control over their performance in their present science course. Students felt that emotional support in the form of verbal encouragement from their significant others was very important. Most students related that they were not presently actively involved in clubs, organizations, church, or community groups due to time constraints related to their work and/or time needed to study for their classes.

Summary

This chapter discussed the analyses of the data. For the total sample of students in science courses, there were significant relationships between self-esteem, self-concept of ability, and social support and success in science classes. There also were significant relationships among the academic variables, which included TASP reading scores, TASP math scores, and cumulative science course GPA and success in science classes. The number of minority students in science courses in the study was extremely small, and the data did not reveal significant differences between minority and non-minority students with respect to any of the academic or non-academic variables studied. A combination of seven factors was identified that best predicted success for students in science courses. This combination of factors accounted for almost one-half of the variance in science course grades.

CHAPTER V

SUMMARY, DISCUSSION, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

This chapter presents a summary of the study, discusses findings for each research question, and presents conclusions and implications. Recommendations for further research conclude this chapter.

Summary

The purpose of this study was to identify academic and/or non-academic variables which influence success in selected college-level science courses. The study examined the relationship, for college students in science courses, among demographic characteristics, selected academic variables (total GPA, prior and current science course GPA, and Texas Academic Skills Program Test scores), and non-academic factors of self-esteem, self-concept of ability, and perceived social support. Success for purposes of this study was defined on the basis of GPA in the science course in which they were currently enrolled during the time of this study.

This research was guided by the intention to determine answers to the following five research questions:

1. Is there a relationship between success of students in science courses and selected non-academic variables of self-esteem, self-concept of ability, and perceived social support?

2. Is there a relationship between success of students in science courses and the academic variables of cumulative science course GPA, total GPA, and/or TASP scores?

3. Do ethnic groups of students in science courses differ significantly in their scores on measures of self-esteem. self-concept of ability, social support, TASP scores, GPA in prior or current science scores, or total GPA?

4. Do the demographic characteristics, other than ethnicity, which describe minority students differ from those which describe non-minority students in science courses?

5. What combination of factors are the best predictors of success for all students, minority students, and non-minority students in science courses?

The present study was conducted at one campus of a state-supported community junior college in a metropolitan area of one southern state. A total of 45 subjects volunteered to participate in the study by completing a research questionnaire. Of the 45 subjects, 19 were contacted and interviewed personally for additional information related to their learning styles and experiences. The sample included 40 non-minority students, 1 African-American student, 2 Asian-American students, 1 Native American student, and 1 Hispanic student. Data from the questionnaires were examined by descriptive statistics, Chi-square analysis, *t*-tests, and backward multilinear regression analysis.

1. There were significant relationships between self-esteem, self-concept of ability, and social support and success of students in science courses.

2. Seven non-cognitive variables (self-esteem scores, self-concept of ability scores, total loss scores, loss quality scores, loss quantity scores, aid scores, and total functional social support scores) explained 32.89% of the variance in science course GPA.

3. There were significant relationships among the academic variables and success of students in science courses.

4. TASP reading scores and cumulative science course GPA accounted for 30% of the variance in current science course GPA.

5. There were no significant differences found between minority and non-minority students with respects to any of the identified academic or non-academic research variables.

6. Minority and non-minority students differed significantly on only one demographic variable, the number of hours of college classes in which they were currently enrolled. Minority students were enrolled in an average of 14.4 hours of course work, while non-minority students were enrolled in an average of 9.5 hours of course work.

7. Successful students had TASP reading scores an average of 20 points higher than the less successful students in science courses.

8. Successful students had cumulative GPAs of .6 points higher than the less successful students in science courses.

9. Seven psychosocial predictor variables (self-concept of academic ability, self-esteem, loss quality scores, loss quantity scores, aid scores, total loss scores, and total functional support scores) accounted for 33% of the variance in current science course GPA.

10. Five demographic predictor variables (financial aid, highest grade completed, miles commuted per week to class, age, and hours employed per week) accounted for 26% of the variance in current science course GPA.

11. Successful students differed significantly from less successful students in science courses with respect to the demographic variable of age. Successful students were an average of 31 years of age while the less successful students were an average of 25.9 years of age.

12. Seven variables (TASP reading scores, number of hours employed per week, total loss scores, cumulative GPA, miles commuted per week to class, loss quality scores, and loss quantity scores) accounted for 49% of the variance in current science course GPA. The total loss score was responsible for more of the variance than any other of these predictor variables.

Discussion

Methodological Considerations

The small sample size was a limitation of this study. As a consequence, any interpretation of the results obtained, or any generalizations from this study should be done with caution.

The extremely small number (n=5) of minority students in the sample is another limitation of this study. This small response from minority students is not unlike that which has been previously experienced by researchers. One study by Allen, Nunly, and Scott-Warner (1988) incorporated students from eight institutions but yielded only 41

African-American subjects. One factor which may have contributed to the small minority response in the current study is the fact that the researcher is of Caucasian (non-minority) status. Levin and Levin (1993) support that such "investigator" effects can be a problem when attempting to investigate minority populations.

In future research, seeking student subjects from a larger number of classes might result in a greater number of responses. In addition, incorporating a minority co-researcher who could visit the classes with the non-minority researcher for recruitment purposes might improve minority student response.

Academic Factors

The variables of total GPA, cumulative science course GPA, TASP reading scores, TASP writing scores, and TASP math scores were examined to determine if there was a relationship between any of these variables and current academic success of college students in science courses. There were significant relationships among the academic variables to TASP reading scores, TASP math scores, and cumulative science course GPA and the criterion variables of current science course GPA.

The higher achieving students in this study (GPA $\geq$ 3.0) had TASP reading scores an average of 20 points higher than less achieving students (GPA $\leq$ 2.9). College course work, especially in science courses, often involves large amounts of reading and contains technical scientific vocabulary. This finding of higher reading scores in more successful students, thus, is not surprising.

These findings are consistent with those of Ochsner (1992) who found that significant predictors of nursing student success included: (a) general education GPA, (b) cumulative science GPA, and (c) reading skills. Rodgers (1991) also had similar findings in that SAT scores were predictive of college grade point average in college nursing students. The findings of this study also echo those of Allen, Higgs, and Holloway (1988) who found that preadmission cumulative GPA and prerequisite course GPA were the strongest and most consistently predictive variables for student success.

There were no significant differences found, in this study, between minority and non-minority students with respect to any of the identified academic research variables. This finding is not surprising, given the small number of minority subjects who volunteered in this study.

It should be noted that 2 (40%) of the minority subjects, in this study, were of Asian-American ethnicity. One of these students had a 4.0 cumulative GPA as well as a 4.0 science GPA. The literature supports that Asian-American students often out-perform other students, both non-minority and other minority, in the sciences. The inclusion of such a large percentage of students from this ethnic minority also may have been a factor in not finding a difference between the minority and non-minority students. In future research with larger minority samples, it would be advisable to investigate the minority students as sub-samples of specific minorities rather than as a member of one large minority group.

The minority students in this research were not typical of the average minority student. For example, minority subjects in this research worked fewer hours, were enrolled in more classes, had $10,000 per year or more in yearly family income, and received less financial aid than did non-minority subjects. Thus, they were more similar to the average non-minority student than the average minority student.

In other research which included larger numbers of minority students, such as that by Rami (1993), it has been found that the academic variables of ACT scores and microbiology GPA had a negative relationship with minority student success. For minority students, research supports that non-academic variables such as self-esteem, goal commitment, and supportive social environments are more predictive of success than are academic variables (Arbona & Navy, 1990; Tracey & Sedlacek, 1987; Valencia, 1994). This also may account for the finding, in this research, of no differences between minority and non-minority students with reference to academic variables.

Non-academic Factors

Sociodemographic Variables. There were no significant dependent relationships with minority/non-minority status and any of the sociodemographic variables in this study. Again, the very small number of minority subjects in this study may be responsible for this finding, and the results should not be held in high confidence.

There were differences noted in the sociodemographic variables between successful and non-successful students in science courses. The successful students were older, with a mean age of 31.7 years, while the less successful students had a mean age of 25.9 years. This may be related to the fact that research such as that by Nunn (1994) has found that students between the ages of 25 to 30 years have lower levels of self-concept as a learner than do younger or older students. As higher self-concept of academic ability is most often correlated with greater academic achievement, this may account for the finding (Eshel & Kurman, 1994). Older students also are often more mature, with more well-developed coping resources, allowing them to focus their attention more on the task of achieving in school.

Five sociodemographic variables (financial aid, highest grade completed, miles commuted per week to class, age, and hours per week of employment) accounted for 26% of the variance in current science course GPA. The relationship of financial aid to academic success is easy to understand. The more aid students receive, the less hours they need to work in order to support themselves, and the more time they have available for study purposes. This appears to be the case in this study. A similar relationship appears to exist for number of miles commuted to attend class. The successful students commuted an average of 40 miles per week less than the less successful students. This amounts to the equivalent of almost 1 hour more per week available for study.

Successful students had completed slightly more college than less successful students. The mean for successful students was 12.5 years, and the mean for less successful students was 12.3 years. This represents only a very slight difference but may be attributed to the fact that as students engage in formal learning for longer periods of time, they tend to improve at it.

In this study, the surprising finding was that the successful students were employed an average of 23.5 hours per week, while the less successful students were employed an average of 22.7 hours per week. This amounts to almost 1 hour less time for studying for the successful students. One possible explanation might be that the students who had less time available for study became more organized and more efficient at studying than did the students who did not work quite so much.

Psychosocial Factors. This research found significant relationships between the psychosocial factors of self-esteem, self-concept of ability, and social support and the criterion variable of success of students in science courses. Seven psychosocial factors accounted for almost 33% of the variance in current science course GPA.

Five of the seven psychosocial variables were scores from the Norbeck Social Support Inventory. All three loss scales (total loss, loss quality, and loss quantity) figured prominently in the regression equation. Thus, it is substantiated that loss of social support can have a detrimental influence on science success.

In interviews, students related many losses, including those through the death of family members and friends, through the process of moving, and from divorce. One student missed 3 weeks of school in order to be with her father during the last weeks of his terminal illness. As a result, she dropped out of school because she felt that she was too far behind the rest of the students. This loss, thus, had a significant impact on her successfulness in science. These data clearly reveal how important losses may be to students and the importance of acknowledging their effects on student performance.

These findings, with respect to self-esteem, are similar to those by Rodgers (1991) who found a positive relationship between levels of global self-esteem and academic success. This was found for the entire sample, including subjects of minority as well as non-minority status. Similar findings also were made by other researchers (Allen, Higgs, & Holloway, 1988; Sedlacek, 1987).

Eshel and Kurman (1994) found that both academic self-concept and accuracy of perceived ability were significantly associated with academic achievement. Similar findings were made by Caon and Treagust (1993) who established that unsuccessful students perceived that the science course in which they were enrolled was either "much too difficult" or "somewhat difficult" for their science background and ability.

During interviews, every one of the 19 students stated that they believed that they were capable of doing well in their science classes. About one-third of those interviewed qualified their statement with comments such as, "Yes, I am capable of doing well, if I had more time to study," or "Yes, I'm smart, but I have other things going on in my life right now and don't give it all the effort, perhaps, I should." It, thus, appeared that they believed that they were capable of doing well but may be presently performing at less than that capacity due to work or other commitments or constraints on their time.

The importance of social support to academic success has been reported in numerous research articles (Mallinckrodt & Leong, 1992; Marshall, 1989; Wohlgemuth & Betz, 1991). During student interviews in this study, social support from others was consistently reported as being important. Students stated that they received support most often in the form of verbal encouragement to continue their studies, and it came most often from family members. This study, thus, continues to add support for the need for students to have broad support networks which encourage their educational goals.

Conclusions

The conclusions listed below are drawn from the findings of this study:

1. The non-academic variables of self-esteem, self-concept of ability, and social support are related to science student success.

2. The academic variables of cumulative science course GPA, TASP math scores, and TASP reading scores are related to science student success.

3. There are no differences between minority and non-minority students with respect to any of the research variables.

4. The best set of predictor variables for success in college students in science courses consists of: (a) TASP reading scores, (b) hours worked per week, (c) total loss score, (d) cumulative GPA, (e) miles commuted per week to attend class, (f) loss quality score, and (g) loss quantity score.

Implications

The following implications for education can be drawn from this study:

1. An effort to support and enhance student reading skills should be made.

2. An effort to identify student losses in a timely manner should be made, so that prompt intervention/ assistance may be offered.

3. Available support services should be widely communicated and promoted to all students and these services expanded, where necessary.

4. Faculty should engage in activities which promote positive self-concept of ability and positive self-esteem in students.

5. Colleges should continue to make financial aid available for needy students.

6. Where possible, an effort should be made to limit the distance which students have to commute to attend classes.

Recommendations

The following recommendations for further research are proposed as a result of this study:

1. The study should be replicated using larger samples and various locales.

2. The study should be replicated using a minority co-researcher to solicit volunteer subjects.

3. The study should be replicated with large groups of ethnic students, allowing the detection of differentiation between ethnicities.

REFERENCES

Allen, C. B., Higgs, Z. R., & Holloway, J. R. (1988). Identifying students at risk for academic difficulty. Journal of Professional Nursing, 4(2), 113-118.

Allen, M., Nunley, J., & Scott-Warner, M. (1988). Recruitment and retention of Black students in baccalaureate nursing programs. Journal of Nursing Education, 27(3), 107-116.

Arbona, C., & Novy, D. M. (1990). Noncognitive dimensions as predictors of college success among Black, Mexican-American, and White students. Journal of College Student Development, 31(5), 415-422.

Astin, A. W. (1990). Educational assessment and educational equity. American Journal of Education, 98, 458-478.

Atkinson, D. R., Whiteley, S., & Gim, R. H. (1990). Asian-American acculturation and preferences for help-providers. Journal of College Student Development, 31, 155-160.

Ballantine, J. H. (1989). The system of higher education. In The sociology of education: A systematic analysis (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

Beane, J. A. (1991). Sorting out the self-esteem controversy. Educational Leadership, 49, 25-30.

Beane, J. A., & Lipka, R. P. (1986). Self-concept, self-esteem, and the curriculum. New York: Teachers College Press.

Beane, J. A., & Lipka, R. P. (1990). Self-concept and self-esteem: A construct differentiation. Child Study Journal, 10, 1-6.

Black, S. (1991). Self-esteem sense and nonsense. American School Board Journal, 178(7), 27-29.

Bolger, N., & Kellaghan, T. (1990). Method of measurement and gender differences in scholastic achievement. Journal of Educational Measurement, 27, 165-174.

Brookover, W. B., & Gottlieb, D. (1964). Sociology of Education (2nd ed.). New York: American Book Company.

Caon, M., & Treagust, D. (1993). Why do some nursing students find their science courses difficult? Journal of Nursing Education, 32(6), 255-259.

Champagne, A. B., & Newell, S. T. (1992). Directions for research and development: Alternative methods of assessing scientific literacy. Journal of Research in Science Teaching, 29, 841-860.

Chartrand, J. M. (1990). A causal analysis to predict the personal and academic adjustment of nontraditional students. Journal of Counseling Psychology, 37, 65-73.

Caon, M., & Treagust, D. (1993). Why do some nursing students find their science courses difficult? Journal of Nursing Education, 32(6), 255-259.

Clark, E. J., & Rieker, P. P. (1986). Gender differences in relationships and stress of medical and law students. Journal of Medical Education, 61, 32-40.

Connel, J. P., & Ilardi, B. (1987). Self-esteem concomitant of discrepancies between children's and teachers' evaluations of academic competence. Child Development, 58, 1297-1307.

Cooper, S. E., & Robinson, D. A. (1991). The relationship of mathematics self-efficacy beliefs to mathematics anxiety and performance. Measurement and Evaluation in Counseling and Development, 24(4), 4-11.

Craik, F., & McDowd, J. (1987). Age differences in recall and recognition. Journal of Experimental Psychology: Learning, Memory, & Cognition, 13(3), 474-479.

Crown, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. Journal of Counseling Psychology, 243, 349-354.

Demo, D., & Parker, K. (1884). Academic achievement and self-esteem among Black and White college students. Journal of Social Psychology, 127(4), 345-355.

Eshel, Y., & Kurman, J. (1994). Academic self-concept, accuracy of perceived ability and academic attainment. British Journal of Educational Psychology, 61, 187-196.

Gick, M., Craik, F., & Morris, R. (1888). Task complexity and age differences in working memory. Memory and Cognition, 16(4), 353-361.

Fagin, C. (1992). We must increase minority representation. Nursing and Health Care, 13(8), 434-435.

Fuertes, J. N., Sedlacek, W. E., & Liu, W. M. (1994). Using the SAT and noncognitive variables to predict the grades and retention of Asian American university students. Measurement and Evaluation in Counseling and Development, 27(7), 74-84.

Gecas, V. (1982). The self-concept. Annual Review of Sociology, 8, 1-33.

Hanna, G. (1986). Sex differences in the mathematics achievement of eighth graders in Ontario. Journal for Research in Mathematics Education, 17, 231-237.

Harter, S. (1985). Competence as a dimension of self-evaluation: Toward a comprehensive model of self-worth. In R. L. Leahy (Ed.), The development of self (pp. -). New York: Academic Press.

Holtz, C., & Wilson, C. (1992). The culturally diverse student: A model for empowerment. Nurse Educator, 17(6), 28-31.

Hsia, J., & Peng, S. S. (1995). Asian American academic achievement: Facts and fiction. In N. Zane & L. C. Lee (Eds.), Handbook of Asian American psychology (pp. -). Chicago: University of Chicago Press.

Hussey, C., & Wieczorek, R. R. (1991). Enrichment education: Key to NCLEX success. Nursing and Health Care, 12(5), 234-239.

Jones, M. G., & Wheatley, J. (1990). Gender differences in teacher-student interactions in science classrooms. Journal of Research in Science Teaching, 27, 861-874.

Kahle, J. B. (1990). Real students take chemistry and physics. In K. O. Tobin, J. B. Kahle, & B. J. Fraser (Eds.), Windows into science classrooms: Problems associated with higher-level cognitive learning (pp. 92-135). New York: Falmer.

Kahn, R. L. (1979). Aging and social support. In M. W. Riley (Ed.), Aging from birth to death: Interdisciplinary perspectives. Boulder, CO: Westview Press.

Kelly, A. (1988). Gender differences in teacher-pupil interactions: A meta-analytic review. Research in Education, 39, 1-23.

Levin, J. R., & Levin, M. E. (1993). Methodological problems in research on academic retention programs for at-risk minority college students. Journal of College Student Development, 34, 118-124.

Linn, M. C., Benedictis, T. D., Delucchi, K., Harris, A., & Stage, E. (1987). Gender differences in national assessment of educational progress science items: What does "I don't know" really mean? Journal of Research in Science Teaching, 24, 267-278.

Magner, D. K. (1989). Colleges try new ways to insure minority students make it to graduation. Chronicle of Higher Education, 36(13), 36-37.

Mallinckrodt, B., & Leong, F. T. (1992). Social support in academic programs and family environments: Sex differences and role conflicts for graduate students. Journal of Counseling and development, 70(4), 716-723.

Malone, J. A. (1988). The social support social dissupport continuum. Journal of Psychosocial Nursing, 26(12), 18-22.

Marsh, H. W. (1986). Verbal and math self-concepts: An internal/external frame of reference model. American Educational Research Journal, 23, 129-149.

Marsh, H. W. (1989). Age and sex effects in multiple dimensions of self-concept: Preadolescence to adulthood. Journal of Educational Psychology, 81, 417-430.

Marsh, H. W. (1990). The structure of academic self-concept: The Marsh/Shavelson model. Journal of Educational Psychology, 82(4), 623-636.

Marsh, H. W. (1993). The multidimensional structure of academic self-concept: In variance over gender and age. American Educational Research Journal, 30(4), 841-860.

Marsh, H. W., Byrne, B. M., & Shavelson, R. (1988). A multifaceted academic self-concept: Its hierarchical structure and its relation to academic achievement. Journal of Educational Psychology, 80, 366-380.

Marsh, H. W., & Parker, J. W. (1984). Determinants of student self-concept: Is it better to be a relatively large fish in a small pond even if you don't learn to swim as well? Journal of Personality and Social Psychology, 47, 213-231.

Marsh, H. W., Walker, R., & Debus, R. (1991). Subject-specific components of academic self-concept and self-efficacy. Contemporary educational psychology, 16, 331-345.

Marshall, J. (1989). Student attrition: Is lack of support a key? Nursing Outlook, 37(4), 176-178.

McNairy, F. C. (1987). Clarion University: A comprehensive approach to Black student retention. Black Issues in Higher Education, 4(1), 5-8.

Merrit, S. (1991). The abilities and aptitudes of students must be considered in program design. Nursing and Health Care, 12(5), 240-242.

Moeller, T. G. (1994). What research says about self-esteem and academic performance. The Education Digest, 59, 34-37.

Mullis, E., & Jenkins, L. B. (1988). The science report card: Elements of risk and recovery. Princeton, NJ: Educational Testing Service.

Murphy, R. J. (1982). Sex differences in objective test performance. British Journal of Educational Psychology, 52, 213-219.

National Project on Women in Education. (1978). Toward a nonsexist school: Taking sexism out of education (HEW Pub. No. [OE]77-01017). Washington, DC: U.S. Government Printing Office.

Norbeck, J. S., Lindsey, A. M., & Carrieri, V. L. (1981). The development of an instrument to measure social support. Nursing Research, 30(5), 264.

Norbeck, J. S., Lindsey, A. M., & Carrieri, V. L. (1983). Further development of the Norbeck social support questionnaire: Normative data and validity testing. Nursing Research, 32(1), 4.

Nunn, G. D. (1994). Adult learners' locus of control, self-evaluation and learning temperament as a function of age and gender. Journal of Instructional Psychology, 21(3), 260-264.

Oakes, J. (1990). Lost talent: The underparticipation of women, minorities, and disabled persons in science. Santa Monica, CA: Rand.

Ochsner, S. (1992). Improving the admission process for associate degree nursing students at Tarrant County Junior College. Unpublished doctoral dissertation, Nova University, .

Office of Science and Technology Policy. (1991). By the year 2000: Report of the FCCSET Committee on Education and Human Resources. Washington, DC: U.S. Government Printing Office.

Okun, M. A., & Fournet, L. M. (1993). Academic self-esteem and perceived validity of grades: A test of self-verification theory. Contemporary Educational Psychology, 18(4), 414-426.

Peng, S. S., & Wright, D. (1994). Explanation of academic achievement of Asian American students. Journal of Educational Research, 87(6), 346-352.

Rami, J. (1993, April). A minority health care agenda for Louisiana. A paper presentation to Hillary Clinton, New Orleans.

Rawls, R. (19911). Minorities in science. Chemical and Engineering News, 4, 20-35.

Rodgers, S. G. (1991). _Minority student success in predominantly White schools of nursing: Cognitive and noncognitive factors_. Unpublished doctoral dissertation, University of Maryland, .

Rosenberg, M. (1979). _Conceiving the Self_. Malabar, FL: Robert E. Krieger.

Rosenberg, M. (1989). Self-concept research: A historical overview. _Social Forces_, _68_(1), 34-44.

Ryland, E. B., Riordan, R. J., & Brack, G. (1994). Selected characteristics of high-risk students and their enrollment persistence. _Journal of College Student Development_, _35_, 54-58.

Sadker, M. P., & Sadker, D. M. (1990). _Subtle bias in the college classroom_. West Central Consortium Project. University of Wisconsin-Stout.

Sadker, M. P., & Sadker, D. M. (1994). _Failing at fairness: How America's schools cheat girls_. New York: Charles Scribner's Sons.

Salthouse, T. (1993). Speed mediation of adult age differences in cognition. _Developmental Psychology_, _29_(4), 722-738.

Schmeiser, C., & Ferguson, R. (1979). Effects of culture-based test materials on performance of Black and White examines. _Educational Horizons_, _58_(1), 53-58.

Sedlacek, W. (1987). Black students on White campuses: 20 years of research. _Journal of College Student Personnel_, _28_(6), 484-495.

Shepardson, D. P., & Pizzini, E. L. (1992). Gender bias in female elementary teachers' perceptions of the scientific ability of students. _Science Education_, _76_(2), 147-153.

Slavin, R. E. (1992). _Research methods in education_ (2nd ed.). Allyn and Bacon: Boston.

Solberg, V. S., Choi, K., Ritsma, S., & Jolly, A. (1994). Asian-American college students: It is time to reach out. Journal of College Student Development, 35(7), 296-301.

Sward, K. (1992). Recruitment and retention of disadvantaged students in the baccalaureate nursing programs. New York State Nursing Association Journal, 15(2), 9-16.

Tarrant County Junior College. (1994). [Science student statistical data]. Unpublished raw data.

Texas Higher Education Coordinating Board and Texas Education Agency. (1994). TASP Technical Summary 1993-1994. Austin, TX: National Evaluation Systems.

Texas Higher Education Coordinating Board and Texas Education Agency. (1994). TASP Test Registration Bulletin. Austin, TX: National Evaluation Systems.

The Nation's students. (1992, August 26). The Chronicle of Higher Education, pp. 9, 11.

Tracey, T. J., & Sedlacek, W. E. (1987). Prediction of college graduates using noncognitive variables by race. Measurement and Evaluation in Counseling Development, 19, 177-184.

Valencia, A. A. (1994). The attributes of academically successful Mexican-American university male and female students. Journal of Multicultural Counseling and Development, 22(10), 227-238.

VanTassel-Baska, J, Olszewski-Kibilus, P., & Kulieke, M. (1994). A study of self-concept and social support in advantaged and disadvantaged seventh and eighth grade gifted students. Roeper Review, 16(3), 186-191.

Wohlgemuth, E., & Betz, N. E. (1991). Gender as a moderator of the relationships of stress and social support to physical health in college students. Journal of Counseling Psychology, 38(3), 367-374.

Wylie, R. (1974). The self-concept. Lincoln, NE: University of Nebraska Press.

Young, D., & Fraser, B. J. (1994). Gender differences in science achievement: Do school effects make a difference? Journal of Research in Science Teaching, 31(8), 857-871.

Zacks, R., Hasher, L., Doren, B., Hamm, V., & Attig, M. (1987). Encoding and memory of explicit and implicit information. Journal of Gerontology, 42(4), 418-422.

APPENDICES

Appendix A

Consent Form

Researcher: Mary Ann Yantis, MS
Phone: 817-531-4646 (TCJC)
214-317-1171 (Home)

TEXAS WOMAN'S UNIVERSITY
SUBJECT CONSENT TO PARTICIPATE IN RESEARCH

The title of this research is "Academic and Non-Academic Characteristics of Successful and Non-Successful College Science Students." This study is being conducted by Mary Ann Yantis, a Doctoral student at Texas Woman's University and a faculty member at Tarrant County Junior College.

This study will attempt to examine, for college science students, the relationship among selected academic variables (total GPA, current science course GPA, and TASP scores), demographic characteristics, and non-academic factors of self-esteem, perceived social support, and self-concept of ability.

The research will involve the completion of a 12 page questionnaire which includes questions related to demographic information and data related to self-assessment of academic ability and social relations. It will take approximately 30 to 45 minutes of time to complete this questionnaire. A portion of those individuals who participate in the research will be randomly contacted and asked to meet with the researcher, if convenient. At this meeting, additional information regarding the study environment and factors which influence the learning of science will be discussed.

Participation in this study will involve minimal risks to the subjects. These risks may include: (a) the release of confidential data concerning grades or responses to research interviews, (b) fatigue from completing questionnaires or interviews, (c) loss of time and/or (d) monetary costs of traveling to meet with the researcher for an interview.

Data will be returned in a sealed envelope, provided by the researcher. It will be opened, reviewed, and maintained only by the researcher. All data will be kept in a locked file drawer in the home of the researcher while data analysis is being completed. At the end of this time, within a period of 6 months, all questionnaire will be shredded.

Participation in this study is completely voluntary and the subject may withdraw from the study at any time. Refusal to participate will involve no penalty or loss of benefits to which the subject is otherwise entitled.

Efforts will be made to prevent any complications that could result from this research. Medical services and compensation for injuries incurred as a result of your participation in the research are not available. The investigator is prepared to advise you in the case of adverse effects, which you should report to her promptly. Phone numbers where the investigator may be reached are listed in the heading of this form.

If you have any questions about the research or about your rights as a subject, we want you to ask us. If you have questions later, or if you wish to report a research-related complication (in addition to notifying the investigator), you may call the Office of Research & Grants Administration at TWU during office hours at 817-898-3375.

An offer has been made to answer all of my questions regarding this research, and a copy of the dated and signed consent form has been made available.

The proposed study has been explained to me and I have had the opportunity to ask questions about the study and participation in the study. I hereby consent to voluntarily participate in this research.

Signature ____________________________ Date ______________

I understand that the researcher may want to supplement the data supplied, by my participation by means of seeking a personal interview with a small number of participants.

I am _________ or am not _________ willing to be contacted for such a follow-up interview.

Signature ____________________________ Date ______________

Appendix B

Permission to Conduct Study from TCJC

MEMORANDUM

TO: Mary Ann Yantis

FROM: Jim Hale

DATE: November 15, 1994

SUBJECT: Research Request

Your request to conduct research at TCJC as specified in the Research Request form dated November 4, 1994 has been approved. Please sign and return the attached Research Agreement form to my office.

Good luck on your dissertation project.

cm

Attachment

Appendix C

Verbal Explanation to Potential Subjects

VERBAL EXPLANATION TO POTENTIAL RESEARCH SUBJECTS

My name is Mary Ann Yantis, and I am a graduate student at Texas Woman's University and a faculty member at TCJC. I am attempting to conduct educational research here at Tarrant County Junior College in partial fulfillment of requirements for a PhD. in Adult Education. I am particularly interested in identifying academic and/or non-academic factors which influence success for students in college-level science courses. The identification of such factors may ultimately lead to improvement in these courses and/or the development of programs which will help students overcome barriers to success in these science classes.

In order to do this research, I am asking for your assistance. I am seeking subjects to participate in this research from your class. If you are at least 18 years old, have taken the TASP test, and are currently enrolled in this course, you qualify to participate.

Participation will involve completing a questionnaire which includes demographic information and which requests your responses to questions related to your academic ability and social relations. The entire questionnaire should take from 30 to 45 minutes of your time to complete. Your decision to participate or not to participate in this research will in no way effect your grade in this course. In addition, a few of you who complete the questionnaire may be contacted and asked to meet with the researcher if convenient, for some additional questions related to your learning experiences. This interview should take from 30 to 45 minutes and can take place on campus at a convenient time for you.

I would like to distribute questionnaires at this time to any one who meets the above criteria, and who agrees to participate. Please return the questionnaire to your instructor within one week. I am including a large envelope in which I ask you to place the completed questionnaire. Please seal this envelope before you return the document to ensure confidentiality of information. I will be the only person who will have direct knowledge of the answers to your questionnaires. They will be maintained for a period of approximately 6 months at my home in a locked file cabinet. They will be shredded at the end of this time, when data analysis is completed.

Research results will be available in the Science Department on the South campus at the completion of analysis. This process will take not more than 6 months. If you would like any additional information related to this research, please feel free to notify me in the Nursing Department on the South campus at 817-531-4646. Thank you again for your help in this matter.

Appendix D

Rosenberg Scale

Please circle the abbreviation that best fits your response to each of the following 10 questions.

SA = strongly agree
A = agree
D = disagree
SD = strongly disagree

1. On the whole, I am satisfied with myself.
   SA A D SD

2. At times I think I am no good at all.
   SA A D SD

3. I feel that I have a number of good qualities.
   SA A D SD

4. I am able to do things as well as most other people.
   SA A D SD

5. I feel I do not have much to be proud of.
   SA A D SD

6. I certainly feel useless at times.
   SA A D SD

7. I feel that I'm a person of worth, at least on an equal plane with others.
   SA A D SD

8. I wish I could have more respect for myself.
   SA A D SD

9. All in all, I am inclined to feel that I am a failure.
   SA A D SD

10. I take a positive attitude toward myself.
   SA A D SD

Appendix E

Brookover Scale

SELF-CONCEPT OF ABILITY SCALE

1. How do you rate yourself in school ability compared with your close friends?
   a. I am the best
   b. I am above average
   c. I am average
   d. I am below average
   e. I am the poorest

2. I expected to have a harder time in college than most students.
   a. strongly agree
   b. agree
   c. uncertain
   d. disagree
   e. strongly disagree

3. I am as skilled academically as the average student.
   a. strongly agree
   b. agree
   c. uncertain
   d. disagree
   e. strongly disagree

4. It is not very hard to get a "B" average here.
   a. strongly agree
   b. agree
   c. uncertain
   d. disagree
   e. strongly disagree

5. What kinds of grades do you think you are capable of getting?
   a. Mostly A's
   b. Mostly B's
   c. Mostly C's
   d. Mostly D's
   e. Mostly F's

6. Forget for a moment how others grade your work. In your opinion, how good do you think your work is?
   a. My work is excellent
   b. My work is good
   c. My work is average
   d. My work is below average
   e. my work is much below average

7. How do you rate yourself in school ability compared with those in your class?
   a. I am the best
   b. I am above average
   c. I am average
   d. I am below average
   e. I am among the poorest

8. Where do you think you would rank in your class in college?
   a. Among the best
   b. Above average
   c. Average
   d. Below average
   e. Among the poorest

9. Do you think you have the academic ability to complete an associate degree?
   a. Yes, definitely
   b. Yes, probably
   c. Not sure either way
   d. Probably not
   e. No

10. Do you think you have the academic ability to complete a baccalaureate degree?
   a. Yes, definitely
   b. Yes, probably
   c. Not sure either way
   d. Probably not
   e. No

11. In order to become a doctor, lawyer, or university professor, work beyond four years of college is necessary. How likely do you think it is that you would complete such advanced work?
   a. Very likely
   b. Somewhat likely
   c. Not sure either way
   d. Unlikely
   e. Most unlikely

12. If you did attend a professional school such as law school or medical school, where do you think you would rank in your class?
   a. Among the best
   b. Above average
   c. Average
   d. Below average
   e. Among the poorest

Appendix F

Norbeck Inventory

SOCIAL SUPPORT QUESTIONNAIRE

Please read all directions on this page before starting.

Please list each significant person in your life and their relationship to you. Consider all the persons who provide personal support for you or who are important to you.

Use only first names or initials, then indicate the relationship as in the following example:

Example:

FIRST NAME OR INITIALS	RELATIONSHIP
1. Mary T.	Friend
2. Bob	Brother
3. M. T.	Mother
4. Sam	Neighbor

etc.

Use the following list to help you think of the people important to you, and list as many people as apply in your case.

- spouse
- family members or relatives
- friends
- work or school associates
- neighbors
- health care providers
- counselor or therapist
- minister/priest/rabbi
- other

You do not have to use all 20 spaces. Use as many spaces as you have important persons in your life.

When you have finished, go to the next page.

PERSONAL NETWORK

FIRST NAME OR INITIALS	RELATIONSHIP
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.
11.	11.
12.	12.
13.	13.
14.	14.
15.	15.
16.	16.
17.	17.
18.	18.
19.	19.
20.	20.

For each person you listed in your Personal Network, please answer the following questions by writing in the number that applies.

0 = not at all
1 = a little
2 = moderately
3 = quite a bit
4 = a great deal

Question 1: How much does this person make you feel liked or loved?	Question 2 : How much does this person make you feel respected or admired?
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.
11.	11.
12.	12.
13.	13.
14.	14.
15.	15.
16.	16.
17.	17.
18.	18.
19.	19.
20.	20.

Use the following scale to answer questions 3 and 4:

0= not at all
1= a little
2= moderately
3= quite a bit
4= a great deal

Question 3: How much can you confide in this person?

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.

Question 4: How much does this person agree with or support your actions or thoughts?

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.

Use the following scale to answer questions 5 and 6:

0= not at all
1= a little
2= moderately
3= quite a bit
4= a great deal

Question 5: If you needed to borrow $10, a ride to the doctor, or some other immediate help, how much could this person usually help?

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.

Question 6: If you were confined to bed for several weeks, how much could this person help you?

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.

Question 7:
How long have you known this person?

0= less than 6 mos.
1= 6 to 12 mos.
2= 1 to 2 years
3= 2 to 5 years
4= more than 5 years

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

16.

17.

18.

19.

20.

Question 8:
How frequently do you usually have contact with this person? (Phone calls, visits or letters)

4= daily
3= weekly
2= monthly
1= a few times a year
0= once a year or less

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

16.

17.

18.

19.

20.

Question 9. During the past year, have you lost any important relationships due to moving, a job change, divorce or separation, death, or some other reason?

0. No__________
1. Yes__________

If the answer is Yes, please answer the following questions:

9a. Please indicate the number of persons from each category who are NO LONGER available to you:

_________ spouse or partner
_________ family members or relatives
_________ friends
_________ work or school associates
_________ neighbors
_________ health care providers
_________ counselor or therapist
_________ minister/ priest/ rabbi
_________ other (specify) ______________________

9b. Overall, how much of your support was provided by these people who are no longer available to you?

__________ 0. none at all
__________ 1. a little
__________ 2. a moderate amount
__________ 3. quite a bit
__________ 4. a great deal

Thank you for completing this research questionnaire. Please retain one copy of the permission slip, and place the remaining questionnaire in the envelope provided. Seal the envelope and return it to your Science instructor.

Appendix G

Demographic Questionnaire

Name________________________________ Student Number ___________

Phone Number ________________________

Please complete by writing in the appropriate information or placing a check mark beside the correct descriptor.

1. Age _______ 2. Gender __________

3. Ethnicity
   Asian_______ Hispanic _______
   Black_______ Native Amer. _______
   White_______ Other (Specify) _______

4. Marital Status
   Married _______ Widowed _______
   Single _______ Separated _______
   Divorced _______ Other _______

5. Residence
   How many individuals reside with you?
   Total number __________
   Number of adults ___________
   Number of children and ages ___________________________
   Are you responsible for the care of children? Yes ___ No ___
   Are you responsible for the care of elderly relatives?
   Yes _____ No _____

6. Commute
   How many miles fo you commute to attend classes in an average week? _______________

7. Work
   Are you employed? Y____ N____
   How many hrs. per week?_______________
   Type of employment __________________________________

8. Financial Aid
   Are you receiving financial aid? Yes _____ No _____
   If yes, source (scholarship, loan, work study, family, etc.)
   ____
   How much financial aid are your currently receiving per semester?
   ____

9. Annual Family Income
   Excluding financial aid, what is your yearly family combined income? (Please list in multiples of $1000) ________________

10. Education
Highest grade completed ___________, Year _______
Date of High School Graduation _____________________________
GED Year, if applicable _______________
Since HS graduation or GED acquisition, has there been a period of time during which you were not enrolled in a college, university, or trade school? Y__________ N__________
If the answer was Yes to the above question, what was the period or periods of time that you were not enrolled?
____
Any college degrees? Y _____ N _____ If yes, please identify specific type of degree(s) and year obtained
____

11. Current Academic Courses
How many hours of college courses are you presently enrolled in?
____
Current Science Courses (Please list) ______________________________
____
Have you previously taken any of the current science courses?
Yes _____ No _____
If yes, which one(s) and number of times taken including this semester____
____

12. Goals
What is your reason for enrolling in your present science course(s)?____
____
____
What are your present personal and educational goals?
____
____
____
____

13. What is your current declared major? ______________________________
If you do not presently have a declared major, what do you plan to major in? ____

Appendix H

Interview Protocol

INTERVIEW QUESTIONS:

1. What previous science courses have you taken?

2. When you think about those courses, what can you identify that helped you do well?

3. Can you think of any barriers that kept you from doing well in previous science courses?

4. How do you prepare for class? Study methods?

5. When you sit down to study, can you describe the environment to me?

6. Does your preparation and environment for study for science classes differ in any way from when you are getting ready for other classes? If so, how?

7. What personal characteristics do you feel that you have that keep you from doing well in science classes?

8. What personal characteristics do you feel that you have that keep you from doing well in science classes?

9. Do you think that you are capable of doing well in your present science course?

10. What qualities or actions of your present science instructor have been helpful to you?

11. What qualities or actions of your present science instructor have NOT been helpful to you?

12. Can you see any way in which your present science course is going to help you with your career goal?

13. How much control do you feel that you have over your performance in your present science courses?

14. Is there one person that you feel gives you a lot of support at this time? If so, what do they do that specifically helps you?

15. Are you presently involved in any type of organizations, like college clubs, church, or community groups? If so, how involved are you? Do you hold any positions of responsibility?

16. When you think about science classes here at the college, have you had any personal experience with racist or sexist attitudes? If so, could you tell me about the situation.

17. Is there anything else that you can think of, that you feel has influenced your performance in your present science courses here on campus? If so, what?