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Baccalaureate Degree Completion: 
A Test of Holland's Congruence Assumption 
Using Four-Year Public College Students in Ohio

by

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Submitted as partial fulfillment of the requirements for 
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An Abstract of

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Holland’s (1997) theory of vocational personalities and work environments, extended to educational environments, was used as the theoretical framework that guided this study, which investigated the relationship between the degree of vocational interest-educational environment congruence and academic achievement. The population of 20,187 first-time, full-time students who entered four-year state-supported institutions of higher education in Ohio in 1998, and who completed the ACT Assessment, the Revised Unisex Edition of the American College Testing Interest Inventory (UNIACT; Swaney, 1995), and the student profile section of the ACT Assessment were used as the subjects. Descriptive statistics were computed for the predictor variables, Pearson product moment correlation coefficients were determined for all variables under consideration, and a stepwise multiple regression model was utilized to determine the proportion of variance in the attainment of a four-year degree that can be explained by the extent of person-environment fit. A total of 19 independent variables correlated with the dependent
variable. The stepwise logistic regression analysis produced a model that consisted of 10 predictor variables that accounted for 17.8% of the variance in the outcome variable of graduation from college (BACHDEGREE). The experimental variable, CONGRUENCE correlated positively ($r = .018, p < .01$) with the outcome variable BACHDEGREE, but was not included in the regression model. Therefore, the experimental variable, CONGRUENCE was found not to be predictive of graduating from college.
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CHAPTER 1
THE PROBLEM

Introduction

Colleges and universities are under intense pressure to be more accountable. Federal and state governments, philanthropic organizations, business and industry, students, and the general public alike are scrutinizing higher education outcomes such as retention and graduation rates, time to degree, preparation for employment, job placement rates, and costs.

As lawmakers, White House representatives, and the U.S. Department of Education work on the reauthorization of the Higher Education Act of 1965, strong consideration is being given to student performance, as well as rising costs (Burd, 2003a). At least one proposal that would reward colleges for student retention and on-time graduation is being considered (Burd, 2003b). Recently, in an attempt to influence public policy, the Ford Foundation, in association with the State Higher Education Executive Officers Association, formed the National Commission on Accountability in Higher Education to study and recommend performance goals and accountability systems that will ensure positive outcomes (Arnone, 2004). In Ohio, shortly after appointing The Governor’s Commission on Higher Education and the Economy, Governor Bob Taft (2003) exclaimed,

We must ensure that Ohio’s system of higher education operates effectively and productively to meet the needs of students and their
families, employers and the state’s economy as a whole. We must receive a maximum return on state’s $2 billion plus annual investment in higher education.

In addition, students are becoming increasingly concerned about out-of-pocket expenses, graduation rates, and job placement rates.

Since 1990, when the federal government made the submission of six-year graduation rates a condition of receiving Title IV aid for four-year institutions with the passage of the Student Right to Know Act, the focus on graduation rates has been institutionalized at four-year colleges (American Association of State Colleges and Universities [AASCU], 2002). This measure of institutional quality has become the primary metric of concern, especially for federal and state government. Subsequently, Ohio, like many states, has developed an elaborate performance reporting system to describe student progress, degree attainment, employment outcomes, and job training activities (Ohio Board of Regents [OBR], 2004).

As a consequence of the demands for increased accountability in Ohio, especially for increased graduation rates and preparation for work in the “knowledge economy” (Taft, 2003), institutions of higher education must find ways to maximize their effectiveness in converting intellectually curious students into productive college graduates. Colleges and universities must provide students not only with a strong general education, but they must also provide career-related knowledge, skills, and experiences that will prepare students for economically productive and satisfying lives.

One way to keep students engaged in academic work and progressing towards a college degree is to expose them to academic disciplines, course content, and vocational experiences that are of interest to them. Holland’s (1997) Theory of Vocational
Personalities and Work Environments provides a useful method of understanding how the degree of similarity between one’s vocational interests and educational environment leads to successful outcomes (Feldman, Smart, & Ethington, 2004; Leuwerke, Robbins, Sawyer, & Hovland, 2004; Smart, Feldman, & Ethington, 2000). Holland believed that the more congruent a person’s preferred activities, interests, and special competencies are with the environment to which they are exposed, the more likely the person is to experience stability (persistence), satisfaction, and achievement in educational behavior. In other words, a good fit between the person and the environment will result in positive educational outcomes. Conversely, a poor fit will decrease the likelihood for positive outcomes.

Holland’s (1997) theory consists of four basic assumptions. The first assumption is that persons can be categorized into one of six different personality types: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), or Conventional (C). These RIASEC personality types are a result of various biological, social, and cultural influences that lead to different interests and competencies, which in turn, predispose people to think, perceive, and behave in different ways. The second assumption is that there are six corresponding model environments, which are dominated by a given type of RIASEC personality. Holland theorizes that because different personality types have different skills, interests, and dispositions, they will tend to surround themselves with like-minded people and will seek out problems that are congruent with their interests, competencies, and world-view. This tendency for individuals to search for environments that will allow them to exercise their skills and talents, express their personality, and take on problems and roles with which they are comfortable represents Holland’s third
assumption, also known as the congruence assumption. Finally, the fourth assumption is that a person’s behavior is determined by the interaction between personality and environment.

If, as Holland’s theory suggests, behavior is determined by the interaction between personality and environment, and positive outcomes such as stability (persistence), satisfaction, and achievement can be achieved by maximizing the fit between personality and environment, then it follows that higher education decision-makers can increase the likelihood that students will complete college degrees by helping them to identify, select, and pursue educational environments that are congruent with their personalities. Fortunately, it is possible to determine students’ Holland personality types through widely utilized assessment instruments, including the ACT Assessment, which also includes the Revised Unisex Edition of the American College Testing Interest Inventory (UNIACT: Swaney, 1995). In addition, through the use of the Dictionary of Holland Occupational Codes (Gottfredson & Holland, 1996), it is possible to identify students’ educational environments based on the academic major. Finally, one can measure the magnitude of the fit between personality and environment using various congruency indices (Brown & Gore, 1994). Therefore, using these tools, researchers and practitioners alike can study the persons, environments, person-environment relationships, and outcomes as described by Holland.

In fact, previous researchers have used Holland’s theory and the concept of congruence to study college students, educational environments, and desirable college outcomes as described above. In addition to the review of literature surrounding the person-environment congruence performed by Holland (1997), several other literature
reviews have been performed, including Spokane (1985); Assouline and Meir (1987);
Walsh and Holland (1992); Tranberg, Slane, and Ekeberg (1993); Spokane, Meir, and
Catalano (2000); and Spokane, Luchetta and Richwine (2002). In general, there has been
consistent, though often weak, evidence suggesting that congruence is associated with
positive educational and vocational outcomes (Smart et al., 2000).

A few recent examples of how researchers have studied the personality-
environment congruence concept are instructive. Leuwerke, Robbins, Sawyer, and
Hovland (2004) found that major-interest congruence was more predictive of retention
than was mathematical ability in engineering students at a large southern university.
Umbach and Milem (2004) applied Holland’s theory to examine how college students
view diversity, while Feldman, Smart and Ethington (2004) explored the increases in
academic abilities and interests of students who studied in incongruent environments.

In addition, Smart, Feldman, and Ethington (2000), examined how self-reported
growth changed over a four-year period in over 2000 college students who attended the
same four-year institutions for all four years and found that different educational
environments had different effects on self-reported growth. For example, students whose
Holland personality type was artistic and who studied in a congruent (artistic) academic
major increased their artistic abilities and interests, while students who did not have an
artistic personality type and who studied in an incongruent (non-artistic) academic major
exhibited a decrease in their self-reported artistic abilities and interests. Finally, Antony
(1998), in examining the ways in which personality-career fit influences those who began
college with medical career aspirations, found additional support for Holland’s
congruence hypothesis when personality types that were thought to be common among physicians were found to be predictive of medical career aspirations.

*Purpose of the Study*

The purpose of this study was to better understand the influence that person-environment congruence has on the graduation rates of college students at four-year public institutions of higher education in Ohio. This purpose was met by determining how well the degree of fit between individuals and their environments predicts graduation from college when controlling for person variables using stepwise logistical regression.

This study also serves to fill in a gap in the research. Although many studies have examined person-environment congruence in college students, few have used such a large sample size, controlled for many of the person variables, isolated the influence of person-environment interaction, and have studied graduation from college as a successful outcome.

Findings from this study have implications for college students, counselors, and higher education policy makers. Students may benefit from this analysis by coming to understand the importance of selecting majors that are most congruent with their personality types. Career development counselors at the college level and guidance counselors at the high school level can also benefit by learning which person-environment interactions lead to graduation from college for the various Holland personality types. Policy makers may find utility in the results of this study and may choose to emphasize the importance of career assessment and planning by investing human and financial resources in programs and services that maximize person-
environment congruence. In addition, since some research suggests that person-environment congruence is closely related to persistence and subsequent success, enrollment management professionals and college admissions officers may begin to consider person-environment congruence more heavily as they assist students with the identification and selection of appropriate academic programs.

**Statement of the Problem**

The demand for accountability from students, government, and the general public has made successful college outcomes an important issue in higher education in Ohio. Subsequently, the academic enterprise needs to find ways to increase the number of students that graduate from higher education and go on to serve meaningful roles as working citizens who contribute to the knowledge economy.

This study takes an unconventional examination of the problem. Instead of examining issues of access, academic preparation, or institutional effectiveness, this study examines the congruence assumption of Holland’s (1997) theory to determine if the interaction between persons and environments is predictive of graduation from college.

**Assumptions Underlying the Study**

The researcher made certain assumptions about the instruments and constructs considered in this study. The first assumption is that the Holland’s theory of personality types and work environments is a valid and useful theory in studying the outcome of graduating from college. Next, it is assumed that the UNIACT accurately identifies students’ Holland personality type. Third, it is assumed that major fields of study are reasonable approximations of educational environments. Although it is possible to assess
the typology of educational environments directly using the Environmental Assessment Technique (Astin & Holland, 1961), the categorization of major fields into the various three letter Holland typologies as defined by Gottfredson and Holland (1996) is assumed to be valid. Fourth, it is assumed that the C index (Brown & Gore, 1994) is a valid assessment of the strength of the person-environment fit.

The researcher also made assumptions about the population, experimental method, and statistical analysis. The population of students who completed the ACT Assessment, including the UNIACT, and attended a four-year state-supported institution in Ohio in the fall of 1998 is assumed to be representative of students who attend four-year public schools in Ohio and the populations of similar states. Regarding the experimental method, it is assumed that the subjects accurately identified their demographic characteristics on the ACT Assessment and accurately responded to the items on the UNIACT. Finally, it is assumed that a step-wise multiple regression is a valid and useful technique to understand the extent to which the congruence between vocational interest and educational environment (major) influence graduation from college.

**Research Question**

To what extent does the level of congruence between students’ Holland personality type and their major in college at public four-year institutions in the state of Ohio predict graduation from college within six years?
Delimitations

The theoretical framework and research design places constraints on this study. First, the population under consideration is narrowly defined. Although many institutions and a large sample size are considered, there is no consideration given to students attending two-year, independent, or proprietary institutions. Next, the only environmental measure that the researcher considers is the student’s major. Other environmental variables such as educational setting (i.e. rural, urban, suburban), hours spent studying, and place of residence (i.e. on campus, at home with parents) may impact graduation rates but were not considered. Third, the researcher does not attempt to validate portions of Holland’s theory upon which the study is based.

Definitions and Operational Terms

Achievement refers to a secondary construct in Holland’s theory and one of the positive outcomes of a person being in a congruent environment. In this study, graduation from college is hypothesized to be an eventual achievement associated with being in a congruent environment.

Congruence refers to the degree of “fit” between one’s personality and the environment in which one works or studies. A congruent or fitting environment is one in which a person’s preferred activities and competencies are required, and his or her preferences, values, and perspective are reinforced (Holland, 1997). In this study, the C index (Brown & Gore, 1994) is used to quantify the level of congruence.

Consistency refers to a secondary construct in Holland’s theory that describes the internal coherence of a person’s personality profile. It is defined as “the degree of
relatedness between personality types or between environmental models” (Holland, 1997, p. 4). A person whose personality pattern is A-S is consistent because A and S are adjacent to one another on the Holland hexagon, whereas a person whose personality pattern is A-C is inconsistent because the two types are opposite one another on the Holland hexagon.

*Differentiation* refers to a secondary construct in Holland’s theory and is defined as “the degree to which a person or an environment is well defined” (Holland, 1997, p. 4). It is the absolute difference between a person’s highest and lowest percentile rank personality scale score on the UNIACT.

*Educational Environment* refers to “the situation or atmosphere created by the people who dominate a given environment” (Holland, 1997, p. 41). In this study, the student’s academic major defines the educational environment.

*Identity* refers to another secondary construct in Holland’s theory, the “possession of a clear and stable picture of one’s goals, interests, and talents” (Holland, 1997, p. 5).

*Holland Code* refers to a letter code assigned to a particular major that indicates the relative influence of Holland’s six descriptive categories on Educational environments. It is a three-letter code determined through consulting with the *Dictionary of Holland Occupational Codes* (Gottfredson & Holland, 1996).

*Holland Type* refers to a construct in Holland’s theory expressed as an individual letter or a set of letters in the Holland hexagon of personality and environmental types. In this study the top three scales on the UNIACT are used to define students’ Holland type.
Major refers to the student’s academic major, and is used as a proxy to define the educational environment.

Satisfaction refers to a secondary construct in Holland’s theory and one of the positive outcomes of a person’s presence in a congruent environment. In this study, it is considered student satisfaction with their educational environment.

Stability refers to a secondary construct in Holland’s theory and one of the positive outcomes of a person’s presence in a congruent environment. It is commonly referred to as persistence in educational settings and is considered in that manner for this study.

Summary

State supported four-year institutions in Ohio are under much pressure to produce positive outcomes, such as increased graduation rates and increased numbers of graduates prepared for the knowledge economy. In a report recently issued by the Commission on Higher Education and the Economy (CHEE, 2004), it was recommended that state government, the higher education community, and the business community form a “compact” to strengthen accountability for increased participation in higher education and expanded research and commercialization, and that future funding increases be made contingent upon productivity and efficiency. Consequently, the focus on outcomes such as graduation rates and productive college graduates will continue to be of importance to government officials and higher education policy makers.

Holland’s (1997) theory of vocational personalities and work environments can be used as a theoretical framework to understand how students interact with their educational environments. The theory can be used to classify students, educational
environments, and the strength of the fit between them. Holland also provides the framework that can be used to predict educational behavior and successful outcomes such as stability (persistence), satisfaction, and achievement (graduation from college).

The purpose of this study was to gain a better understanding of how well the degree of fit between individuals and their environments predicts graduation from four-year public institutions of higher education in Ohio. The results of this study may serve as an important component of the vast literature on Holland theory research and has important implications for students, career development practitioners, and higher education policy makers.
CHAPTER 2

REVIEW OF LITERATURE

The performance of higher education institutions and their accountability to state and federal government, governing boards, and the American public has been and will likely continue to be an important focus for high education policy makers and administrators. Of particular interest are outcomes such as persistence rates and graduation rates. Consequently, higher education practitioners and policy makers alike are in search of ways to meet the expectation for accountability by improving some of these key performance indicators.

Different approaches can be used to accomplish the task of improving these performance indicators. One approach is to improve the academic quality of students who enter our colleges and universities. Another approach is to improve the teaching and learning that occurs in the educational environment. A third approach is to improve both the students and the educational environment. Finally, higher education practitioners and policy makers could look to improve the fit between students and educational environments in the hope of matching students’ interests, abilities, values, and goals with those of the faculty and their fellow students.

This approach of maximizing the fit between persons and their environments is not new. Plato argued for the assignment of people with specific temperaments and
abilities to jobs that matched those characteristics (Tinsley, 2000). Much later, Parsons in the early 20th Century, and Patterson and Darly in the 1930s (cited in Tinsley, 2000), discussed models of vocational choice and established the usefulness of personal-environment fit models in vocational psychology. John L. Holland, an academic disciple of John Darly at the University of Minnesota, went on to propose, develop, and refine one of the most widely used person-environment fit models (Savickas & Gottfredson, 1999).

**Holland’s Theory of Vocational Personalities and Work Environments**

While serving as a personnel clerk in World War II, John L. Holland noticed that similar people tended to be attracted to the same jobs and that they could be classified into a few types based on the occupational histories of the soldiers (Weinrach & Srebalus, 1990). After the war, Holland began a classification system as a doctoral student at the University of Minnesota and continued to refine his thoughts as a college instructor and vocational counselor at Case-Western Reserve University in the 1950s (Savickas & Gottfredson, 1999).

Later, while working for the National Merit Scholarship Corporation, Holland (1959) published the first rendition of his theory of vocational choice. During the 1960s, Holland served as the Vice President for Research at the American College Testing Program (American College Testing [ACT], 2004c; Holland, 1999). While at ACT, Holland and his associates refined and developed aspects of his theory, including the Holland hexagon of occupational types and the vocational interest inventories, which were precursors to the interest inventory (UNIACT) being considered for this study.

After his original conceptualization of the theory, Holland produced four more iterations (Holland, 1966, 1973, 1985a, 1997). Holland’s (1997) theory has generated
hundreds of research studies (Feldman, Smart, & Ethington, 2004) and has been one of
the most widely investigated theoretical frameworks in vocational and personality
literature (Savickas & Gottfredson, 1999). Further, Holland has been one of the most
published psychologists ever (G. D. Gottfredson, 1999).

The four key working assumptions, which were introduced in the previous chapter
and are found in the most recent version of Holland’s (1997) theory will be discussed
here. In addition, consideration will be given to empirical evidence from higher
education; the secondary constructs of Holland’s (1997) theory; and the assessment
instruments that exist to determine personality types, environments, and the congruence
between them.

*Individuals: The Six Personality Types*

Holland argued that a person’s vocational personality develops through the
interaction between biological and environmental factors. Factors such as heredity,
activities, interests, competencies, and disposition interact with a person’s environment,
resulting in the development of his or her vocational personality.

Holland postulated that there are six different vocational personality types:
Realistic (R) Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional
(C). A short summary of the types is offered next.

The R type prefers occupations or situations that entail working with his or her
hands, tools, machines, and technology. This type of person is averse to intellectual and
educational pursuits and has relatively low self-esteem. R types have a narrow range of
interests and possess a very closed system of beliefs and values. In problem solving, R
types prefer practical and structured solutions.
The I type prefers activities that entail working with ideas, observing, understanding, and controlling processes. This type of person is averse to persuasive, social, and business activities. I types have a wide range of interests and have liberal goals and values. To solve problems, I types rely on thinking, gathering data, and making careful analyses.

An A type person would rather perform activities that are ambiguous, unsystematic, and creative. A types are averse to systematic, orderly, or monotonous activities. Self-expression and equality are highly valued. Problem solving usually involves creative and artistic competencies.

The S type person prefers manipulating others in an attempt to heal, cure, educate, develop, or train them. This type of person is averse to manual and technical competencies. Values include helpfulness, forgiveness, and equality. Human interaction and social competencies dominate the problem-solving process.

An E type person prefers manipulating others in an attempt to attain organizational goals or economic gain. This type of person is averse to scientific and intellectual tasks. E types value controlling others while being free of control and have a rather closed belief system. Problems are usually approached from a social influence perspective.

The C type prefers dealing with data, performing systematic activities, and organizing things. Artistic, ambiguous, or exploratory tasks are avoided. A very closed belief system is accompanied by a value for business and economic achievement. To solve problems C types follow established rules and seek advice or counsel.
Holland’s Hexagon (Holland, Whitney, Cole, & Richards, 1969) was originally developed in order to depict the psychological resemblances and differences of the personality types visually (see Figure 1). These types were organized so that each corner of the hexagon represented each type. The order in which the types appear was important because adjacent types were thought to be most similar and opposite types least similar. For example, the S type was more similar to the A type and had opposite interests to the R type.

![Image of the Holland Hexagon](image)

*Figure 1.* The Holland Hexagon depicting the psychological resemblances and differences of the Holland types.

Hundreds of studies have been conducted that support the existence of the vocational personality types and their associated competencies, values, and
identifications as described by Holland (Spokane, Luchetta, & Richwine, 2002). A detailed review of several studies conducted with college students on the Holland personality types can be found in Holland (1997).

Vocational interest inventories can be used to determine an individual’s personality pattern. A personality pattern is a profile of a person’s resemblances to the six personality types. These patterns may consist of between two and six variables or types. For example, a person’s two-type personality pattern could be described as SE, which represents his or her scores on the two highest scales of one of the vocational interest inventories. Meanwhile, that same person’s six-type personality pattern could be described as SEAICR for all six scales on one of the vocational interest inventories. The various personality patterns can be distinguished further with additional constructs that have been formulated by Holland. The three secondary constructs relating to personality patterns will be discussed here.

Consistency describes the internal coherence of a person’s personality profile and is often calculated by determining the distance between two points on the Holland hexagon. The pattern is consistent if the personality types under consideration have common characteristics. For example, consider a person whose two highest personality scores were R and I. Since the R and I types are similar (and located adjacent on the Holland hexagon), then the personality pattern for the two highest personality types is consistent. Conversely, a person whose two highest personality scores were R and S would have an inconsistent personality type because the R and S types are dissimilar and located on opposite sides of the hexagon.
Differentiation describes how well a person’s interests are defined. It also provides information about the relative definition of types in a personality profile. It is expressed as the difference between a person’s highest and lowest scores for the Holland personality types on one of the vocational interest inventories. Sharp peaks and low valleys in a personality pattern would indicate a highly differentiated personality, while a relatively flat pattern would be classified as poorly differentiated.

Identity describes the degree of clarity in one’s goals, interests, and talents. Identity can be measured using the Vocational Identity Scale from My Vocational Situation (Holland, Gottfredson, & Power, 1980). Persons with high scores have few goals belonging to a few main categories, while persons with low scores have many goals that are associated with many main categories.

At least six vocational interest inventory instruments exist and are effective in assessing an individual’s interests to determine a vocational personality. Recently, Savickas, Taber, & Spokane (2002) illustrated the convergent and discriminant validity of the Campbell Interest and Skills Survey (Campbell, Hyne, & Nilsen, 1992), the Kuder Occupational Interest Survey-Form DD (Kuder & Zytowski, 1991), the Self-Directed Search (Holland, Fritzche, & Powell, 1994), the Strong Interest Inventory (Harmon, Hansen, Borgen, & Hammer, 1994), and the UNIACT (Swaney, 1995). The Vocational Preference Inventory (Holland, 1985b) is also a widely used instrument that has been demonstrated to have substantial construct validity (Spokane et al., 2002).

The vocational personality assessment instrument that is used in this study is the UNIACT. The UNIACT is completed by approximately 5 million persons each year (Prediger, 2002) and is a component of the ACT Assessment.
In 1998, 60% of Ohio high school graduates took the ACT Assessment (ACT, 2004b). This represents approximately 65,000 students (Western Interstate Commission for Higher Education [WICHE], 2003). Further, the ACT Assessment and the UNIACT are convenient instruments for this study because they can provide descriptive (demographic and academic) information about college-bound students and their vocational interests respectively. Due to the dominance of the ACT Assessment (and hence the UNIACT) in Ohio, as well as the wide range of demographic, academic, and vocational personality information that can be obtained in conjunction with the ACT Assessment, the use of the UNIACT was a logical choice of vocational interest inventories for this study.

The ACT Assessment consists of four components (ACT, 2004a). The tests of educational development section assess students’ general educational development in four subject areas: English, mathematics, reading, and science. The course/grade information section provides 30 self-reported high school grades in the areas of English, mathematics, natural sciences, social studies, language, and the arts. The student profile section, which is completed by students when they register for the ACT Assessment, consists of 190 items of information in categories such as educational plans, interests, and needs; college extracurricular plans; financial aid; and demographic background information.

The fourth section of the ACT Assessment is the UNIACT. There are 90 items on the UNIACT, with six scales of 15-items corresponding to each of the Holland personality types. Students are directed to indicate how much they would like doing activities such as building furniture, writing payroll checks, or teaching people a new
hobby. A three-choice response format is used: like, indifferent, and dislike (ACT, 2003). The UNIACT can provide researchers with a standard score and percentile ranks for each of the Holland types. This allows researchers to determine the one, two, or three-letter (most common), or even six-letter Holland type. In addition, the differentiation that a personality type possesses can be obtained by subtracting the lowest score from the highest score on the RIASEC scales (Rose & Elton, 1982). Consistency can also be determined by measuring the hexagonal distance between the first and second letter of the Holland type (Rose & Elton, 1982).

Day, Rounds, and Swaney (1998) obtained good hexagon approximations for male and female 11th and 12th grade Caucasian Americans, African Americans, Asian Americans, Mexican Americans, and Native Americans, providing good support for the construct validity of the UNIACT. The UNIACT’s criterion-related validity has been illustrated across 14 studies that used the highest UNIACT score to predict criterion group membership (Prediger, 2002). Internal consistency reliability for the UNIACT scales has been shown to range from 0.83 to 0.93 (Prediger & Vansickle, 1992). Most recently, Savickas et al. (2002) affirmed the discriminant validity of the UNIACT. Prediger, Swaney, and Mau (1993) direct researchers to ACT (1988), Lamb and Prediger (1981), and Swaney (1990) for the specifics regarding the psychometric characteristics of the UNIACT.

Hundreds of studies have utilized one of the vocational interest inventories to study college students, and several have used the UNIACT and its precursors to assess the vocational interests of college students (Holland, 1997). Spokane (1985) identified some early studies of college students using one of the UNIACT precursors, the ACT
Vocational Interest Profile (Hanson, 1974), that were conducted by Elton and Rose (1981) and Wolfe and Betz (1981). Rose and Elton (1982) also used the Vocational Interest Profile, while Laing, Swaney and Prediger (1984) used ACT’s next version of a vocational interest assessment, the ACT Interest Inventory (Hanson, 1974). Later, Betz, Heesacker, and Shuttlesworth (1990) used the UNIACT to study gender roles of college students. Other studies (Farh, Leong, & Law, 1998; Soh & Leong, 2001) have used the UNIACT to investigate the cross-cultural application of Holland’s (1997) theory. Recently, Schaefers, Epperson, and Nauta (1997), Tracey and Hopkins (2001), Tracy (2003), and Leuwerke et al. (2004) have also used the UNIACT.

*Environments: The Six Model Environments*

The second assumption in Holland’s (1997) theory is that there are six model environments that parallel the six Holland personality types. The following is a summary of the model environments taken from Holland (1997), Thompson and Smart (1999), and Smart et al. (2000).

The R environment is characterized by environmental demands and opportunities to manipulate materials, tools, machines, and animals. People in this environment are encouraged to see the world in simple and traditional terms and to see themselves as having mechanical ability while lacking interpersonal skills.

The I environment possesses environmental demands and opportunities to observe and investigate physical, biological, or cultural phenomena. It encourages people to see the world in complex and abstract ways and to see themselves as possessing quantitative skills and scientific ability while lacking in leadership ability.
The A environment stimulates creative activities and innovative intellectual endeavors. People in this environment are encouraged to have a complex, independent, and unconventional worldview and to see themselves as having aesthetic values and unconventional ideas.

The S environment provides environmental demands and opportunities to manipulate others in a helpful or facilitative manner. People who find themselves in this type of environment are encouraged to see the world in a flexible way and to see themselves as being understanding, cooperative, sociable, and concerned about the welfare of others.

The E environment is characterized by environmental demands and opportunities to manipulate others to attain organizational, personal goals. Persons in this environment are encouraged to possess a world view in which of power, status, and responsibility are viewed in simple, stereotyped terms and to see themselves as having leadership skills and as being aggressive, popular, and self-confident.

The C environment promotes activities with things, numbers, or machines according to a prescribed plan to meet organizational requirements or standards. It encourages persons to see the world in a simple, constricted, and dependent manner and to see themselves as being conforming, orderly, and non-artistic.

There are also secondary effects of being exposed to any given environment. In general, people become susceptible to influences that typify the environment. For example, persons who have been exposed to an I environment become more susceptible to abstract, theoretical, and analytic influences. Another secondary effect is that people become attracted to occupations and roles in which they can express themselves in
activities that typify the environment. An example of this phenomenon is people who are exposed to an A environment are attracted to roles and occupations in which they can express themselves artistically. The third secondary effect is that people will be apt to deal with others in ways that typify the environment. For example, a person who has been exposed to an S environment will be likely to treat others in a friendly, helpful, and cooperative manner. The final secondary effect is that each environment leads people to be open to varying levels of new ideas and beliefs. I and A environments foster a wide range of interests and the most open-minded mentality; S and E environments promote a moderate range of interests and lead to a modest amount of open-mindedness, while R and C environments cultivate a narrow range of interests and a rather closed belief system.

Holland (1997) identified one dozen studies that investigated his hypothesis about environmental models. A detailed review of several studies conducted with college students within Holland’s (1997) theoretical framework educational environments can be found in Holland (1997) and L. S. Gottfredson and Richards (1999).

At least three different tools have been used to assess and classify educational environments (Smart et al., 2000). The Environmental Assessment Technique (Astin & Holland, 1961) has been shown to be valid and reliable in determining the educational environment at an undergraduate institution by ascertaining the distribution of student types at that institution and categorizing the proportion of students in different major fields (Holland, 1997; Spokane, 1985). *The College Majors Finder* (Rosen, Holmberg, & Holland, 1989) can be used to determine the profile of educational environments by classifying majors according to their distinctive interests, skills, and abilities. Similarly,
the *Dictionary of Holland Occupational Codes* (*DHOC*: G. D. Gottfredson & Holland, 1996) can also be used to study educational environments by translating the Classification of Instructional Program (CIP) codes into Holland codes. Both the College Majors finder and the *DHOC* provide three-letter Holland codes for hundreds of academic disciplines and areas of study.

The environmental assessment tool being used for this study is the *DHOC*. The *DHOC* contains numerous tables that translate Holland codes into Dictionary of Occupational Title codes, Census Occupational classification codes, and CIP codes, among other things. Researchers have often used this reference to define an educational environment by using the student’s college major (Smart et al., 2000; Spokane, 1985).

For a review of all iterations of the Holland classification system, including validity and reliability studies of the *DHOC*, see Holland (1985a; 1997) or L. S. Gottfredson and Richards, (1999). This tool was chosen because of its capacity to determine the Holland model environment to which a student is exposed to based on the CIP code of the academic major in which the student is enrolled. In this study, the students CIP codes were obtained from the Ohio Board of Regents (OBR).

Researchers have been utilizing students’ majors as an environmental measure for decades, and this practice is typical in studies of college students within the theoretical framework of Holland’s (1997) theory (Spokane, 1985). As Huang and Healy (1997) argued, academic majors are organizational entities with which all students have some affiliation, entities that have a characteristic set of goals and missions, attract different types of faculty and students, and possess its own curricular requirements. See Spokane (1985), Holland (1997), and Spokane, Meir, and Catalano (2000) for dozens of examples
of studies that have used students’ majors as an environmental measure. Examples of recent studies that have used the academic major as the environmental measure include Feldman, Smart and Ethington (2004); Leuwerke et al. (2004); and Umbach and Milem (2004).

Congruence: Interaction between Individuals and Environments

The third assumption in Holland’s (1997) theory is that persons are most likely to flourish when their personality type and the model environment match. Further, when activities, opportunities, tasks, and roles of a person’s environment are congruent with the competencies, interests, and self-perceptions of his or her personality type, then higher levels of stability, satisfaction, and achievement will result. These outcomes resulting from congruence will be discussed in more detail later.

There are various degrees of congruence. The highest level of congruence occurs when a personality type is in the matching model environment. The next highest level of congruence occurs when a personality type is in an environmental model that is adjacent on the Holland hexagon. A personality type in a model environment that is an alternate position (not adjacent, but not opposite) on the Holland hexagon would exhibit a lower level of congruence. Lastly, the lowest level of congruence occurs when a personality type is exposed to a model environment on the opposite side of the Holland hexagon.

Researchers have determined congruence by comparing the first letter and the first two letters in the model environment and personality type. In addition, several indices have been constructed and tested to measure the degree of congruence using the first three letters of the Holland code. (Assouline & Meir, 1987; Spokane, 1985; Tranberg, Slane, & Ekeberg, 1993). Young, Tokar, and Subich (1998) reviewed 11
congruence indices and state that there are “strong theoretical grounds for preferring the
K-P [(Kwak & Pulvino, 1982)] and C [(Brown & Gore, 1994)] indices over all of the
other indices when testing Holland’s theory” (p. 220).

The endorsement of the C index is echoed by Holland (1997) himself, who used
words like “pay dirt” (p.165) and “promising” (p. 169) to describe the C index. He also
cautions students to “Define the degree of congruence carefully. Use the Brown-Gore
Index…” (p. 284).

The C index was developed as simpler alternative to the K-P index. Brown and
Gore’s (1994) C index is superior to others that have been developed because it is
consistent with Holland’s (1997) theory, easy to calculate, more comprehensive than
other indices, and sensitive to code orders (Miller, Wells, Springer, & Cowger, 2003).
Other advantages to the C index are that results from all practically possible
combinations of three-letter person and environmental codes were symmetrically
(normally) distributed and that the C index utilizes a hexagonal distance measure with the
calculation of congruence scores (Brown & Gore, 1994).

The C index uses the formula:

\[ C = 3(X_i) + 2(X_i) + (X_i), \]

where \( X_i \) are values of 3, 2, 1, or 0. Values are assigned on the basis of the
hexagonal distance between the letters for the personality type-environmental model
comparison: 3 = identical position, 2 = adjacent position, 1 = alternate position, 0 =
opposite position. Scores on the C index can range from 0 (low) to 18 (high).

Searches of research databases and reviews of literature conducted after the
development of the C index performed by Holland (1997), Spokane and his colleagues
(Spokane et al., 2002; Spokane et al., 2000), and Smart et al. (2000) revealed only three studies that have used the C index to study college students. The studies identified by this researcher that have used the C index to determine the level of congruence between college students and their environment are Oleski and Subich (1996); Schaefers et al. (1997); and Miller, Wells, Springer, and Cowger (2003).

Based on the review of literature, and despite the limited application of the C index in the study of college students, it is still the congruence index favored by this researcher. Therefore, due to the ease of use, the favorable review by Young et al. (1998), and the recommendation from Holland (1997) himself, the C Index was the tool of choice to measure congruence for this study.

*Interactions Determine Behavior*

The final key assumption of Holland’s (1997) theory is that if a person’s personality pattern is known, and the pattern of an environment is known, then it is possible to forecast (or predict) behavior and outcomes resulting from the pairing of personality types and environments. Examples of predictable behavior include choice of vocation, competence, educational behavior, and vocational behavior. Outcomes include stability, achievement, and satisfaction. For the purposes of this study, educational behavior is the type of behavior under consideration, and academic achievement is the outcome being studied.

Smart et al. (2000) have authored a book that appears to be the first comprehensive review of Holland’s (1997) theory and research as it pertains to the study of college students and faculty. This book offers both comprehensive reviews of literature and the reporting and discussion of the important empirical research conducted
by the authors. Consequently, this book serves as an outstanding resource for researchers who apply Holland’s (1997) theory to higher education settings.

They (Smart et al., 2000) demonstrate that Holland repeatedly states that the basic assumptions for his theory of vocational personalities and work environments are equally valid in educational settings. They go on to identify three key educational behavioral implications of Holland’s (1997) theory based on the first three key assumptions. Their behavioral implications of self-selection, socialization, and congruence will be discussed here in some detail.

Self-selection refers to the phenomenon in which students “actively search for and select academic environments that encourage them to develop further their characteristic interests and abilities to enter (and be successful in) their chosen career fields” (Smart et al., 2000, p. 52). This self-selection assumption in educational settings comes out of Holland’s (1997) assertions that persons prefer environments or situations in which they can engage in the activities, roles, competencies, and interests that parallel their personality types, and that people will avoid circumstances that are incongruent with their personality types.

In their review of literature relating the self-selection assumption to college students in educational settings, Smart et al. (2000) substantiate the claim that students select academic environments that are congruent with their career goals and aspirations (Huang & Healy, 1997) and perceive themselves as having strong abilities and interests associated with their intended major (Smart & Feldman, 1998). In addition, results from their own study (Smart et al., 2000) also suggest that students initially select college majors that are assumed to reinforce and reward their stronger self-perceived abilities.
More recently, Umbach and Milem (2004) found that students select majors that are congruent with their attitudes and beliefs about diversity.

Socialization refers to the phenomenon in which academic environments (such as institutions, departments, or classrooms) allow faculty and students to engage in a distinctive set of activities and to develop competencies associated with those activities. This socialization assumption in educational environments is supported by tenets of Holland’s (1997) theory asserting that environments stimulate people to engage in activities that typify the environment, foster competencies and achievements indicative of the environment, encourage people to see themselves with traits conducive to the environment, and reward them for displaying behavior reflecting the values and goals of the environment.

In their review of the extant evidence on the socialization assumption, Smart et al. (2000) document evidence suggesting that some academic environments are effective in impacting change in students’ interests and abilities to be more like the model environment irrespective of the students’ personality types. A environments were found to be most effective in socializing students, I environments were found to be moderately effective in socializing students, and S and E environments were less effective. However, the results of their own study (Smart et al., 2000) revealed that all four environments under consideration were relatively equally effective in socializing students and impacting change in interests, abilities, and self-perceived growth. More recent work by these researchers (Feldman, Ethington, & Smart, 2001; Feldman et al., 2004) once again supports Holland’s (1997) theory, “which implicitly postulates a uniform pattern of
reinforcement and reward by the respective academic environments irrespective of students’ levels of congruence with those environments” (Feldman et al., 2004, p. 541).

Smart et al. (2000) reiterate Holland’s (1997) congruence assumption, which postulates that increased levels of stability, satisfaction, and achievement will be obtained when personality types and educational settings are congruent. They also describe the measurement of stability in educational settings as being alternatively stated as retention or persistence.

The congruence assumption has been studied by hundreds of researchers. In addition, two meta-analyses (Assouline & Meir, 1987; Tranberg et al., 1993) have been performed, and several reviews of literature (Holland, 1985a, 1997; Smart et al., 2000; Spokane, 1985; Spokane et al., 2002; Spokane et al., 2000; Tinsley, 2000; Walsh & Holland, 1992) have been performed. Since the outcome under consideration for this study is achievement, the research that relates to college students on the outcomes of stability and satisfaction will only be summarized. A more detailed discussion of the literature on achievement for college students will follow.

Overall, there are mixed findings with regard to the outcome of stability. Smart et al. (2000) acknowledge that the findings from the research (Bruch & Krieshok, 1981; Spokane, Malett, & Vance, 1978) show a weak positive relationship between congruence and stability (persistence or retention). On the other hand, Spokane (2000) identified two studies (Lent, Brown, & Larkin, 1987; Swanson & Hansen, 1986) in which congruence was not related to academic stability or persistence. Earlier, Spokane (1985) identified three studies (Bruch & Krieshok, 1981; Holland, 1963; Southworth & Morningstar, 1970) that did report a positive relationship between congruence and persistence.
Holland and his colleagues (Holland, 1997; Walsh & Holland, 1992) reviewed studies that have defined stability in terms of personal adjustment, academic adjustment, personality, self-concept, ability, and feminist attitudes. Their conclusion was that congruence was related to measures of personal and vocational adjustment, integration, vocational maturity, and planfulness.

In this researcher’s own review of literature, other studies (Antony, 1998; Laing et al., 1984; Leuwerke et al., 2004; Rose & Elton, 1982; Schaefers et al., 1997; Scott & Sedlacek, 1975; Spokane et al., 1978; Taylor & Hanson, 1970, 1972; Villwock, Schnitzen, & Carbonari, 1976; Walsh, 1974; Walsh & Osipow, 1973) reported mostly positive results using Holland’s concept of congruence to study various measures of academic stability.

With respect to the outcome of satisfaction, there have generally been stronger and more positive findings with the congruence assumption. Smart and his colleagues (2000) pointed to a series of their own studies (Elton & Smart, 1988; Smart, 1987; Smart, Elton, & McLaughlin, 1986) and a series of studies by Walsh and his colleagues (Frantz & Walsh, 1972; Walsh & Lewis, 1972; Walsh & Russel, 1969; Walsh, Spokane, & Mitchell, 1976) which illustrate how satisfaction was positively associated with congruence. Smart et al. (2000) also point to studies in which the results weren’t reported as positive (Assouline & Meir, 1987) or the results varied for males and females (Holland, 1958; Morrow, 1971).

Spokane (Spokane, 1985; Spokane et al., 2000) and his associates also identified several studies (Holland, 1968; Nafziger, Holland, & Gottfredson, 1975; Rand, 1968; Spokane, 1979; Spokane & Derby, 1979; Walsh, Howard, O’Brien, Santa-Maria, &
Edmunson, 1973; Williams, 1972) investigating satisfaction that were not reviewed by Smart et al. (2000). Holland and his colleagues (Holland, 1997; Walsh & Holland, 1992) also assert that there is evidence demonstrating that congruence leads to satisfaction.

However, not all researchers agree about the strength of the relationship between congruence and satisfaction. Tinsley (2000), in a strong critique of the congruence literature, asserts that hexagonal congruence and satisfaction do not correlate significantly. As support, Tinsley points to the meta-analyses done by Assouline and Meir (1987) and Tranberg et al. (1993), which reported mean congruence-satisfaction correlations of .21 (all studies) and .10 (college students only), respectively. Others (Chartrand, Camp, & McFadden, 1992) were also unable to find positive results supporting the congruence-satisfaction link. Despite these studies that were not favorable, there appears to be ample evidence to support Holland’s (1997) congruence assumption as it relates to satisfaction.

**Academic Achievement**

Achievement has been the least studied outcome resulting from congruence. In addition, the findings in this area of congruence research are perhaps the weakest (Assouline & Meir, 1987; Smart et al., 2000; Walsh & Holland, 1992).

Holland (1963) was the first to investigate the congruence assumption as it relates to academic achievement. The 592 participants in this longitudinal study were finalists for the 1956 Merit Scholarship Program who completed a vocational interest inventory during their senior year in high school and were polled again during their senior year of college to determine their level of achievement (leadership, science, arts) in college. He had two sets of hypotheses: one relating personality type to achievement in leadership,
science, or art; and another relating to personality type-academic environment congruence and achievement.

Holland (1963) first hypothesized that for both males and females, S and E types would experience higher levels of achievement in leadership; I and R would exhibit higher levels of achievement in science; and A types would demonstrate higher levels of artistic achievement. The correlation coefficients that were reported supported the hypotheses with two exceptions. Artistic achievement for males was higher for E types than for A types, and scientific achievement in females was equally correlated with I and C types.

In addition, Holland (1963) also examined the institutional influences on achievement by examining the congruence between students and the educational environment. The Environmental Assessment Technique was used to assess the Holland code for the college environment. His hypothesis was that congruency would be positively associated with achievement. After controlling for entering student characteristics (standardized test scores and high school achievement), it was determined that males who studied at a college that was congruent (first letter) with their personality type reported more artistic and leadership achievement than males who studied in incongruent environments. However, findings for males relating to scientific achievement were not statistically significant. Further, findings for females in all three types of achievement under consideration were not statistically significant.

Although the results of Holland’s (1963) early investigation of achievement were somewhat positive, the study did have some shortcomings. First, the sample was not representative of college students in general: instead, it was a sample of academically
talented students. Next, the crude use of one letter congruence comparison is less than optimal. However, more sophisticated congruence indices were not yet developed. Nevertheless, results from this study provided Holland reason to believe that his congruence hypothesis had value. A noteworthy strength of this study was the control for students’ pre-college characteristics.

Six years after Holland’s (1963) study, Walsh and Lacey (1969) studied the perceived change in traits and abilities of 151 senior male college students who were assigned a Holland personality type based on their academic major. They developed six scales to measure the perceived impact that the college years and experiences had on students, one for each of the Holland types. In addition, as a component of these scales, adjectives and phrases that reflect unique characteristics of the different Holland personality types were included in the scales. Although they didn’t assess personality type of the students directly, this scale combining abilities and self-descriptions is being considered a crude estimation of personality type by this researcher.

Using an ANOVA, Walsh and Lacey (1969) found that the perceived change in I-related abilities for chemistry and engineering students was significantly different (p < .01) from psychology, economics, political science, and fine arts students. They also found that perceived change in A-related abilities for fine arts students was significantly different (p < .01) from engineering, chemistry, psychology, economics, and political science students. In other words, they found higher levels of perceived change in I abilities for chemistry and engineering students and higher levels of perceived change in A abilities for fine arts students.
Despite this positive result for I and A type students, this study (Walsh & Lacey, 1969) has some serious limitations. First, a small sample of males at one university is hardly representative, thus limiting generalizability. The use of an experimental scale also limits the validity and reliability of the measurements. In addition, there was no attempt to control for students’ entering characteristics. Lastly, this is not really a congruence study since the personality type and the environment were not determined. Therefore, one could argue that this is a study solely of the socialization assumption. However, the combined use of abilities and adjectives describing the different Holland personality types in the scales that were developed, were crude approximations of personality type. Since the relationship between these estimations of personality type and major is similar in design to this study, this piece of evidence was considered.

In another early study in this area, Posthuma and Navran (1970) studied how the congruence between 121 students and 44 faculty personality types was related to academic performance. A qualitative code analysis revealed that the Holland code profile for the faculty (AISCER) was found to be most similar to the Holland code profile of the students (IACRSE) who achieved final grades of ‘A’ and ‘B’ in their courses during their first year of study at Royal Military College. Conversely, the students who failed (RACSEI) were found to be incongruent. However, a congruency index was not used to measure congruence. Instead, rank-order correlations between the faculty profile and each student subgroup were calculated and were not found to be statistically significant. A potential limitation to this study is the tendency for I types to be associated with high levels of academic performance (Walsh & Holland, 1992). Therefore the fact that high I Holland personality types did well academically may well have been due to
this fact across studies and not due to the congruence with faculty. It is also worth noting that students who failed exhibited inconsistent codes (RA) at the top of their Holland code personality profile.

In a similar study, Frantz and Walsh (1972) studied the congruence between 65 graduate faculty and 88 graduate students, in addition to the degree of differentiation and consistency of the student personality types. Congruence between faculty and student personality type and consistency taken alone failed to predict achievement. However, the combined effects of congruence, consistency, and differentiation predicted both achievement and satisfaction in graduate school. Limitations of this study include the fact that the measurement of achievement was only the first semester grades in the graduate program. In addition, the study did not control for student characteristics such as intelligence and undergraduate achievement. Finally, the small sample sizes at one institution limit the ability to generalize results.

Later, Walsh and Hanle (1975) studied congruence as it related to vocational maturity, academic aptitude, and academic achievement of 53 sorority sisters. Congruence was determined by comparing the students’ current occupational choice with their Holland personality type. The congruent group was found to have a higher grade point average compared to the incongruent and undecided groups. Although the results were not statistically significant, the findings were in a direction consistent with Holland’s (1997) theory. In addition to the non-significant findings, the small sample, this time only females from one institution, limits the impact of this study. As in most of the other studies of achievement, students’ pre-college characteristics were not considered.
Reutefors, Schneider, and Overtone (1979) examined congruence as it related to college grade point average in 392 male and 424 female freshmen college students. They compared Holland personality type to college major choice and found that congruent students had higher grade point averages than incongruent students. However, this study is limited because it used only a first letter congruence measure and did not consider students’ entering characteristics. In addition, the subjects in this study were first semester freshmen, which means that they had limited contact with courses, faculty, or other students in their major. Despite these shortcomings, this study does demonstrate outcomes in line with Holland’s (1997) theory.

In an investigation of 158 I and R type students enrolled in an engineering program that emphasized mathematical and physical science concepts, Bruch and Krieshok (1981) found that students whose high point Holland code was I achieved higher grade point averages than students whose Holland type was R. The fact that they used three successive classes of students over a four semester period makes this study particularly strong (Holland, 1997). Similar to the Posthuma and Navran (1970) study, a potential limitation to this study might be that I types tend to perform better in academic settings than do the other Holland types. The use of a one-letter comparison for congruence and a lack of control for student characteristics are also shortcomings.

In a study that is very similar to this investigation, Martin and Bartol (1986) examined the relationship between personality type-academic major congruence and successful program completion (graduation from MBA program). Their subjects were 168 MBA students with concentrations in accounting, finance, information systems, management, operations research, or marketing. The Vocational Preference Inventory
was used to assess the Holland personality type, and the DHOC was used to determine the three letter Holland environmental code by utilizing the most common jobs obtained by individuals in the six concentrations. The Iachan (1984) index, which compares the three letter codes of personalities and environments, was used to calculate congruence. A correlational analysis, which was used to test the hypothesis that congruence predicted program completion, proved to be significant \((r = .156, p = .05)\). What makes this study particularly strong is the fact that the researchers assessed personality types, utilized a valid and reliable instrument to determine environmental codes, and used an index to compare the three-letter codes of personalities and environments. Shortcomings to this study include the small sample size at one institution in one academic area of study (business), a lack of control for entering student characteristics, and the use of a correlational analysis to infer causation.

In another study slanted towards I personality types, Henry (1989) studied the congruence between personality type and academic major of 157 students enrolled in a medical/dental preparatory program to see if congruence would predict academic achievement. Students were classified as congruent if their Holland code high point was I; students whose Holland code high point was not I were considered incongruent. The environment was considered to be I for all students since they were all enrolled in the same science major. A one-way ANOVA was used to determine if there was a significant difference between the congruent and incongruent groups. The F ratios for mean GPA and science GPA were both statistically significant \((F = 16.96 \text{ and } 14.57 \text{ respectively, } p = .01)\). However, these positive results are tempered by a weak experimental design. Since only the first letter of the Holland code was considered in a
major area that is dominated by I types, who tend to perform well academically, this study is positive but not conclusive. Although this study analyzed the differences between groups based on gender and race, other entering characteristics such as intelligence were not considered.

Holland’s (1997) model was used to examine college satisfaction, retention, and academic achievement in a longitudinal study (cited in Spokane, 2000) of 772 college students conducted over a 5-year period at the University of Maryland. No significant correlations were found between grade point average and majors in programs congruent with personality type.

Beginning in 1997, Smart and his colleagues published a series of three studies based on longitudinal data from the Cooperative Institutional Research Program (CIRP). Their findings, which have been summarized in Smart et al. (2000), have provided strong support of Holland’s (1997) theory as it relates to academic achievement. The first study (Smart, 1997) provided broad support of Holland’s (1997) theory, their second study (Smart & Feldman, 1998) showed some support for the congruence hypothesis, while the last study (Feldman, Smart, & Ethington, 1999) addressed the congruence hypothesis specifically.

In the first study, Smart (1997) examined self-perceived growth of ability in I, A, S, and E personality types. Subjects were 2,036 students who attended the same four-year institution for four years. Students’ self-identified college major was converted to a Holland code using the College Majors Finder (Rosen et al., 1989) and was used as the environmental measure. R and C environments were excluded from the study because of the small number of majors in those areas. In an attempt to control for students’ entering
characteristics (preferences for the different Holland environments), the author used four scales that he developed from the 1986 CIRP freshman survey. Smart offered reliability estimates from .67 to .75 and argued that these were reasonably valid measures of students’ predisposition to the four academic environments under consideration.

Achievement was determined by analyzing the self-reported growth in various skills and abilities as posed on 18 items on the 1990 CIRP follow-up survey. A multivariate analysis of covariance analysis was used to analyze the data.

Results indicated that self-reported growth was related to students’ 1986 predispositions to the four environments. Students whose initial 1986 preferences were for E environments showed the most growth in the career and leadership abilities; those who preferred artistic environments had the most growth in artistic and cultural skills and abilities, and those who preferred social environments showed the most growth in educational and social skills and abilities. Although this study showed strong support for Holland’s (1997) theory, it was not a study of congruence. Results comparing how much congruent and incongruent self-reported growth occurred were not offered. However, this study had a strong experimental design because it attempted to control for entering student characteristics, had a large sample size, and considered subjects at various four-year institutions.

In the second study of this series (Smart & Feldman, 1998), Holland’s (1997) socialization assumption was the primary focus, and congruence was considered only as a secondary objective. Samples and controls, and student and environmental measures similar to those used in Smart (1997) were also utilized in this study. This time the authors reported that for students who possessed strong predispositions of “Artistic and
Enterprising abilities and interests, the ‘fit’ between the individual and the environment made a difference” (Smart & Feldman, 1998, p. 412).

In their third study (Feldman et al., 1999), the researchers specifically sought to test Holland’s (1997) congruence hypothesis. Again, they used the students’ self-reported major as the environmental measure and controlled for students’ pre-college characteristics. Just as before, R and C environments were excluded from the study because of the small number of majors in those areas. Also again, they used the students’ self-reported ratings of various goals and values associated with the various Holland types. Students’ responses to these items were used to classify their Holland personality type: the authors point out that, “Holland (1997) has noted that an individual’s personality type may be measured by his or her responses to ability and interest scales. We therefore used the four 1986 ability and interest scales…to determine each student’s primary personality type” (Feldman et al., 1999, p. 644). The total sample was 2,309 students who attended the same four-year institution for all four years. The researchers used a 2 x 2 x 2 x 2 split-plot analysis of variance using the 1986 and 1990 ability and interest scales as dependent variables with the 1986 scales adjusted for regression to the mean (Smart, 2000).

Their (Feldman et al., 1999) findings were convincing. Students who entered A, E, and I academic environments that were congruent with their personality type showed higher levels of academic achievement (gains in self-reported abilities and interests) compared to students who entered incongruent environments. Although these findings were strong, this study has some limitations. First, Holland personality type was not assessed directly using one of the personality inventories typically used. Instead, the
scale created in Smart (1997) and used in Smart and Feldman (1998) was used to determine personality type. Second, due to this crude manner of determining personality type, a one-letter congruence comparison was the only way in which congruence could be determined. However, the experimental design both features a large sample from many institutions and controls for entering student characteristics, which makes this study a strong piece of evidence in support of Holland’s (1997) congruence assumption as it relates to academic achievement.

In a thorough search of research databases, and a review of recent vocational and higher education literature, this researcher was unable to identify any studies published since Feldman et al. (1999) using Holland’s (1997) congruence assumption as the theoretical framework and academic achievement as the outcome. Therefore this study, with its positive features of a large sample size across several institutions, the direct assessment of personality types, the use of a valid and reliable instrument to assess the environment, the use of a three-letter congruence index comparison, and strong controls for entering student characteristics may be a welcomed addition to the body of knowledge investigating outcomes in higher education.

Grounded in years of research and empirical evidence, Holland’s most recent rendition of his theory (1997) has several hypotheses regarding personality types, environments, and the interaction between people and environments. The hypotheses regarding personality types and environments that relate to educational achievement and this study will be identified here, as well as the hypothesis that this study tests.

Hypotheses about personality types that are most relevant include Hypothesis 18, which states that high educational achievement correlates to the following personality
pattern rank order: I, S, A, C, E, R. Hypothesis 19 posits, “persons with different personality patterns respond to instructors, teaching methods, and styles according to the formulation of the types” (Holland, 1997, p. 38). In addition, Hypothesis 20 says that high levels of consistency, differentiation, and identity increase the likelihood that the first two hypotheses about personalities will hold.

There is also one hypothesis (11) specific to an environmental model that is relevant to this study. It states, “Each model environment reinforces a characteristic group of educational behaviors” (Holland, 1997, p. 53).

While at least a few of these hypotheses relate to this study and were considered when control variables were identified, the hypothesis that this study tests is Holland’s (1997) hypothesis about people in environments and educational behavior. Holland states,

The hypotheses about educational behavior derived from the personality types resemble those for vocational behavior. The choice of, stability in, satisfaction with, and achievement in a field of training or study follow rules identical to those outlined for vocational behavior (p.71).

Holland’s (1997) Hypothesis 3 regarding people in environments, when adjusted for use in describing educational behavior, is therefore stated as ‘The ‘level’ of a person’s … [educational] achievement is encouraged by the congruence of his or her … [educational] environment’ (p. 71). This hypothesis represents what this study tests. More specifically, this study tests the hypothesis that graduation from college is encouraged by the congruence between Holland personality types of students and the academic major in which they are enrolled.
Variables Under Consideration

Before one can test Holland’s (1997) congruence hypothesis, one must consider Holland’s clause about “other things being equal” (p. 13). This clause represents a few boundary conditions that must be observed in order for the theory to be applied successfully. Holland points out that researchers must control for three broadly defined categories: influence, status, and perceptions of job-self compatibility. He also identifies specific characteristics that should be controlled for: age, gender, ethnicity, geography, social class, physical assets or liabilities, intelligence, influence, educational level attained, and effort required.

Many of these pre-college control variables that Holland (1997) identifies as relevant to academic achievement are also iterated by his friend and colleague, Alexander Astin (1993). In his highly regarded study, Astin examined data on 24,847 students who completed the CIRP freshman survey in 1985 and the follow-up survey in 1989. Astin concluded,

those entering freshmen who are most likely to complete a bachelor’s degree within four years have high grades in high school and high scores on college admissions tests, come from high socioeconomic levels, are either Roman Catholic or Jewish in their religious preference, are women, are nonhedonistic, and are disinclined toward science. (p. 193)

Most of the variables identified by Holland (1997) and Astin (1993) that influence completion of a bachelor’s degree are controlled for in this study so that the researcher can isolate the effect that congruence has on graduation from college. Data from the ACT Assessment and the students’ OBR enrollment records is used to control for many of the person variables, while the UNIACT controls for many of the personality
variables. The environmental variable under consideration (major in college) was also acquired from institutions through OBR.

Person Variables Under Consideration

The ACT Assessment provides many of the demographic and academic control variables that Holland (1997) and Astin (1993) identified. There are 190 items in the student profile section of the ACT Assessment. Since many of these items are optional, only the variables that were most likely to be obtained are included in this study.

The demographic variables identified by Holland (1997) that can be controlled for using ACT Assessment data include gender, racial/ethnic background, and age. Since students report their gender and age when they take the ACT Assessment and can report their racial/ethnic background on an optional item in the ACT student profile section of the instrument, these variables are all available. These variables are very similar to those used by Astin (1993) and others (see Holland, 1997).

Holland (1997) also identified social class as a construct that needed to be controlled in research, and Astin (1993) argued that socioeconomic status influences the outcome of graduation from college. To account for this concern, parental income, which is a reported item in the student profile section of the ACT Assessment, is be used as a proxy for social class. Parental income is reported in ranges from less than $18,000 to more than $100,000.

Another important category of variables that should be controlled for are those that address intelligence (Holland, 1997). As a proxy for intelligence, the academic ability variables of standardized test score, high school GPA, and high school class rank is used. These measures are very similar to those used in Astin (1993) and many other
studies (Holland, 1997). The standardized test score is the ACT composite score from 
the ACT Assessment. The high school GPA range is also available from the ACT 
Assessment data. Here, the students report their overall high school average by selecting 
a response option such as (D- to D) 0.5 – 0.9, (D to C-) 1.0 – 1.4, (C- to C) 1.5 – 1.9, and 
so on. The high school class rank is another piece of information that is also self-
reported. Students can identify their high school class rank belongs by quartile.

Two items in the student profile section of the ACT Assessment can be used to 
address Holland’s (1997) concern for educational level obtained. There is the likelihood 
that some students will have studied an advanced curriculum or earned college credit 
while in high school. Students can respond to an item that asks if the student was 
enrolled in advanced placement, accelerated, or honors courses in the subjects of English, 
mathematics, social studies, natural sciences, or foreign language. Another item is a 
statement regarding the earning of college credit prior to enrollment in college; students 
can respond “yes” or “no”.

Therefore, with the exception of variables relating to geography, physical assets 
or liabilities, effort required, and influence, this study can account for all of Holland’s 
(1997) control variables. In addition, many of the influential variables identified by Astin 
(1993) are also addressed.

The UNIACT is used to identify and control for many of the personality variables 
as described in Holland (1997). In fact, it is possible to use the UNIACT to identify the 
Holland personality type of students as well as the secondary constructs of consistency 
and differentiation.
The UNIACT provides the standard score and percentile rank for each of the Holland personality types. The percentile rank for each of the scales was used for identifying personality types and for secondary construct calculations. The top three scales were used to determine the three-letter Holland code. The high point code (or highest scale score) is the first letter, the second highest scale score is the second letter, and the third highest scale score is the third letter. Further, this three-letter Holland code was compared to the three-letter Holland code of the environment using the C index.

The dominant personality type was determined by using the high point code, or highest scale score. Holland’s (1997) secondary construct of consistency was measured by determining the hexagonal distance between the first two letters of Holland type. Another secondary construct, differentiation, will be determined by subtracting the value of the low point Holland code from the high point Holland code. Unfortunately, this study will not be able to measure or control for Holland’s (1997) secondary construct of identity.

Environmental Variable Under Consideration

In this study the environment was measured and classified using the CIP code for the academic major in which the student was enrolled during their last term of attendance. This CIP code for each student, which was obtained through OBR, was converted to a three-letter Holland code using the DHOC. Then, this three-letter Holland code for the academic major was compared to the three-letter Holland code for the student personality type using the C index, resulting in a measure of congruence.
Summary

Holland’s (1997) theory of vocational personalities and work environments is useful for studying college students in their educational environments. The theory postulates that students can be categorized into one of the six RIASEC personality types. In addition, the theory posits that institutions, colleges, academic departments, and majors can be classified into corresponding Holland environments. Thirdly, the theory suggests that the strength of congruence or fit between personality types and environments can influence positive outcomes, such as graduation from college.

This study uses the UNIACT to measure the personality types of Ohio high school graduates from the class of 1998 who took the ACT Assessment and enrolled in a four-year state-supported institution in Ohio in the fall of 1998. This study will use the students’ major in their last term of attendance as a proxy for the educational environment as defined by the DHOC. The C index was used to determine the degree of congruence between the students’ personality type and their educational environment. Graduation from college within six years of entry to college is the outcome under consideration. Information from the Student Profile Section and the registration form of the ACT Assessment was used to control for students’ pre-enrollment characteristics.

A step-wise multiple regression was used to determine the extent to which the congruence between Holland personality type and college major influence graduation from college. A gross conceptual representation of the regression equation looks like this:

Person Variables + Personality Variables + Congruence = Level of Achievement
where the person variables are the demographic, socioeconomic, geographic, academic, and educational level variables as described earlier. The personality variables are Holland’s (1997) high point code, consistency, and differentiation. These person variables and personality variables represent the control variables. Congruence, the experimental variable, is the degree of fit between the person and the academic environment as determined by the C index. Level of achievement is a dichotomous outcome variable representing whether or not the student graduated from college.
CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study is to determine the impact that person-environment fit has on the outcome of graduation from college. Holland’s (1997) theory of vocational personalities and work environments serves as the theoretical framework for this study. Further, this study intends to test Hypothesis 3 (for people in environments) of Holland’s (1997) theory, which posits that the level of a person’s educational achievement is encouraged by the degree of fit or congruence between the person and the environment. Therefore, the research question for this study is this:

To what extent does the level of congruence between students’ Holland personality type and their major in college at public four-year institutions in the state of Ohio predict graduation from college within six years?

The rest of this chapter is devoted to outlining the methods and procedures for this investigation. Areas to be covered include research methods, population, dependent variable, independent variables, and statistical analysis.

Research Methods

The first step in this study was to review the literature that is relevant to this line of inquiry. Searches of the Educational Resources Information Center database

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(Educational Resources Information Center, 2004), the Education Abstracts (H.W. Wilson, 2004), and the PsycINFO (American Psychological Association, 2004) databases were conducted. Journal articles were obtained through the full text features of the Ohio Library Information Network (2004), from the Carlson Library at The University of Toledo and through interlibrary loan services of various libraries of higher education institutions in Ohio. Books were borrowed or purchased. The results from this review of literature were presented in Chapter Two.

Next, permission was granted from the American College Testing Company (ACT) to utilize ACT Assessment data of 1998 Ohio high school graduates for use as the population under consideration. The Ohio Board of Regents (OBR) then granted access to enrollment information of those students in the population who attended public four-year institutions and began college in the fall of 1998 and may have continued through the summer of 2004.

Data was provided to the researcher in March of 2005. In order to provide appropriate privacy and protection to the participants in this study, OBR removed unique identifiable data, such as names and social security numbers, prior to providing the data set to the researcher. In addition, the ACT Assessment data and enrollment information were linked in one comprehensive database by OBR prior to the delivery of the data set.

The original data set included 33,304 records. Records that were missing data in the required independent and dependent variable fields, as well as records of students who initially enrolled at two-year institutions were removed.

Since the dataset from OBR contained student data with CIP codes from both the 1990 and 2000 CIP versions, a data table that the combined 1990 and 2000 CIP code
versions was prepared. Then, the DHOC was used to convert the CIP major codes for 431 of those major codes into three-letter Holland codes. Records that did not possess a CIP code with an available Holland code were removed from the data set.

The data set was then recoded for statistical analysis. Unexpectedly, during the recoding process it was determined that approximately one-fifth of the remaining records had a tie for the Holland personality high point code as determined by the UNIACT. This presented a challenge for calculation of the experimental variable (congruence) as well as the calculation for consistency. The researcher contacted the developer of the C index and was advised to treat the Holland personality types that were tied for any given position as equally likely to be in that position. The researcher was instructed to calculate the C index for each possible combination, and to then utilize the average value of all possible combinations (Paul Gore, personal communication, April 1, 2005).

Population

The population of 20,187 first-time, full-time students who entered four-year state-supported institutions of higher education in Ohio in 1998, and who completed the ACT Assessment, the UNIACT, and the student profile section of the ACT Assessment were used as the subjects.

Dependent Variable

The dependent variable (BACHDEGREE) for this study is dichotomous in nature. That is, either students graduated from college within six years, or they didn’t. Consequently, the dependent variable is a binary indicator variable (Neter, Wasserman, & Kutner, 1989) where the value 0 represents failure to graduate from a four-year public
institution in six years, and the value 1 represents graduation from a four-year public institution in six years.

**Independent Variables**

There are 21 control variables and 1 experimental variable in this study. According to the conceptual model of this study, the independent variables are placed into four categories.

1. Student demographic characteristics (i.e. sex, ethnicity, parental income).
2. Student academic characteristics (i.e. ACT composite score; high school grade point average range; high school class rank; total number high school courses in advanced placement, accelerated, or honors courses; and earned college credit).
3. Student personality characteristics (i.e. Holland personality type, differentiation, consistency).
4. Person-Environment Congruence (i.e. congruence as measured by the C index).

Table 1 provides operational definitions and sources of the independent variables.
Table 1
Operational definitions of independent variables.

<table>
<thead>
<tr>
<th>Student Demographic Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGE</strong>: discrete variable that represents the student’s age in years. Source: OBR student data file.</td>
</tr>
<tr>
<td><strong>SEX</strong>: a dummy variable coded 1 = female, 0 = male. Source: OBR student data file.</td>
</tr>
<tr>
<td><strong>AFRICANAMERICAN</strong>: a dummy variable coded 1 = African American, 0 = other ethnic background. Source: OBR student data file.</td>
</tr>
<tr>
<td><strong>AMERICANINDIAN</strong>: a dummy variable coded 1 = American Indian, Alaskan Native, 0 = other ethnic background. Source: OBR student data file.</td>
</tr>
<tr>
<td><strong>ASIANAMERICAN</strong>: a dummy variable coded 1 = Asian American, Pacific Islander, 0 = other ethnic background. Source: OBR student data file.</td>
</tr>
<tr>
<td><strong>CAUCASIAN</strong>: a dummy variable coded 1 = Caucasian, 0 = other ethnic background. Source: OBR student data file.</td>
</tr>
<tr>
<td><strong>HISPANIC</strong>: a dummy variable coded 1 = Puerto Rican, Cuban, Other Hispanic Origin, 0 = other ethnic background. Source: OBR student data file.</td>
</tr>
<tr>
<td><strong>LEVELPARENTSINCOME</strong>: a discrete variable that represents the estimated total combined income of the student’s parents. The variable is coded 0 = Less than $18,000, 1 = About $18,000 to $24,000, 2 = About $24,000 to $30,000, 3 = About $30,000 to $36,000, 4 = About $36,000 to $42,000, 5 = About $42,000 to $50,000, 6 = About $50,000 to $60,000, 7 = About $60,000 to $80,000, 8 = About $80,000 to $100,000, 9 = More than $100,000. Source: Item 59 in ACT Student Profile Section of ACT Assessment.</td>
</tr>
</tbody>
</table>
Table 1 (Continued)

Student Academic Characteristics

**COMPOSITESCORE:** a discrete variable with a range of 1 – 36 that represents level of academic achievement. Source: Composite score from Tests of Educational Development Component of ACT Assessment.

**HIGHSCHOOLCLASSRANK:** a discrete variable that represents the quartile of the student’s self-reported high school class rank. The variable is reverse coded so that 1 = fourth quartile, 2 = third quartile, 3 = second quartile, 4 = first quartile. Source: Item 81 in ACT Student Profile Section of ACT Assessment.

**HIGHSCHOOLGPA:** a discrete variable that represents the student’s self-reported high school average. The variable is coded 1 = (D- to D) 0.5-0.9, 2 = (D to C-) 1.0-1.4, 3 = (C- to C) 1.5-1.9, 4 = (C to B-) 2.0-2.4, 5 = (B- to B) 2.5-2.9, 6 = (B to B+) 3.0-3.4, 7 = (A- to A) 3.50-4.0. Source: Item 82 in ACT Student Profile Section of ACT Assessment.

**APTOTAL:** a discrete variable with a range of 0 – 5 that represents how many subjects of advanced placement, accelerated courses, or honors course the student enrolled in during high school. Source: Items 94-98 in ACT Student Profile Section of ACT Assessment.

**EARNEDCOLLCREDIT:** a dummy variable coded 0 = no and 1 = yes that represents whether or not a student had earned college credit previous to completing the ACT Assessment. Source: Item 10 in ACT Student Profile Section of ACT Assessment.
### Table 1 (Continued)

<table>
<thead>
<tr>
<th>Student Personality Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>REALISTIC: a dummy variable representing whether or not the student’s vocational interest high point code (percentile rank) is Realistic. Coded 1 = Realistic, 0 = other interest area high point. Source: Basic Interest Area High Point (percentile rank) from ACT Interest Inventory (UNIACT) on ACT Assessment.</td>
</tr>
<tr>
<td>INVESTIGATIVE: a dummy variable representing whether or not the student’s vocational interest high point code (percentile rank) is Investigative. Coded 1 = Investigative, 0 = other interest area high point. Source: Basic Interest Area High Point (percentile rank) from ACT Interest Inventory (UNIACT) on ACT Assessment.</td>
</tr>
<tr>
<td>ARTISTIC: a dummy variable representing whether or not the student’s vocational interest high point code (percentile rank) is Artistic. Coded 1 = Artistic, 0 = other interest area high point. Source: Basic Interest Area High Point (percentile rank) from ACT Interest Inventory (UNIACT) on ACT Assessment.</td>
</tr>
<tr>
<td>SOCIAL: a dummy variable representing whether or not the student’s vocational interest high point code (percentile rank) is Social. Coded 1 = Social, 0 = other interest area high point. Source: Basic Interest Area High Point (percentile rank) from ACT Interest Inventory (UNIACT) on ACT Assessment.</td>
</tr>
<tr>
<td>ENTERPRISING: a dummy variable representing whether or not the student’s vocational interest high point code (percentile rank) is Enterprising. Coded 1 = Enterprising, 0 = other interest area high point. Source: Basic Interest Area High Point (percentile rank) from ACT Interest Inventory (UNIACT) on ACT Assessment.</td>
</tr>
<tr>
<td>CONVENTIONAL: a dummy variable representing whether or not the student’s vocational interest high point code (percentile rank) is Conventional. Coded 1 = Conventional, 0 = other interest area high point. Source: Basic Interest Area High Point (percentile rank) from ACT Interest Inventory (UNIACT) on ACT Assessment.</td>
</tr>
<tr>
<td>DIFFERENTIATION: a continuous variable ranging from .01 to .99 representing the difference between the student’s vocational interest area low point code (percentile rank) and student’s vocational interest high point code. Source: ACT Interest Inventory (UNIACT) on the ACT Assessment.</td>
</tr>
<tr>
<td>CONSISTENCY: a discrete variable ranging from 1 to 3 representing the hexagonal distance between the student’s vocational interest high point code (percentile rank) and second highest vocational interest high point code. Source: ACT Interest Inventory (UNIACT) on the ACT Assessment.</td>
</tr>
</tbody>
</table>
Table 1 (Continued)

<table>
<thead>
<tr>
<th>Person-Environment Congruence (Experimental Variable)</th>
</tr>
</thead>
</table>

**CONGRUENCE:** a discrete variable resulting from the C index representing the degree of fit between student’s vocational personality type and educational environment. The C index uses the formula:

\[
C = 3 \times (X_i) + 2 \times (X_i) + (X_i),
\]

where \(X_i\) are values of 3, 2, 1, or 0. Values are assigned on the basis of the hexagonal distance between the letters for the personality type-environmental model comparison: 3 = identical position, 2 = adjacent position, 1 = alternate position, 0 = opposite position. Scores on the C index can range from 0 (low) to 18 (high). Sources: The Holland personality type from the UNIACT was used to determine the student’s vocational personality types and the CIP major code (provided by OBR) that the student is enrolled in during the last term of attendance will serve as a proxy for the academic environment. The *DHOC* was used to convert the CIP codes to one of the Holland personality types.

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**Statistical Analysis**

The analysis was conducted in two parts. First, descriptive data such as the frequencies, means, and zero-order correlations among the independent and dependent variables is presented and the implications discussed. Then, the researcher conducted a step-wise multiple regression to determine the extent to which the congruence between vocational interest and major influences graduation from college. The Statistical Package for the Social Sciences, version 13 (2005), was used to perform all statistical calculations.
CHAPTER 4

RESULTS

The purpose of this study was to determine the impact that person-environment fit has on the outcome of graduation from college. Descriptive statistics were computed for the predictor variables, and correlation coefficients were determined for all variables under consideration. Then, a stepwise multiple regression model was utilized to determine the proportion of variance in the attainment of a four-year degree that can be explained by the extent of person-environment fit. A description of the participants, measures of association, and findings from the regression model analyses are presented in this chapter.

Population Descriptive Statistics

The population of 20,187 first-time, full-time students who entered four-year state-supported institutions of higher education in Ohio in 1998, and who completed the ACT Assessment, the UNIACT, and the student profile section of the ACT Assessment were used as the subjects. Please see Table 2 for selected measures of central tendency and measures of dispersion.

Demographically, the population was 56.6% female. This is similar to the national statistics for first-time, full-time freshmen at public four-year institutions in 1998, which was 54.4% female (National Center for Educational Statistics [NCES],
The average age of 18.47 years at time of entry is also typical of college freshmen. The ethnic background of the population was 86.6% Caucasian, 7.2% African American, 1.9% Asian, 1.3% Hispanic, 0.2% American Indian. The ethnic background

Table 2

Descriptive statistics.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Standard Deviation of Scores</th>
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<td>BACHDEGREE</td>
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<td>1</td>
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<td>18.474</td>
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<td>18</td>
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<td>1</td>
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<tr>
<td>LEVELPARENTSINCOME(^a)</td>
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<td>5.149</td>
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<td>6</td>
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<tr>
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<tr>
<td>HIGHSCHOOLGPA(^b)</td>
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<td>57.711</td>
<td>59</td>
<td>64</td>
<td>18.469</td>
</tr>
<tr>
<td>CONSISTENCY</td>
<td>20,187</td>
<td>1.457</td>
<td>2</td>
<td>2</td>
<td>0.671</td>
</tr>
<tr>
<td>CONGRUENCE</td>
<td>20,187</td>
<td>10.008</td>
<td>10</td>
<td>10</td>
<td>3.659</td>
</tr>
</tbody>
</table>

Note:
\(a\): 0 = Less than $18,000, 1 = About $18,000 to $24,000, 2 = About $24,000 to $30,000, 3 = About $30,000 to $36,000, 4 = About $36,000 to $42,000, 5 = About $42,000 to $50,000, 6 = About $50,000 to $60,000, 7 = About $60,000 to $80,000, 8 = About $80,000 to $100,000, 9 = More than $100,000.

\(b\): 1 = (D- to D) 0.5-0.9, 2 = (D to C-) 1.0-1.4, 3 = (C- to C) 1.5-1.9, 4 = (C to B-) 2.0-2.4, 5 = (B- to B) 2.5-2.9, 6 = (B to B+) 3.0-3.4, 7 = (A- to A) 3.50-4.0.
of approximately 2.8% of the population was unknown. In comparison, the proportion of Caucasian students enrolled in all higher education institutions in Ohio in the fall of 1998 was 85.7% (NCES, 2005b). The mean level of parental income was between $42,000 and $50,000.

Academically, the population had a mean composite ACT score of 22.01. The national average for 1998 high school graduate ACT test takers was 21.0, and was 21.4 for the state of Ohio (ACT, 2004). However, the population in this study only includes those students who attended four-year state-supported institutions and not those students who chose not to attend college or chose to attend two-year colleges. Since these students who do not attend a four-year college generally have lower composite ACT scores, the population in this study is likely a good representation of first-time, full-time students at four-year, state-supported institutions in Ohio. The mean high school grade point average was 2.50 to 2.90 on a 4.0 scale, and the mean class rank was in the second quartile. Less than 5% of the population earned college credit before enrolling full-time. Further, students took an average of 1.7 advanced placement, accelerated, or honors courses.

The Holland personality types for the population were 21.3% Investigative, 18.5% Social, 17.1% Enterprising, 17.0% Artistic, 16.7% Realistic, and 16.2% Conventional. The distribution of personality types is greater than 100% because 1492 students had a tie for the first letter of their Holland personality type. In other words, when this population took the UNIACT, approximately 7.4% of the students had a tie between two or more letters as their dominant Holland personality type.
Table 3

Baccalaureate degree completion rates.

<table>
<thead>
<tr>
<th>Student Demographic Variables</th>
<th>n</th>
<th>Graduated</th>
<th>Completion Rate</th>
</tr>
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<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>1</td>
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<tr>
<td>16</td>
<td>35</td>
<td>5</td>
<td>14.3%</td>
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<tr>
<td>17</td>
<td>127</td>
<td>57</td>
<td>44.9%</td>
</tr>
<tr>
<td>18</td>
<td>12270</td>
<td>7465</td>
<td>60.8%</td>
</tr>
<tr>
<td>19</td>
<td>6893</td>
<td>4102</td>
<td>59.5%</td>
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<td>20</td>
<td>380</td>
<td>122</td>
<td>32.1%</td>
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<tr>
<td>21</td>
<td>163</td>
<td>57</td>
<td>35.0%</td>
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<tr>
<td>22</td>
<td>129</td>
<td>37</td>
<td>28.7%</td>
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<tr>
<td>23</td>
<td>92</td>
<td>27</td>
<td>29.3%</td>
</tr>
<tr>
<td>24</td>
<td>74</td>
<td>21</td>
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</tr>
<tr>
<td>25</td>
<td>15</td>
<td>4</td>
<td>26.7%</td>
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<tr>
<td>26</td>
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<tr>
<td>28</td>
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<td>1</td>
<td>33.3%</td>
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<tr>
<td>30</td>
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<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>39</td>
<td>1</td>
<td>0</td>
<td>0.0%</td>
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<tr>
<td>48</td>
<td>1</td>
<td>0</td>
<td>0.0%</td>
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<tr>
<td><strong>Sex</strong></td>
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<td>55.9%</td>
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<td>Female</td>
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<td>6998</td>
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<tr>
<td>About $36,000 to $42,000</td>
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<td>About $42,000 to $50,000</td>
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<td>62.3%</td>
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<tr>
<td>About $60,000 to $80,000</td>
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<td>2385</td>
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<tr>
<td>About $80,000 to $100,000</td>
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<td>1401</td>
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<tr>
<td>More than $100,000</td>
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<td>Composite Score</td>
<td>n</td>
<td>Graduated</td>
<td>Completion Rate</td>
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<tr>
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<td>6.0%</td>
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<td>27</td>
<td>77.1%</td>
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<td>8</td>
<td>88.9%</td>
</tr>
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<td>36</td>
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<table>
<thead>
<tr>
<th>High School GPA</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>(D- to D) 0.5-0.9</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td>(D to C-) 1.0-1.4</td>
<td>65</td>
<td>11</td>
</tr>
<tr>
<td>(C- to C) 1.5-1.9</td>
<td>446</td>
<td>75</td>
</tr>
<tr>
<td>(C to B-) 2.0-2.4</td>
<td>2011</td>
<td>591</td>
</tr>
<tr>
<td>(B- to B) 2.5-2.9</td>
<td>3994</td>
<td>1701</td>
</tr>
<tr>
<td>(B to B+) 3.0-3.4</td>
<td>6727</td>
<td>3949</td>
</tr>
<tr>
<td>(A- to A) 3.50-4.0</td>
<td>6923</td>
<td>5558</td>
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</table>

<table>
<thead>
<tr>
<th>High School Class Rank</th>
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</thead>
<tbody>
<tr>
<td>Top Quartile</td>
<td>9610</td>
<td>7024</td>
</tr>
<tr>
<td>Second Quartile</td>
<td>7180</td>
<td>3700</td>
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<tr>
<td>Third Quartile</td>
<td>3110</td>
<td>1102</td>
</tr>
<tr>
<td>Fourth Quartile</td>
<td>287</td>
<td>72</td>
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</tbody>
</table>
### Table 3 (Continued)

<table>
<thead>
<tr>
<th>Student Personality Variables</th>
<th>n</th>
<th>Graduated</th>
<th>Completion Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holland Personality Type</td>
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<td></td>
</tr>
<tr>
<td>Artistic</td>
<td>3446</td>
<td>2041</td>
<td>59.2%</td>
</tr>
<tr>
<td>Conventional</td>
<td>3272</td>
<td>1867</td>
<td>57.1%</td>
</tr>
<tr>
<td>Enterprising</td>
<td>3463</td>
<td>2190</td>
<td>63.2%</td>
</tr>
<tr>
<td>Investigative</td>
<td>4311</td>
<td>2611</td>
<td>60.6%</td>
</tr>
<tr>
<td>Realistic</td>
<td>3391</td>
<td>1832</td>
<td>54.0%</td>
</tr>
<tr>
<td>Social</td>
<td>3748</td>
<td>2244</td>
<td>59.9%</td>
</tr>
</tbody>
</table>

In this population, 59% of the students graduated with at least a baccalaureate degree in six years. Please see Table 3 for six-year baccalaureate degree completion rates based on selected student characteristics.

**Relationship Among Predictor and Outcome Variables**

A two-tailed Pearson correlation analysis was performed to determine which variables were related to the attainment of a four-year degree. This produced 19 variables that correlated both positively and negatively at the $p < .01$ and $p < .05$ levels. A total of 14 independent variables correlated positively with the dependent variable BACHDEGREE.

The predictor variable with the highest correlation to the outcome variable was HIGHSCHOOLGPA ($r = .367, p < .01$). Although HIGHSCHOOLGPA was the highest correlation, the relationship between the BACHDEGREE and HIGHSCHOOLGPA was only considered to be a weak association. Other predictor variables which were found to correlate with a weak association were COMPOSITESCORE ($r = .312, p < .01$) and HIGHSCHOOLCLASSRANK ($r = .297, p < .01$).
There were also two predictor variables with moderately weak correlations. They were LEVELPARENTSINCOME \((r = .198, p < .01)\) and APTOTAL \((r = .191, p < .01)\).

The rest of the predictor variables that were significant but had very weak associations were AFRICANAMERICAN \((r = -.098, p < .01)\), AGE \((r = -.086, p < .01)\), CAUCASIAN \((r = .077, p < .01)\), SEX \((r = .055, p < .01)\), REALISTIC \((r = -.045, p < .01)\), DIFFERENTIATION \((r = .042, p < .01)\), ENTERPRISING \((r = .040, p < .01)\), EARNEDCOLLCREDIT \((r = .030, p < .01)\), ASIAN \((r = .029, p < .01)\), CONGRUENCE \((r = .018, p < .01)\), CONVENTIONAL \((r = -.017, p < .05)\), INVESTIGATIVE \((r = .017, p < .05)\), CONSISTENCY \((r = .015, p < .05)\), and HISPANIC \((r = -.015, p < .05)\).
Table 4

Summary of data intercorrelations.

<table>
<thead>
<tr>
<th>Variable</th>
<th>(x^1)</th>
<th>(x^2)</th>
<th>(x^3)</th>
<th>(x^4)</th>
<th>(x^5)</th>
<th>(x^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACHDEGREE (x^1)</td>
<td>1</td>
<td>.119**</td>
<td>.047**</td>
<td>.365**</td>
<td>.214**</td>
<td>-.315**</td>
</tr>
<tr>
<td>AGE (x^2)</td>
<td></td>
<td>1</td>
<td>.056**</td>
<td>-.114**</td>
<td>-.018**</td>
<td>.103**</td>
</tr>
<tr>
<td>SEX (x^3)</td>
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<td></td>
<td>1</td>
<td>-.080**</td>
<td>-.082**</td>
<td>-.039**</td>
</tr>
<tr>
<td>COMPOSITESCORE (x^4)</td>
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<td></td>
<td>1</td>
<td>.226**</td>
<td>-.521**</td>
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<td>LEVELPARENTSINCOME (x^5)</td>
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<td></td>
<td></td>
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<td>-.074**</td>
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<td>HIGHSCHOOLCLASSRANK (x^6)</td>
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<td>HIGHSCHOOLGPA (x^7)</td>
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<td>APTOTAL (x^9)</td>
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<td>AMERICANINDIAN (x^{11})</td>
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<td>ASIAN (x^{12})</td>
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<td>CAUCASIAN (x^{13})</td>
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<td>HISPANIC (x^{14})</td>
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<td>REALISTIC (x^{15})</td>
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<td>INVESTIGATIVE (x^{16})</td>
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<td>ARTISTIC (x^{17})</td>
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<td>CONGRUENCE (x^{23})</td>
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</table>

** = Correlation is significant at the 0.01 level (2-tailed).
* = Correlation is significant at the 0.05 level (2-tailed).
Table 4 (Continued)

Summary of data intercorrelations.

<table>
<thead>
<tr>
<th>Variable</th>
<th>(x_7)</th>
<th>(x_8)</th>
<th>(x_9)</th>
<th>(x_10)</th>
<th>(x_11)</th>
<th>(x_12)</th>
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</thead>
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<tr>
<td>BACHDEGREE (x_1)</td>
<td>.389**</td>
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<td>.236**</td>
<td>-.084**</td>
<td>-.007</td>
<td>.033**</td>
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<td>-.068**</td>
<td>.006</td>
<td>.001</td>
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<tr>
<td>SEX (x_3)</td>
<td>.108**</td>
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<td>.019**</td>
<td>.045**</td>
<td>.009</td>
<td>-.009</td>
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<td>.459**</td>
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<td>.030**</td>
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<td>-.415**</td>
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** = Correlation is significant at the 0.01 level (2-tailed).
*  = Correlation is significant at the 0.05 level (2-tailed).
Table 4 (Continued)

Summary of data intercorrelations.

<table>
<thead>
<tr>
<th>Variable</th>
<th>(x^{13})</th>
<th>(x^{14})</th>
<th>(x^{15})</th>
<th>(x^{16})</th>
<th>(x^{17})</th>
<th>(x^{18})</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACHDEGREE (x^{1})</td>
<td>0.60**</td>
<td>-0.020**</td>
<td>-0.071**</td>
<td>0.030**</td>
<td>0.025**</td>
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</tr>
<tr>
<td>AGE (x^{2})</td>
<td>-0.008</td>
<td>0.001</td>
<td>0.009</td>
<td>-0.012</td>
<td>-0.023**</td>
<td>0.008</td>
</tr>
<tr>
<td>SEX (x^{3})</td>
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<td>0.004</td>
<td>-0.243**</td>
<td>-0.006</td>
<td>0.016**</td>
<td>0.168**</td>
</tr>
<tr>
<td>COMPOSITESCORE (x^{4})</td>
<td>0.174**</td>
<td>-0.029**</td>
<td>-0.056**</td>
<td>0.129**</td>
<td>0.088**</td>
<td>-0.080**</td>
</tr>
<tr>
<td>LEVELPARENTSINCOME (x^{5})</td>
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<td>-0.011</td>
<td>0.005</td>
<td>0.031**</td>
<td>-0.009</td>
</tr>
<tr>
<td>HIGHSCHOOLCLASSRANK (x^{6})</td>
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<td>0.019**</td>
<td>0.058**</td>
<td>-0.122**</td>
<td>-0.003</td>
<td>0.404**</td>
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<tr>
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<td>0.004**</td>
<td>0.023**</td>
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<tr>
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<td>-0.017**</td>
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</tr>
<tr>
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<td>-0.001</td>
<td>-0.085**</td>
<td>0.129**</td>
<td>0.016**</td>
<td>-0.025**</td>
</tr>
<tr>
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<td>-0.045**</td>
<td>-0.027**</td>
<td>-0.027**</td>
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</tr>
<tr>
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<td>ASIAN (x^{12})</td>
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<tr>
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<tr>
<td>CONVENTIONAL (x^{20})</td>
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<tr>
<td>CONGRUENCE (x^{23})</td>
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</tr>
</tbody>
</table>

** = Correlation is significant at the 0.01 level (2-tailed).
* = Correlation is significant at the 0.05 level (2-tailed).
Table 4 (Continued)

Summary of data intercorrelations.

<table>
<thead>
<tr>
<th></th>
<th>(x(^{10}))</th>
<th>(x(^{20}))</th>
<th>(x(^{21}))</th>
<th>(x(^{22}))</th>
<th>(x(^{23}))</th>
</tr>
</thead>
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<td>BACHDEGREE (x(^{1}))</td>
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<tr>
<td>AGE (x(^{2}))</td>
<td>.016*</td>
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<td>.001</td>
<td>-.009</td>
<td>-.010</td>
</tr>
<tr>
<td>SEX (x(^{3}))</td>
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<td>.014*</td>
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<td>.001</td>
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<td>-.043**</td>
<td>.120**</td>
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</table>

** = Correlation is significant at the 0.01 level (2-tailed).
* = Correlation is significant at the 0.05 level (2-tailed).
Stepwise Multiple Regression Model

To determine the extent to which the experimental variable CONGRUENCE influences degree attainment, the researcher conducted a step-wise multiple regression by entering all 19 predictor variables that were correlated with the outcome variable. Stepwise multiple regression is a way of computing the amount of variance ($R^2$) accounted for in the outcome (dependent) variable from a set of predictors (independent variables). The predictor variable that accounts for most of the variance in the outcome variable is entered into the model first. In the second stage, the researcher enters the remaining predictor variable with the highest partial correlation with the outcome variable, while controlling for the first predictor variable. This process of entering the predictor variable with the highest partial correlation while controlling for the previously entered predictor variables is repeated again and again until the addition of a remaining predictor variable does not increase R-squared by a significant amount. The result of running a stepwise multiple regression analysis is the set of independent variables that best predicts the dependent variable.

The last step of the regression analysis produced a ten variable model that accounted for 17.8% of the variance in the prediction of BACHDEGREE. Due to its insignificance, CONGRUENCE was not included in the model. Therefore CONGRUENCE was found to not be predictive of BACHDEGREE. Please see the regression table (Table 5) for the complete list of predictor variables and their respective statistics.
Table 5

Regression analysis results.

<table>
<thead>
<tr>
<th>Independent (Predictor) Variables</th>
<th>Cases (N)</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>$F$ (ANOVA)</th>
<th>$r$ (Pearson)</th>
<th>$\beta$ (First Step)</th>
<th>$\beta$ (Last Step)</th>
<th>Adjusted $R^2$</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGHSCHOOLGPA</td>
<td>20187</td>
<td>5.86</td>
<td>1.094</td>
<td>3146.144</td>
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<td>0.367</td>
<td>0.246</td>
<td>0.135</td>
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<tr>
<td>LEVELPARENTSINCOME</td>
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<td>2.572</td>
<td>1925.581</td>
<td>0.198</td>
<td>0.160</td>
<td>0.143</td>
<td>0.160</td>
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<td>4.271</td>
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<td>0.050</td>
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</tr>
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<td>0.036</td>
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<tr>
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<td>-0.028</td>
<td>-0.029</td>
<td>0.177</td>
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</tr>
<tr>
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<td>0.041</td>
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</tr>
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<td>0.016</td>
<td>0.016</td>
<td>0.178</td>
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<td>ASIAN</td>
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<td>0.014</td>
<td>0.014</td>
<td>0.178</td>
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</tbody>
</table>

***Significant at .001 level
**Significant at .01 level
* Significant at .05 level
Of those 10 predictor variables in the last step, 8 were significant at the $p < .001$ level, 1 was significant at the $p < .01$ level, and the other was significant at the $p < .05$ level. In the model there were 3 academic variables, 4 demographic variables, and 3 personality variables.

The model indicated that HIGHSCHOOLGPA had the largest relative influence on BACHDEGREE, accounting for 13.5% of the variance. The partial regression coefficient ($\beta = .246$) indicated the expected change in the outcome variable associated with a one-unit change in HIGHSCHOOLGPA when all other variables are held constant. The significance of the F test ($p < .001$) hints toward the magnitude of the difference between groups of students who graduate from college within six years and those who do not based on HIGHSCHOOLGPA.

LEVELPARENTSINCOME accounted for 2.5% of the variance and had a beta weight of .143. The significance of the F test ($p < .001$) indicates that there is a rather large difference in the outcome variable between groups based on LEVELPARENTSINCOME. The predictor variable with next largest influence was COMPOSITESCORE ($\beta = .130$), which accounted for 1.1% of the variance. The other 7 variables accounted for less than 1% of the variance combined.
CHAPTER 5

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Summary

As a consequence of the demands for increased accountability in Ohio, institutions of higher education must find ways to maximize their effectiveness in converting intellectually curious students into productive college graduates. One way to keep students engaged in academic work and progressing towards a college degree is to expose them to academic disciplines, course content, and vocational experiences that are of interest to them. Holland’s (1997) Theory of Vocational Personalities and Work Environments provides a useful method of understanding how the degree of similarity between one’s vocational interests and educational environment leads to successful outcomes such as graduating from college.

Although many studies have examined person-environment congruence in college students, few have used such a large number of subjects, controlled for many of the demographic and academic variables, isolated the influence of person-environment interaction, and utilized graduation from college as the outcome variable. In addition, few studies have used a three-letter comparison between the Holland personality type and the environment to quantify the degree of congruence.
The purpose of this study was to better understand the influence that person-environment congruence has on the graduation rates of college students at four-year public institutions of higher education in Ohio. This purpose was met by determining how well the degree of fit between individuals and their environments predicts graduation from college when controlling for demographic and academic variables using stepwise logistical regression.

The population of 20,187 first-time, full-time students who entered four-year state-supported institutions of higher education in Ohio in 1998, and who completed the ACT Assessment, the UNIACT, and the student profile section of the ACT Assessment were used as the subjects. Descriptive statistics were computed for the predictor variables, Pearson product moment correlation coefficients were determined for all variables under consideration, and a stepwise multiple regression model was utilized to determine the proportion of variance in the attainment of a four-year degree that can be explained by the extent of person-environment fit.

The population in this study is similar to the population of traditional-aged college students who entered four-year state supported institutions nationally in 1998 in many ways. The population was mostly female (56.6%), the average age at time of entry was 18 years, and the ethnicity was predominately Caucasian (86.6%). Academically, the composite ACT score was a 22, the average high school grade point average was between 2.50 and 2.90 on a 4.0 scale, and the average class rank was in the second quartile.

The Holland personality types for the population were 21.3% Investigative, 18.5% Social, 17.1% Enterprising, 17.0% Artistic, 16.7% Realistic, and 16.2% Conventional. There were 1,492 students who had a tie for the first letter of their Holland
personality type as determined by the UNIACT. The six year baccalaureate degree completion rate for this population was 59%.

A total of 19 independent variables correlated with the dependent variable. The stepwise logistic regression analysis produced a model that consisted of 10 predictor variables that accounted for 17.8% of the variance in the outcome variable of graduation from college (BACHDEGREE). The experimental variable, CONGRUENCE, correlated positively ($r = .018, p < .01$) with the outcome variable, BACHDEGREE, but was not included in the regression model. Therefore, the experimental variable, CONGRUENCE, was not predictive of graduating from college.

Discussion

Although CONGRUENCE was not predictive of BACHDEGREE, the fact that CONGRUENCE was correlated with BACHDEGREE ($r = .018, p < .01$) is noteworthy. While many studies (Bruch & Krieshok, 1981; Feldman et al., 1999; Henry, 1989; Reutefors, Schneider, and Overtone, 1979; Smart, 1997; Smart & Feldman, 1998; Walsh & Lacey, 1969) have demonstrated statistically significantly differences between groups of congruent and incongruent students as it relates to academic achievement, few have used correlational analyses and found significant results.

The weak partial support of Holland’s (1997) congruence assumption in this study is similar to the results found in an investigation (Martin & Bartol, 1986) with a similar experimental design. In their study, Martin and Bartol (1986) examined the relationship between personality type-academic major congruence and graduation from an MBA program. They too found that congruence was related to graduation ($r = .156, p < .05$).
However, the researchers did not perform a statistical test to determine how well congruence predicted graduation.

In addition, the results of this study are similar to another correlational analysis that examined the relationship between congruence and successful college outcomes. Holland (1963) demonstrated how congruence between male students’ Holland personality types and the college environment was correlated with artistic and leadership achievement. Holland (1963) reported a mean correlation coefficient of 0.10 but did not define the level of statistical significance.

Although the correlational analysis lends weak support to Holland’s congruence assumption, the regression analysis does not support Holland’s (1997) theory as it relates to congruence and academic achievement since CONGRUENCE was not predictive of BACHDEGREE. In this study academic predictor variables had the greatest impact on the outcome variable, followed by the demographic and then the personality predictor variables.

Of the 17.8% of the total variance in BACHDEGREE that can be explained by the predictor variables in this study, 82% of the explained variance (14.6% of the total variance) is a result of HIGHSCHOOLGPA, COMPOSITE SCORE, and HIGHSCHOOLCLASSRANK. Specifically, HIGHSCHOOLGPA accounted for 13.5% of total variance, COMPOSITE SCORE for 1.1% of total variance, and HIGHSCHOOLCLASSRANK for 0.1% of total variance. This assertion regarding the relative importance of academic predictor variables is supported by the fact that HIGHSCHOOLGPA and COMPOSITESCORE entered into the model as the first and third predictor variables respectively, therefore underscoring the influence of these
academic variables on BACHDEGREE relative to the demographic and personality predictor variables. Other academic variables that were significantly correlated with but not predictive of BACHDEGREE were APTOTAL and EARNEDCOLLCREDIT.

Meanwhile, demographic predictor variables had a relatively weak impact on the outcome variable. LEVELPARENTSINCOME accounted for 2.5%, SEX for 0.2%, AGE for .01%, and ASIAN for less than 1% of the total variance in BACHDEGREE. In sum, these demographic predictor variables accounted for 15.7% of the explained variance and 2.5% of the total variance. Other demographic variables that were significantly correlated with but not predictive of BACHDEGREE were AFRICANAMERICAN, CAUCASIAN, and HISPANIC.

The personality predictor variables had a very small influence on the outcome variable. Specifically, ENTERPRISING accounted for 0.2% of the total variance while INVESTIGATIVE and CONSISTENCY accounted for less than 0.1% of the total variance each. Collectively, the personality predictor variables accounted for less than 0.4% of the total variance and a mere 2.7% of the explained variance. The order in which these predictor variables entered into the regression model also supports their weak influence. Other personality variables that were significantly correlated with but not predictive of BACHDEGREE were CONGRUENCE, CONVENTIONAL, DIFFERENTIATION, and REALISTIC.

During the research design phase of this study, other considerations were made with respect to control variables and are worthy of discussion. Holland (1997) hypothesized that students will experience varying levels of educational success based on their Holland personality type. Specifically, he asserts that high educational achievement
occurs in the following personality pattern rank order: I, S, A, C, E, R. Because of this assertion, the researcher controlled for the first-letter Holland type in the regression analysis. In this study, based on the first letter Holland personality type, and without controlling other predictor variables, the rank order in terms of baccalaureate degree completion was E, I, S, A, C, R.

Feldman et al. (1999) also found results that were contrary to Holland’s hypothesis about rank order success by first letter Holland personality type. In rank order, they found that A, E, and I types that studied congruent majors demonstrated the greatest self-reported gains in academic ability. The results for S types did not support the congruence hypothesis at all, while R and C types were not considered in their study.

Further, when predictor variables were controlled for in the regression equation in this study, ENTERPRISING entered into the model before INVESTIGATIVE and explained more of the total variance. Clearly, the results from this study and Feldman et al. (1999) are contradictory to Holland’s (1997) hypothesis regarding educational achievement of the different personality types.

Limitations

Despite the large population size, controls for many predictor variables, the use of a three-letter comparison, and isolation of the person-educational environment interaction, this study has some noteworthy limitations. Challenges due to the instruments and the methodology utilized may have had an effect on the results of the study.

The unexpected occurrence of first-letter Holland type ties in 7.3% of the population brings into serious question the ability of the UNIACT to accurately
determine Holland personality types. This sentiment is shared by Spokane et al. (2002), who categorized the UNIACT as “one of the weakest indicators of Holland types” (p. 406).

There were also challenges with using CIP codes and the \textit{DHOC}. Specifically, over 100 CIP codes were not found in the \textit{DHOC}, resulting in the removal of over 5,000 cases from the study. Since some of the four-year state supported institutions of higher education in the State of Ohio switched from the 1990 version of the CIP classification system to the 2000 version while the subjects were enrolled, the 1996 edition of the \textit{DHOC} was unable to convert some of these CIP codes into Holland codes.

In addition, several CIP code descriptions are general or ambiguous in nature, thus limiting the ability to discriminate between curricula. To demonstrate this problem, consider an example of a vague description. “Business, General” (Gottfredson & Holland, 1996, p. 677) is assigned a Holland code of ERS. Meanwhile, accounting, which is be considered by many as a business degree, has a Holland code of CEI.

Arguably, the removal of several thousand cases and the ambiguity of some CIP codes limited this study. Further, the use of the students’ major may not be of much utility for students who did not complete more that two years of college, since most four-year curricula are slanted towards general education until the third year of college, when students begin to enroll in more courses within their major.

Moreover, the use of major alone may not be a very effective measure of environment. After all, the college environment consists of much more than just what happens between faculty and students. Environmental influences such as living arrangements, extracurricular activities, and social support systems would also likely
influence the degree of fit between students and their college environment. Prominent higher education researchers (Astin, 1993; Pascarella & Terenzini, 2005; Tinto, 1993) also argue that social influences from peers such as classmates, resident assistants, and teammates, and from mentors such as advisors and coaches, also impact students.

Although there were many control variables in this study, there were some important factors that couldn’t be controlled. If it were possible to control for variables such as financial aid, extracurricular involvement, work status, or type of campus, then the influence of the experimental variable CONGRUENCE may have been more pronounced. In addition, the regression model may have accounted for more of the variance in BACHDEGREE.

Lastly, other non-cognitive variables that may have predicted graduation from college were not considered or controlled. Consideration of constructs such as motivation, emotional stability, and ability to handle stress would have added substantial insight into non-cognitive factors other than Holland personality type.

Conclusions

Based on the findings related directly to the research question the following conclusion was reached. The degree of fit between students’ Holland type and college major is correlated with achievement of a baccalaureate degree but is not predictive of obtaining a four-year degree. Therefore, Holland’s (1997) Hypothesis 3 regarding people in educational environments, which states the “…’level’ of a person’s … [educational] achievement is encouraged by the congruence of his or her … [educational] environment” (p. 71) is not supported.
Another Holland hypothesis that relates to educational achievement was considered when the control variables were identified, and a conclusion about this related hypothesis could also be made. Holland’s (1997) Hypothesis 18, which states that high educational achievement correlates to the personality pattern rank order of I, S, A, C, E, R, is also not supported.

**Recommendations for Future Research**

The process of conducting this investigation, the results from the study, and the limitations that were identified served as the impetus for several recommendations for future research. This section will discuss ways to overcome some of the aforementioned limitations, as well as other considerations and recommendations.

**Experimental Model**

If it were possible to identify the students who changed majors or institutions, then there would be another way to examine the data. It would be interesting to determine if students who changed majors went from less congruent majors to more congruent majors. It would also be interesting to study the difference in degree completion rates between “changers” and those who did not change majors or institutions. Future researchers should find a manner in which to identify those students who switched majors and institutions to better understand the influence of congruence on degree completion.

As discovered in this investigation, serious challenges with the Holland code taxonomy of majors can arise when using instruments like the DHOC or *The College Majors Finder* (Rosen, Holmberg, & Holland, 1989) to convert majors into Holland
codes. To better understand the influence of congruence, and the interaction of congruence with other variables, perhaps future research should be refocused on first letter Holland personality type of major as a predictor variable. Results from the Feldman et al. (1999) study, the regression analysis in this investigation, and other studies cited in Holland (1997) lend credence to the notion that first letter personality type matters with respect to higher levels of academic achievement.

To address the problem with the conversion of some of the general and ambiguous majors into Holland codes, the use of a different experimental model could be used to see how well congruence predicts graduation from college in specific majors by personality type. Instead of considering all majors and all personality types as this study has done, one could consider one specific and well differentiated major and many Holland personality types, while using the rest of the experimental design in this study to isolate the influence that congruence has on academic achievement. Although previous researchers (Bruch and Krieshok, 1981; Henry, 1989; Walsh and Lacey, 1969) have utilized one or only a few majors, this researcher was unable to find any research that examined the prediction of academic achievement using congruence and other predictor variables.

*Environmental Influence in Higher Education*

In order to better capture the influence of the entire college environment, future researchers should utilize a broader definition of environment. Major alone is too narrow. There is much influence from other environmental factors such a campus culture, living arrangements, extracurricular involvement, and the campus community in general (Astin, 1993; Pascarella & Terenzini, 2005; Tinto, 1993).
Future research should attempt to better integrate popular and contemporary higher education theories with Holland’s (1997) Theory of Vocational Personalities and Work Environments. After all, Holland’s (1997) is a theory about vocational personalities and work environments that has been extended to higher education. There is considerable intuitive appeal in elaborating and integrating aspects of Holland’s (1997) theory with popular higher education theories relating to the interaction between college students and their environment. The integration of Holland’s (1997) theory with Tinto’s (1975) Theory of Student Departure, Astin’s (1984) Theory of Student Involvement, and Weidman’s (1989) Model of Undergraduate Socialization will be offered here.

Tinto’s (1975) Theory of Student Departure identified the academic and social integration of a student into the formal and informal structures of the institution as the primary factors affecting a student’s decision to persist or drop out. Academic integration develops through formal interactions between and among students and faculty and is influenced by various factors, such as faculty-student interaction, levels of faculty supportiveness of students, and student-student interaction of an academic nature. Social integration develops through informal, casual interactions between and among students and other college community members outside the classroom. Tinto posits that the more students become integrated into the academic and social systems of the institution, the more likely they will persist at the institution (Tinto, 1975). Obviously, as the likelihood of student persistence increases, so does the likelihood that students will achieve academically as measured by graduating from college.

Holland’s (1997) theory suggests that the personality types have varying competence in interpersonal relations. Generally speaking, S, E, and A types prefer
dealing with people, while R, C, and I types would prefer dealing with things. According to Holland (1997), social competence occurs in the following rank order: S, E, A, I, C, R. The rank order of baccalaureate degree completion rates in this study is E, I, S, A, C, R. Although the first four letters are disordered, the fact that the personality types that have the lowest competence in interpersonal relations had the lowest graduation rates supports the notion that lower levels of competence in social skills contributes to lower levels of social integration, which, in turn, translates into lower levels of academic success.

In other words, even though some students may be academically prepared and integrated, they may not persist and graduate because they have failed to make social connections at college, or because they lack the social skills to seek help from faculty or work interdependently with peers. If future research were to confirm this conjecture, which integrates tenets of the Holland (1997) and Tinto (1975) theories, then interventions could be performed whereby students with specific Holland personality types could be taught how to improve their social skills. Alternatively, faculty could utilize alternative pedagogical techniques in an attempt to create social opportunities and develop competence in interpersonal relations with students.

Astin’s (1984) Theory of Student Involvement refers to the quantity and quality of the physical and psychological energy students invest in their college experience. A “highly involved student is one who, for example, devotes considerable energy to studying, spends much time on campus, participates actively in student organizations, and interacts frequently with faculty members and other students” (Astin, 1984, p. 297). Further, Astin would argue that the more involved a student is, the more likely it is that the student will persist and graduate.
One could extend Holland’s (1997) theory in general and the congruence assumption specifically to extracurricular activities in college. Greek letter organizations, intercollegiate athletics, student government, clubs, or a campus work-study jobs could serve as environmental measures, just as college major was used in this study. It is possible that a student could satisfy his or her vocational interests through extracurricular involvement while studying a more pragmatic major.

To illustrate this point, consider how a student who has a first-letter Holland personality type of A could fulfill her interests in artistic creativity by participating in the institution’s theatre troupe while studying a curriculum that is not congruent with her vocational personality. If the student is motivated enough to attend classes, complete course work, and become involved in extracurricular activities that are congruent with her vocational interests, and allow her to demonstrate competence and to interact with people with similar interests, then she might still persist, achieve, and be satisfied with her college experience, even though she might not be enrolled a major that is congruent with her vocational personality type.

Several studies (Burnett, Vaughan, & Moody, 1997; Jacoby, Rue, & Taylor-Allen, 1984; Murray & Hall, 2001a; Sergent & Sedlacek, 1990; Varca & Shaffer, 1982) have examined extracurricular activities as they relate to Holland personality types. However, none of these have examined the relationship between personality type-extracurricular activity congruence with baccalaureate degree completion.

Weidman’s (1989) Model of Undergraduate Socialization combines Tinto’s (1975) concept of social and academic integration, Astin’s (1984) tenets regarding involvement, Chickering’s (1969) work on the identity development of college students,
and his own work into a comprehensive explanation of undergraduate socialization. Like other researchers (Astin, 1993; Holland, 1997; Tinto, 1993), Weidman posits that students bring with them a set of background characteristics that have an impact on their college experience. Unlike other researchers, his model also includes normative pressures from parents and non-college reference groups as factors that influence students’ choices in various settings. At the heart of the Weidman model is the college experience, which is the sum of the academic and social integration and the socialization process.

What makes Weidman’s (1989) model especially appealing is its inclusion of career preferences as one of the student background characteristics researchers should consider. In addition, Weidman advocates consideration of employers and community organizations as some of the non-college reference groups that have an influence on students. A final intriguing component of the model is a career choice as one of the four socialization outcomes.

Weidman’s (1989) inclusion of career preferences, career choices, and influences of workplace peers and employers, as well as the integration of some of the most widely accepted theories in higher education, provides the opportunity for person-environment researchers to extend Holland’s (1997) theory to the college environment in a more complete and comprehensive manner.

_A Theory of Vocational Personality and College Environment Congruence_

Based on the theoretical constructs of Holland’s (1997) Theory of Vocational Personalities and Work Environments, and Weidman’s (1989) Model of Undergraduate Socialization, and based on the results of this and other studies, this investigator
recommends that future researchers investigate an extension of Holland’s theory. A Theory of Vocational Personality and College Environment Congruence is proposed, which posits that academic achievement, persistence in college, and satisfaction with college are encouraged by the degree of fit between a student’s vocational personality type and the combination of his or her academic field of study and extracurricular involvement.

It is proposed that the congruence between a student’s vocational personality type and college environment is a sum of academic congruence and social congruence. Academic congruence could be measured and quantified by comparing a student’s vocational personality type and his or her college major, as it was in this study. Social congruence could be measured and quantified using the C Index (Brown & Gore, 1994) by comparing a student’s vocational personality type and his or her involvement in extracurricular activities. These extracurricular activities could be intercollegiate athletics, performing arts groups, academic clubs, campus religious organizations, student government, campus employment, or any other activity that takes place outside of the classroom, where the student spends the greatest amount of time and physical or psychological energy. Further, it is proposed that the influence from academic congruence is equal to that of social congruence.

This proposed elaboration of Holland’s (1997) congruence assumption for use in higher education is supported by many previous Holland type congruence studies. This investigation has discussed several studies (Bruch & Krieshok, 1981; Feldman, Smart, & Ethington, 1999; Frantz & Walsh, 1972; Henry, 1989; Holland, 1963; Martin & Bartol, 1986; Posthuma & Navran, 1970; Reutefors, Schneider, & Overtone, 1979; Smart, 1997;
Smart & Feldman, 1998; Smart, Feldman, & Ethington, 2000; Walsh & Lacey, 1969) that have examined this concept of academic congruence. The notion of extracurricular involvement congruence has been studied by Burnett et al. (1997), Jacoby et al. (1984), Murray and Hall (2001a), Sergent and Sedlacek (1990), Varca and Shaffer (1992). In addition, Murray and Hall (2001b) have developed an instrument to assess a student’s extracurricular interests in order to match their interests with involvement opportunities. Collectively, all of these studies serve as a strong foundation for this proposed integration of Holland’s (1997) theory and Weidman’s (1989) model.
References


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APPENDIX A

HUMAN SUBJECTS REVIEW BOARD APPLICATION

UNIVERSITY OF TOLEDO
HUMAN SUBJECTS RESEARCH & REVIEW COMMITTEE
STUDENT INVESTIGATOR’S SUMMARY DESCRIPTION OF RESEARCH INVOLVING THE USE OF HUMAN SUBJECTS

PLEASE COMPLETE ALL PAGES OF THIS FORM. PLEASE TYPE ALL INFORMATION.

HHRC Project #: Student I. D. #: XXX-XX-XXXX

Submission Date: 3/28/05 Proposed Start-up Date:

<table>
<thead>
<tr>
<th>Student Investigator: Cameron S Cruickshank</th>
<th>Phone: (419) 862-2010</th>
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<tbody>
<tr>
<td>Student Address: 19721 W. Zwicker Road, Martin, OH 43445</td>
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<tr>
<td>Faculty Advisor: David Meabon, Ph.D.</td>
<td>Phone: (419) 530-2666</td>
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<tr>
<td>Department: Educational Leadership</td>
<td>College: Education</td>
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<tr>
<td>Project Title: Baccalaureate Degree Completion: A Test of Holland’s Congruence Assumption Using Four-Year Public College Students in Ohio</td>
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Project Sponsorship Information:

This Project is for: [ ] Personal Scholarship [x] Course-Related Scholarship
[ ] Non-University Agency

This Project will be: [ ] Unsupported [ ] Supported by a University Agency
[x] Supported by an External Agency

Source of Support: The Ohio Board of Regents will provide secondary data.

Is this project contingent upon receiving support? [ ] Yes [x] No

I hereby certify that upon approval of this proposal by the Human Subjects Research & Review Committee, no changes will be made without approval of the HSRRC, and that any problems, adverse reactions or unforeseen conditions encountered in the use of Human subjects will be immediately reported to the Chair of the HSRRC. I further agree to supply the HSRRC with all requested reports and a Certificate of Compliance upon completion of this project.

_____________________________ Date
Student Investigator

_____________________________ Date
Faculty Advisor

Return a copy of this form and a copy of your proposal/project to HSRRC Chair, Gerald Sherman, WO 2243
1. **PROJECT DESCRIPTION:**

In the space below, briefly describe the objectives of your research, data collection procedures, the need for human subjects, and any special conditions or procedures for their involvement. You need not be lengthy, but provide enough information for the Review Board to assess the risks to which your subjects may be exposed and the benefits likely to result from your proposed experiments.

This dissertation research project will use secondary data obtained from the Ohio Board of Regents (OBR). Biographical and demographic information will be obtained from ACT Assessment data via OBR. Educational data will be obtained indirectly from the public four-year institutions in Ohio via OBR. There will be no other data collected or human subjects involved.

2. **CHARACTERISTICS OF SUBJECT GROUP(S):**

Describe the characteristics of the group(s) to be used. Specify particularly if human subjects are either children, mentally incompetent, or legally restricted groups. For each statement, indicate the page number in the proposal where substantiating documentation is found.

a. *Sex, race or ethnic group age range, etc.:*

   All 1998 high school graduates who took the ACT Assessment and attended a public four-year institution in Ohio in the Fall of 1998.

b. *Affiliation of subjects (e.g. college students, elementary school children, hospital patients, general public, etc.):*

   College-bound students.

c. *Subjects’ general state of health (mental or physical):*

   Excellent.

d. *The necessity for using these particular groups:*

   Most recent group of college graduates using six-year graduation rates.

e. *Briefly explain how subjects will be recruited. Describe the procedure to the point of gaining subject consent.*

   Not applicable.

f. *Explicitly describe what the subjects will be asked to do.*

   Not applicable.

3. **RISKS TO SUBJECTS:**

Describe in detail any physical, psychological, social, legal, economic, or other risks you can foresee both immediate and long range. For each statement, indicate the page number in the proposal where substantiating documentation is found.

a. *Immediate risks:*

   None.
b. Long range risks:

None.

c. Rationale for the necessity of such risks:

Not applicable.

d. How will these risks be minimized?

Not applicable.

e. If risks have been identified, briefly describe the importance of the knowledge to be gained and explain why you feel that the value of the information to be gained outweighs the risks?

Not applicable.

4. CONFIDENTIALITY OF DATA:

What precautions will be taken to safeguard identifiable records of individuals? This question also applies if you are using secondary sources of data. Be specific about the long range and immediate use of data by you and others.

All identifiable information will be stripped by OBR. Small cell data will not be used.

Immediate use will be for the dissertation research project. No plans for long range use of data at this time.

5. CONSENT PROCEDURES:

Federal regulations require precautionary measures to be taken to insure the protection of human subjects on physical, psychological, social and other issues. This includes use of "informed consent" procedures, as described in the institutional guidelines.

a. How will the subject be informed of the nature of the investigation, the reasonably foreseeable risks, and the voluntary nature of his/her participation?

☐ in writing

☐ orally

b. Once the above information has been presented, will you obtain written consent from the subject (i.e. his/her signature) prior to his/her participation?

☐ Yes (attach a copy of the consent form)

☐ No (identify the reasons for requesting a waiver of the written consent requirement)

c. If the subjects are: ☐ minors or ☐ mentally incompetent, describe how and by whom permission will be granted

_____________________________ _____
Signature Date
APPENDIX B

MEMORANDUM OF UNDERSTANDING BY AND BETWEEN
CAMERON CRUICKSHANK AND OHIO BOARD OF REGENTS

This Memorandum of Understanding ("MOU") is entered into by and between the Ohio Board of Regents, a governmental body established by the Ohio General Assembly pursuant to Ohio Revised Code §3333.01, with its principal address at 30 East Broad Street, Columbus, Ohio 43215 ("OBR"), and Cameron Cruickshank, whose principal address at 19721 Zwicker Road, Martin, OH 43445 ("INDEPENDENT CONTRACTOR").

WHEREAS, OBR serves as the coordinating body for higher education in the State of Ohio; and

WHEREAS, OBR is authorized to enter into contracts with consultants to discharge the board's duties pursuant to Ohio Revised Code Section §3333.044.

WHEREAS, OBR desires to secure the services of an INDEPENDENT CONTRACTOR to assist OBR with the preparation of a report on the factors influencing the retention and graduation of first-time freshmen beginning college in fall 1998 at Ohio's public four-year universities; and

NOW THEREFORE, in consideration of the mutual covenants and promises set forth herein and for other good and valuable consideration, OBR and the INDEPENDENT CONTRACTOR (individually, a “Party”; collectively the “Parties”) hereby agree as follows:

ARTICLE I: STATEMENT OF WORK

The INDEPENDENT CONTRACTOR agrees to provide the following services:
Prepare a report that investigates the relationship between students’ academic achievement and the degree of agreement between students’ vocational interests and their choice of college major. Data on a cohort of first-time freshmen from Ohio high schools attending Ohio public universities will be used to test the hypothesis that students who choose majors that are more compatible with their vocational interests experience greater academic success than students whose interests and majors are mismatched.

The proposed research will investigate the relationship between the degree of vocational interest-academic environment congruence and academic success. Holland’s theory of vocational choice is used as the theoretical framework that guides the proposed study. Participants will be students at public four-year institutions in the State of Ohio who took
the ACT Assessment and completed the ACT Interest Inventory. Vocational interest-academic environment congruence will be determined by comparing secondary data collected from the ACT Interest Inventory and the student’s major in college during their last term of attendance. Analyses will be performed which determines the degree to which vocational interest-academic environment congruence predicts graduation from college.

Detailed Description of Research Plan

The Problem

The demand for outcomes from students, government, and accrediting bodies has made a successful college outcome an important issue in American higher education. Subsequently, the academic enterprise needs to find ways to increase the number of students that graduate from higher education and go on to serve meaningful roles as working citizens who contribute to society.

Holland’s Theory of Vocational Choice

The underlying concept of Holland’s theory of vocational choice is that human behavior is a function of the interaction between individuals and their environments.

Subsequently there are three components to the theory: individuals, environments, and the congruence between them. Each component has an assumption associated with it.

1. Students choose academic environments compatible with their personality types (self-selection assumption).

2. Academic environments reinforce and reward different patterns of behavior (socialization assumption).

3. Students flourish in environments that are congruent with their dominant personality types (congruence assumption).

Holland also posits that an individual’s selection of a vocation or academic major is an expression of personality. Most people can be categorized into one of six personality types. The six types are realistic (R), investigative (I), artistic (A), social (S), enterprising (E), and conventional (C). These vocational personality types are placed on Holland’s hexagon to illustrate the similarity among and between the personality types. See figure 1.
Research Question

Does the level of congruence between students’ vocational interests and their major in college at public four-year institutions in the state of Ohio influence graduation from college?

Participants

All 1998 Ohio high school graduates who took the ACT Assessment, completed the interest inventory section (which provides the Holland personality types), and enrolled only in public four-year institutions in Ohio.

Procedure

- Use secondary data obtained from ACT and data obtained from the Ohio Board of Regents (OBR) to determine the degree of congruence between vocational interest and college major (academic environment).
- Use the Holland personality type (RIASEC) from ACT Interest Inventory to determine the students’ vocational personality types.
- Use the academic major (provided by OBR) that the student is enrolled in to serve as a proxy for the academic environment. Using the Dictionary of Holland Occupational Codes (Gottfredson & Holland, 1996) convert the classification of instructional program (CIP) codes to one of the Holland personality types.
Measures

- Utilize the ‘C’ Index (Brown & Gore, 1994) to determine the degree of congruence between the person and environment. The formula for C is:
  \[ C = 3(X) + 2(X) + X \]

Where:
- X = 3, 2, 1, or 0 is assigned to each comparison of the three positions of the three letter Holland personality type and of the environment according to the hexagonal distance between the letters.
  - “3” would be assigned when the person and environment letters are the same.
  - “2” would be assigned when the person and environment letters are adjacent to one another on the Holland hexagon.
  - “1” would be assigned when the person and environment letters are in an alternate position on the Holland hexagon.
  - “0” would be assigned when the person and environment letters are opposite one another on the Holland hexagon.

Analysis

- Conduct a step-wise multiple regression to determine the extent to which the congruence between vocational interest and major (academic environment) influence graduation from college.
  - Dependent (outcome) Variable: graduation from college
  - Independent (control) Variables:
    - academic ability (composite ACT)
    - academic preparedness (courses taken in high school)
    - gender
    - socioeconomic status (self-report from ACT)
    - ethnicity
    - proximity from home
    - differentiation (raw score or percentile ranks from ACT)
    - identity (certainty of college major or certainty of vocational choice)
    - consistency (two highest interest scales)
    - measures of involvement (intended hours of work per week, extracurricular activities)?
  - Experimental Variable: congruence as measured by the C index

Article II: Term of the MOU

The term of this MOU shall commence on February 15, 2005, or the date on which both parties sign the contract, whichever date is later, and end June 30, 2005, or until the MOU is terminated pursuant to the terms contained herein, whichever event occurs first.
**Article III: Compensation**

1. In consideration of the promises and performance of the Independent Contractor as set forth herein, OBR agrees to:

   - Allow the Independent Contractor to use the data provided by OBR for his own research purposes, which may include dissertation research and publication in academic journals. The Independent Contractor will be required to give OBR copies of any dissertation or articles written using the data.

   - OBR will provide the Independent Contractor with a unit-record data file containing information on recent Ohio high school graduates who took the ACT college entrance exam and began college as freshmen at public Ohio universities. No personally identifiable student data such as name or social security number will be included in the data file.

   Data supplied will come from two sources:

   - a. Student survey data from ACT test-takers received from ACT, Inc. by OBR. The Independent Contractor has received permission from ACT, Inc. to use this ACT-supplied data in his research. (See attached memo from ACT, Inc. to the Independent Contractor to this effect.) The ACT data is the source of information on student interests, academic ability, courses taken in high school, and family income.

   - b. OBR HEI (Higher Education Information) system data. The HEI data is the source of information on student demographic characteristics, enrollment outcomes, and graduation outcomes.

2. Unless expressly provided for elsewhere in this MOU, INDEPENDENT CONTRACTOR shall be responsible for and assume all office and business expenses that are incurred as a result of the performance of this MOU.

**Article IV: Rights in Data, Patents and Copyright**

OBR shall have unrestricted authority to reproduce, distribute and use (in whole or in part) any reports, data or material prepared by the INDEPENDENT CONTRACTOR pursuant to this MOU. If the Independent Contractor writes articles or reports based on the analysis of the data provided from OBR, OBR shall be cited as the source of the data. Release of results that identify specific universities is not permitted.

**Article V: Termination**

This MOU may be terminated only as follows:
1. By OBR without cause upon three (3) days written notice to the INDEPENDENT CONTRACTOR.

2. By mutual consent of the Parties.

3. In accordance with the term limitations set forth in Article 2 of the MOU entitled “TERM OF THE MOU.”

4. If the General Assembly fails at any time to continue funding for the payments and other obligations set forth herein, OBR obligations under this MOU are terminated as of the date the funding expires and OBR shall have no further obligations hereunder. If OBR discovers or is notified of the discontinuation of funding for this MOU, then OBR agrees to notify the INDEPENDENT CONTRACTOR of said discontinuation as soon as is practicable. The INDEPENDENT CONTRACTOR shall not perform any work under the MOU after it receives such notice.

**ARTICLE VI: COMPLIANCE WITH LAW**

INDEPENDENT CONTRACTOR agrees to comply with all applicable federal, state and local laws in the conduct of the work hereunder. INDEPENDENT CONTRACTOR and its employees are not employees of OBR with regard to the application of the Fair Labor Standards Act minimum wages and overtime payments, Federal Insurance Contribution Act, the Social Security Act, the Federal Unemployment Tax Act, the provisions of the Internal Revenue Code and for state revenue and tax laws, state workers’ compensation laws and state unemployment insurance laws. INDEPENDENT CONTRACTOR accepts full responsibility for payment of all taxes including without limitation, unemployment compensation insurance premiums, all income tax deductions, social security deductions, and any and all other taxes or payroll deductions required for all employees engaged by INDEPENDENT CONTRACTOR in the performance of the work authorized by this MOU. OBR shall not be liable for any taxes under this MOU.

**ARTICLE VII: DRUG AND ALCOHOL FREE WORKPLACE**

The INDEPENDENT CONTRACTOR shall comply with all applicable federal, state, and local laws regarding smoke free and drug free work places and shall make a good faith effort to ensure that any of its employees or permitted subcontractors engaged in the work being performed hereunder do not purchase, transfer, use or possess illegal drugs or alcohol or abuse prescription drugs in any way.

**ARTICLE VIII: CERTIFICATION AND AVAILABILITY OF FUNDS**

The MOU is subject to the provisions of Ohio Revised Code §126.07. It is expressly understood by the parties that none of the rights, duties, and obligations described in this contract shall be binding on either party until all
statutory provisions under the Ohio Revised Code have been complied with and until such time as all necessary funds are made available and forthcoming from the appropriate state agencies.

**ARTICLE IX: AMENDMENTS OR MODIFICATION**

No amendment or modification of this MOU shall be effective against either party unless such amendment or modification is set forth in writing and signed by both parties.

**ARTICLE X: ENTIRE AGREEMENT**

This MOU constitutes the entire agreement of the parties hereto and supersedes any prior understandings or written or oral communications between the parties respecting the subject matter hereof.

**ARTICLE XI: WAIVER**

The waiver or failures of either party to exercise in any respect any right provided for herein shall not be deemed a waiver of any further right hereunder.

**ARTICLE XII: SEVERABILITY**

If any provision of this agreement is found invalid, illegal, or unenforceable in any respect by a court of competent jurisdiction, said provision shall be severed. The validity, legality, and enforceability of all other provisions of this MOU shall not in any way be affected or impaired unless such severance would cause this agreement to fail of its essential purpose.

**ARTICLE XIII: NOTICE**

Any notice required hereunder shall be made in writing and shall be accomplished by personal delivery, facsimile, or by United States certified mail, return receipt requested, postage prepaid, addressed to the party at the address set forth below or such other address as said party shall hereafter designate in writing to the other party.

Mr. Cameron Cruickshank  
19721 Zwicker Road  
Martin, OH 43445  
E-mail: cacruick@tiffin.edu

Ohio Board of Regents  
30 East Broad Street  
36th Floor  
Columbus, OH 43266-0417  
Facsimile: (614) 466-5866

Copy (provided by OBR) to:  
Ohio Attorney General’s Office  
Education Section  
30 East Broad Street, 15th Floor  
Columbus, OH 43216-6610  
Facsimile: (614) 644-7634
**Article XIV: Governing Law**

This MOU shall be construed under and in accordance with the laws of the State of Ohio.

**Article XV: Headings**

The headings herein are for reference and convenience only. They are not intended and shall not be construed to be a substantive part of this MOU or in any other way to affect the validity, construction, interpretation, or effect of any of the provisions of this MOU.

**Article XVI: Effective Date**

This MOU shall be effective on February 15, 2004, or the date signed by the parties hereto, whichever date is later.

**In Witness Whereof**, the parties have executed this MOU on the day and year set aside by their respective signatures.

**Independent Contractor**

By: __________________________    __________________________
    [Please Print or Type Full Name]    Date

FTI# or SS#, as applicable

**The Ohio Board of Regents**

By: _________________________________  __________________________
    Roderick G.W. Chu     Date
    Chancellor