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An evaluation of personality-environmental factors related to job satisfaction of secondary school natural science teachers

George Newton DeShazo
College of William & Mary - School of Education

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**An evaluation of personality-environmental factors related to job
satisfaction of secondary school natural science teachers**

DeShazo, George Newton, Ed.D.
The College of William and Mary, 1992

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Ann Arbor, MI 48106

An Evaluation of Personality-Environmental Factors
Related to Job Satisfaction of Secondary
School Natural Science Teachers

A Dissertation Presented to
The Faculty of the School of Education
The College of William and Mary in Virginia

In Partial Fulfillment
Of the Requirements for the Degree
Doctor of Education

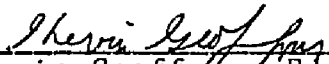
by
G. Newton DeShazo
July 1992

AN EVALUATION OF PERSONALITY-ENVIRONMENTAL FACTORS
RELATED TO JOB SATISFACTION OF SECONDARY
SCHOOL NATURAL SCIENCE TEACHERS

by

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Abstract

AN EVALUATION OF PERSONALITY-ENVIRONMENTAL FACTORS RELATED TO JOB SATISFACTION OF SECONDARY SCHOOL NATURAL SCIENCE TEACHERS

DeShazo, G. Newton, Ed.D. The College of William & Mary in Virginia.

Chair: Professor Kevin Geoffroy

The purpose of this study was to examine the relationship among certain personality traits, vocational interests, and demographic factors with job satisfaction among secondary school natural science teachers. Implications for future research and educational practice were explored.

Volunteers teaching secondary school natural science classes in seven Virginia public school districts primarily in the Hampton Rhodes area were subjects for this study. Subjects completed the Myers-Briggs Type Indicator, the Vocational Preference Inventory, The Job Descriptive Index, and a biographical informational questionnaire.

It was hypothesized that 1) there would be a positive correlation between the predominant basic preference, INTJ, and job satisfaction, 2) there would be a positive correlation between congruence of the Holland code IRS and job satisfaction, 3) there would be a positive correlation between differentiation and job satisfaction, and 4) there would be a positive correlation between age, sex, years as natural science teacher, years in present position, total years in education, highest degree earned and job satisfaction.

Hypotheses 1, 2, and 3 were rejected. In hypothesis 4, years in present position and years as natural science teacher were negatively correlated with job satisfaction. Recommendations for further research and future educational practice were made.

Dedication

This dissertation is dedicated to my parents, Mr. & Mrs. John C. DeShazo for their unfailing encouragement and support.

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I express appreciation to my parents, Mr. & Mrs. John DeShazo, and my aunt, Mrs. Elizabeth Whitlock, for their inspiring influence throughout this study. Also, I acknowledge the invaluable contributions of Diane DeShazo and the unfailing encouragement of Donna Gray, whose interest fostered the completion of this study.

Special appreciation is extended to the three members of the doctoral committee, Dr. Kevin Geoffroy, Dr. Fred Adair, and Dr. Charles Matthews, for their continuous guidance and support.

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TEACHERS

Chapter I

Introduction

Statement of the Problem

The problem of this study was to examine the relationship among certain personality traits, vocational interests, and demographic factors with job satisfaction among secondary school natural science teachers.

Significance of the Study

Are teachers satisfied with their jobs? American leaders in education have become increasingly concerned about this issue. Numerous factors contribute to its importance. Public schools and public school teachers have increasingly become the targets of considerable criticism through the news media and conservative political forces. The privileged social status once enjoyed by teachers has diminished, leaving them with growing negative public opinion (Duke, 1984). Contending with complex bureaucratic educational systems, the complexities of student-teacher relationships, and increasing administrative expectations is often overwhelming. Thus, job related stress, confusion, and disillusionment within the teaching profession have taken a toll on teacher morale, attendance, and performance (Chapman, 1983; Pellicer, 1984).

Perhaps low job satisfaction among teachers has contributed toward the shortage of qualified science teachers in America's public schools during the past two decades. The number of college students expecting to become

science teachers decreased sixty percent between 1971 and 1981 (Champagne & Hornig, 1987). In his student survey, Walton (1982) noted that not all students preparing to teach science actually enter the teaching profession. He found that in 1981, 11% of biological science education major graduates applied for teaching positions. Guthrie and Zusman (1982) reported the proportion of science majors at the University of California at Berkley interested in teaching was "microscopic" (p. 28). In 1981, a national survey indicated that ninety percent fewer physics graduates became high school teachers than a decade earlier (Champagne & Hornig, 1987).

In addition, teachers are attracted to the higher salaries and greater benefits offered by private industry (Guthrie & Zusman, 1982). Consequently, prospective and practicing science teachers are abandoning education (Guthrie & Zusman, 1982; Walton, 1982). Therefore, school divisions are faced with the problem of recruiting science teachers from the dwindling supply and then attempting to retain them (Guthrie & Zusman, 1982; Walton 1982).

As school systems contend with the shortage of science teachers, the need to understand the components of job satisfaction for this particular group of teachers intensifies. A better understanding of these components may assist school systems in attracting, hiring, and retaining more qualified teachers.

Which personal characteristics lead to job satisfaction remains unclear and often contradictory. Certain studies have shown that time related demographic variables such as age, years teaching, and years in present position have no relationship to job satisfaction (Wiggins, 1976; Wiggins, Lederer, Salkowe & Rys, 1983).

Researchers admit that current methods of measuring job satisfaction do not measure all significant variables (Kerr, 1985; Salomone & Sheehan, 1985; Parsons, 1983; Scarpello & cambell, 1983). Nevertheless, while acknowledging weaknesses relating to job satisfaction research, a purpose of this study is to restate factors relating to job satisfaction in a specific population of teachers.

The purpose of this study will be to examine the relationship among certain personality traits, vocational interests, and demographic factors with job satisfaction among secondary school natural science teachers.

Theoretical Rational

The theoretical rational for this study is based on Carl G. Jung's theory of the collective unconscious. Jung, in 1933, developed the concept of the collective unconscious to help explain the evolutionary structural and functional development of man's psyche. Jung believed the human psyche to be as much a definitive functioning structure of man's mind as the brain itself.

Jung (1933, 1959, 1969a) theorized that there exists in the mind an unconscious substratum common to all mankind.

This substratum is formed by the collective unconscious, the contents of which are genetically transmitted. This collective unconscious consist of patterns or archetypes for organizing stimuli relevant to all common human experiences.

Jung believed that the human psyche is the apex of the psychogenetic development of homo sapiens; thus it has developed out of the animal kingdom and throughout the long evolutionary history of mankind.

Jung was careful to distinguish between his concept of the personal unconscious and the collective unconscious. Contrasted with the inherited archetypes of the collective unconscious, the contents of the personal unconscious are learned and at one time were in consciousness but are no longer. This loss of material to consciousness is due to forgetfulness or repression. The archetypes of the collective unconscious, however, do not owe their existence to personal experience and are not personally acquired. Nor have the contents of the collective unconscious ever been a part of consciousness.

Jung (1969b, 1964, 1950) saw confirmation of the expression of the collective unconscious in animals through their collective behavior patterns commonly explained as instinctive behavior. He saw animals having little consciousness but their instinctive trends, such as building nests and organizing colonies, indicated to him the existence of a psyche. Like instincts, the collective thought patterns of the human mind are innate and function

more or less the same in each person. Therefore, within the confines of these "a priori" instinctive patterns, man has no choice but to act in a specifically human way and follow a predetermined pattern of behavior. Such innate patterns limit man's volition and Jung concluded that the more primitive man is the more his consciousness is dependent on his instinctive sphere. The more consciously differentiated the psyche of the individual, however, the more volition he has.

To Jung (1964), man's psyche corresponds to a physical structure and the psyche of the primitive, prehistoric mind is the basis of the present mind just as the structure of the body is based on the general anatomy of the mammal. Jung felt that analogies could be made between expressions of the primitive psyche and expressions of the new psyche. Such was the case as he compared the dreams of modern with primitive mind productions, collective images, and mythological motifs.

The existence of the psyche can only be recognized when its contents are capable of consciousness. Therefore, unconscious content can be recognized only if it can be demonstrated. To explain the manifestation of the unconscious in man's view of himself, in his awareness of his environment, and in his decision making, Jung (1971) developed the theory of psychological types. His theory, as related to perception and judgment, shed light on the

difficulties, misunderstandings, and natural attractions among individuals.

According to Jung's typology theory, people can be classified according to attitude type and function type. The two attitude types are extroversion and introversion. The extroverted individual's libido tends to be directed from himself toward objects in the outer world while the introverted person's libido tends to be directed from objects in the outer world into himself. Realizing that neither of these categories is exclusive or fixed, Jung attempted to describe in a practical way one's dominant attitude towards people, the world, and oneself (Hopcke, 1989).

Jung classified four function types, two categorized as rational and two as irrational. The rational type includes the thinking function which organizes and decides according to rules of analysis and logic and the feeling function organizes and decides according to values and feelings of individual worth (Hopcke, 1989)

The two irrational functions include intuition and sensation. These functions tend to experience first and then decide. The intuitive type functions primarily from unconscious experience and perceptions. The sensate type functions basically through the experience of the concrete, physical world (Hopcke, 1989).

As these personality functions and attitudes direct one's perception of reality and decision making,

they also influence the individual in exercising self-determination. Innate expressions of the personality, along with the drive for self-determination, influence the process and outcome of personal choice. Such choices are also influenced by particular mental and physical attributes, and environmental influences.

Persons choosing to prepare for and to work in the same vocation may be influenced by similar internal and external forces and, thus, may have certain personal characteristics in common. Therefore, the purpose of this study is to analyze certain employee attributes in a specific work environment using appropriate methods and instrumentation.

Definition of Terms

Compatability Index. A procedure using the primary, secondary, and tertiary Holland personality subtypes to determine congruence.

Congruence. The similarity between one's personality type and the working environment as described by Holland's personality-environmental types.

Differentiation. A measure of personality strength as measured by the difference between the strongest and weakest Holland personality-environmental subtypes.

Job Satisfaction. How one perceives rewards from employment as measured by the Job Descriptive Index.

Secondary School Natural Science Teachers. Teachers of biological, geological, and chemistry classes beginning at

the intermediate and middle school levels and continuing through high school.

Personality-environment. Two interacting factors, in one's workplace, impacting on job satisfaction.

Personality Subtype. A descriptive term referring to a particular component of the personality type.

Personality Type. A descriptive term referring to a particular personality as measured by the Vocational Preference Inventory and/or The Myers-Briggs Personality Type Indicator.

Hypotheses

1. There will be a significant correlation between congruence and job satisfaction among secondary natural science teachers.
2. There will be a significant positive correlation between differentiation and job satisfaction among natural science teachers.
3. There will be a significant correlation between certain demographic variables and job satisfaction. These variables include age, years in present position, and total years in education.
4. There will be a significant positive correlation among the prevalence of certain personality subtypes and job satisfaction.

Sample Description and General Data Gathering Procedures

Approximately one hundred presently employed secondary natural science teachers were administered the Myers-Briggs

Type Indicator, Job Descriptive Index, and the Vocational Preference Inventory. A biographical information form was also completed by each participating teacher. The population studied were teachers within participating public school systems voluntarily completing and returning the research instruments.

Written permission to conduct the research was granted by appropriate school division administrators. Individual science department heads coordinated meetings with teachers to explain the study. With school official approval, the incentive of individual feedback was offered to encourage participation. Volunteers were then solicited. Consent forms were completed and signed by each participant.

Self-administered testing materials and the biographical form were distributed for completion. Expected testing time for participants was approximately one hour. Completed materials were collected in approximately one week. Follow-up of non-responders was by telephone.

Limitations of the Study

Limitations of this study include the assumption of honesty of the volunteers. Although it must be assumed that participants complete the instruments honestly, factors involving confidentiality and job security may influence their responses.

The assessment of job satisfaction is not global using available instruments. Therefore, certain factors possibly attributing to job satisfaction may not be considered. Such

factors include gender issues, racial issues, local public support for education, and personal issues.

Volunteers for this study may share particular views or characteristics not shared by those not wishing to participate. Thus, the results may be skewed by a participating sub-group within the total secondary natural science teacher population.

Participants will be taken from certain Virginia school systems. Care should be used in generalizing the results of this study to other populations.

Chapter 2
Review of Literature

Jungs's Theory of Psychological Types

Carl Jung (1971) developed the Theory of Psychological Types to explain one's use of perception and judgement. As part of his theory, he identified four preferences influencing both what people attend to in specific situations and how they perceive situations and make decisions. The four preferences include Extroversion-Introversion (EI), Sensing-Intuitive (SN), Thinking-Feeling (TF), and Judgment-Perception (JP) (Myers & McCaulley, 1989). EI influences decisions regarding whether to direct perception and judgement on the outer world or on the inner world. SN refers to the type of perception preferred when perceiving. TF indicates which judgment to trust when making a decision. JP affects whether to deal with the outer world with a judging attitude or a perceptive attitude.

Jung (1971) found the four basic functions to be Sensing, Intuition, Thinking, and Feeling with one of these four functions being dominant. This dominant function determines the person's primary method of responding to situations.

Utilizing the basic structure of Jung's Theory, Isabel Myers and her mother, Katherine Briggs, developed the Myers-Briggs Type Indicator (MBTI) to identify a person's

individual preferences. Originally, the MBTI was not supported with validity and reliability but was an attempt to classify persons according to personality type by sorting preferences (Geoffroy, 1989). More recently, support has been given for its validity and reliability (Carlson, 1989).

On the MBTI, Extraversion refers to the tendency to relate to the outer world of people and things while Introversion describes the tendency to relate to the inner world of ideas. Judging persons tend to prefer a planned, orderly way of life as compared with Perceptive persons who tend to be flexible and spontaneous (Consulting, 1976).

According to the theory, dynamic relationships exists between preferences. In each type, there is a leading or dominant process and an auxiliary process. Each type has a pattern of dominant and auxiliary processes and attitudes thus creating a dynamic interplay (Myers & McCaully, 1989).

Understanding each preference is important to understanding the interplay dynamics of the various types. The preferences can be described as follows:

Thinking Judgment. Thinking (T) is the function that links ideas together by making logical connections. Thinking relies on principles of cause and effect and tends to be impersonal. Persons who are primarily oriented toward thinking may develop characteristics associated with thinking: analytical ability, objectivity, concern with principals of justice and fairness, criticality, and an orientation to time that is concerned with connections from the past through the present and toward the future.

Feeling Judgment (F). Feeling is the function by which one comes to decisions by weighing relative values and merits of the issues. Feeling relies on an understanding of personal values and group values; thus, it is more subjective than thinking. Because values are subjective and personal, persons making judgments with the feeling function are more likely to be attuned to the values of others as well as their own. Because people oriented toward feeling make decisions by attending to what matters to others, they have an understanding of people, a concern with the human as opposed to the technical aspects of problems, a need for affiliation, a capacity for warmth, a desire for harmony, and a time orientation that includes preservation of the values of the past.

Intuitive Perception (N). Intuition refers to perception of possibilities, meanings and relationships

by way of insight. Jung characterized intuition as perception by way of the unconscious. Intuitions may come to the surface of consciousness suddenly as a "hunch," as the sudden perception of a pattern in seemingly unrelated events, or as a creative discovery. Intuition permits perception beyond what is visible to the senses, including possible future events.

Sensing Perception (S). Sensing refers to perceptions observable by way of the senses. Sensing establishes what exists. Because the senses can bring to awareness only what is occurring in the present moment, persons oriented toward sensing perception tend to focus on the immediate experience and often develop characteristics associated with this awareness such as enjoying the present moment, realism, acute powers to observation, memory for details, and practicality.

Extraverted Attitude (E). In the extraverted attitude (E), attention seems to flow out, or be drawn out, to the objects and people of the environment. There is a desire to act on the environment, to affirm its importance, to increase its effect. Persons habitually taking the extraverted attitude may develop some or all of the characteristics associated with extraversion; awareness and reliance on the environment for stimulation and guidance; an action-oriented, sometimes impulsive way of meeting life; frankness; ease of communication; or sociability.

Introverted Attitude (I). In the introverted attitude (I), energy is drawn from the environment, and consolidated within one's position. The main interests of the introvert are in the inner world of concepts and ideas. Persons habitually taking the introverted attitude may develop some or all of the characteristics associated with introversion: interest in the clarity of concepts and ideas; reliance on enduring concepts more than on transitory external events; a thoughtful, contemplative detachment; and enjoyment of solitude and privacy.

Perceptive Attitude (P). In the perceptive attitude (P), a person is attuned to incoming information. For sensing-perceptive (SP) types the information is more likely to be the immediate realities. For intuitive-perceptive (NP) types the information is more likely to be new possibilities. But for both SP and NP types the perceptive attitude is open, curious, and interested. Persons who characteristically live in the perceptive attitude seem in their outer behavior to be spontaneous, curious, and adaptable, open to new events and changes, and aiming to miss nothing.

Judging Attitude (J). In the judging attitude (J), a person is concerned with making decisions, seeking closure, planning operations, or organizing activities. For thinking-judging (TJ) types, the decisions and plans are more likely to be based on logical analysis;

for feeling-judging (FJ) types the decisions and plans are more likely to be based on human factors. But for all persons who characteristically live in the judging (J) attitude, perception tends to be shut off as soon as they have observed enough to make a decision. (In contrast, persons who prefer the perceptive attitude will often suspend judgment to take another look, reporting "We don't know enough yet to make a decision.") Persons who prefer J often seem in their outer behavior to be organized, purposeful, and decisive.

As a person responds to life's choices, using the function of Sensing, Intuition, Thinking, and Feeling, the attitudes of Perception, Judgement, Introversion, and Extroversion, one subtype of each combination becomes dominant while the other type becomes subordinate. Using the theoretical assumption of the existence of innate preferences in decision making and the existence of a dominant personality type, the assumption can also be made that there will be a significant positive correlation between secondary school natural science teachers and dominant personality types.

Holland's Theory of Vocational Choice As Applied to Scientists

Vocational interests have been assessed in specific careers for the past forty years. Studies measuring these interests have been and continue to be important in the

development of interest inventories. The instrumentation of Holland's theory of vocational choice was a significant advancement in the study of vocational interests and personality types. Since its introduction, Holland's theory has supported the development and use of the Strong Vocational Interest Blank (SVIB), The Strong-Campbell Interest Inventory (SCII), The Vocational Preference Inventory (VPI), and The Self-Directed Search (SDI). These research instruments have been extensively used in the areas of vocational and personality research.

Scott and Sedlacek (1975) studied personality differentiation and the prediction of persistence in physical science and engineering students. The VPI was used, along with the the California Psychological Inventory, to collect data for 914 male students. Results suggest that those who persist in physical science and engineering are significantly distinguishable from one another by using personality data. Physical scientists appear to be clearly differentiated from engineers along an introspection-intellectual versus a social-conventional dimension. The personality variables showed reasonable predictive stability when applied to a cross-validated sample.

In 1976, Kuncze, Decker and Eckelman compared the Strong Vocational Interest Blank scale clusters with occupational satisfaction. They used the Q-factor to analyze the SVIB basic interest scales of 156 male graduates of a large

midwestern university. Using the Q-factor aided in the development of a model classifying occupations into vocational areas such as social vs physical sciences and professional vs technical. Two primary interest areas of each subject were established and occupational status was designated according to the six corresponding classification areas. The five-point Lukert scale was used to determine degree of job satisfaction.

The relationship between interest, job classification, and ratings on job satisfaction was significant with $p < .001$. In addition, 59% of the subjects, with an exact match between interest and job, reported they were "very satisfied" with their jobs. Only 24% of those with an interest-job mismatch reported "very satisfied". Eight percent of those in the exact interest-job match failed to report job satisfaction while 34% of those in the mismatch sample failed to do so.

In 1981, Bruch and Krieschok studied the sensitivity of Holland's congruence method for predicting outcomes where there are subtle person-environment differences. One hundred fifty-eight theoretical engineering majors were used in the study. The study hypothesized that high congruence between the Investigative type student in the Investigative type engineering major as compared with the moderately high congruence of the Realistic type student in the Investigative major would result in more positive

educational outcomes. The VPI was administered to qualifying members of classes of 1975, 1976, and 1977.

Results favored the high student-curriculum congruence hypothesis. Investigative as compared with Realistic subjects demonstrated greater persistence in their engineering major over a two year period and earned higher grades.

A study of personality attributes of science teachers and medical technologists was conducted in 1983 by Kazi and Piper. The VPI was used in conjunction with the Eysenck Personality Inventory to assess 83 medical technologists and 53 community college science teachers. The VPI coded medical technologists and science teachers as IAS (Intellectual-Artistic-Social). The two groups did not differ in their vocational interests and had basically the same personality profile. Therefore, according to this study, different career choices could not be related to work environment.

Hill and Roselle (1985) studied the differences in the vocational interests of research and development managers as compared with those of technical specialists. The study included 110 research and developmental managers and 55 technical specialists. All subjects were male. Only subjects reporting to be "satisfied" or "very satisfied" in their occupations qualified as subjects. The study was conducted by mail.

All subjects were given the 1981 Strong Campbell Interest Inventory to complete either at home or a work. A background questionnaire also requested certain job related and personal information.

Subjects were then matched using age, educational field, educational level, occupational tenure, and proportions of subjects involve in research and in development. An analysis of the general occupational themes and basic interest scales indicated the social, enterprising, and conventional areas predicted the managerial group while the artistic area predicted the technical specialist group.

In 1988, Meir and Yaari studied the hypothesis that the relationship between congruent speciality choice and job satisfaction exceeds the relationship between occupational choice and job satisfaction. The 324 subjects included physicians, teachers, nurses, biologists, psychologists, engineers, policemen, and lawyers. The hypothesis was confirmed.

Since it's development, Holland's Theory of Vocational Choice has been implemented through various instruments including the VPI, SCII, and the SVIB. Numerous studies have utilized these instruments to research personality and the work place.

Studies cited include Scott and Sedlacek's (1975) analysis of personality differentiation and the prediction of persistence in physical science and engineering. In 1976,

Kunce, Decker and Eckleman compared the SVIB clusters with occupational satisfaction using college graduates in various fields including social and physical science. Using the VPI, Bruch and Krieshok, in 1981, used engineering majors to study the sensitivity of Holland's congruence method for predicting outcomes where there are subtle person-environmental differences. In 1983, Kazi and Piper used the VPI to study the personality characteristics of science teachers and medical technologists. Hill and Roselle (1985), using the Strong Campbell Interest Inventory, studied the differences in vocational interests among research and developmental managers and technical specialists. Meir and Yaari (1988) studied the relationship between congruent speciality choice within occupations and job satisfaction as compared with congruent occupation choice and job satisfaction.

Each of these studies was descriptive. Except for research conducted by Meir and Yaari (1988) who used the Courses Inventory, either the VPI, the SVIB, or the SCII was used to measure vocational interests and personality. Again, except for the Meir and Yaari (1988) study, male subjects were used exclusively in studies noted.

The Myers-Briggs Type Indicator as Applied to Professional Personnel

The MBTI has been used to study personnel in specific professions. Such research continues to be important in the development of the MBTI as a descriptive instrument of

Jungian typology. Although few studies were found relating directly to teachers, the numbers of studies using the MBTI as a research tool appears to be increasing. A review of the following studies contributes to understanding the use, strengths, and limitations of the MBTI in research.

In 1969, Hall and Mackinnon conducted a stepwise correlation analysis on seven personality inventories as compared with the rated creativity of sixty-two architects. The MBTI was one of the inventories used. The architects, selected from a nationwide sample, were placed in one of three sample groups and judged on creativity by six groups of architects and architect experts.

Of the eight scales on the MBTI, intuition, perception, sensing, and judgment were significantly correlated with creativity in the total sample of architects. Results also indicated that the creative architect tended to be less extroverted than others and tended to use intuitive perception rather than sensing and judgment.

Greenfield (1969) used the MBTI to conduct a study of persisting and nonpersisting Jewish clergymen. He provided the MBTI (Form B) and a specifically designed biographical questionnaire through the mail to the entire population of rabbis previously ordained at Yeshiva University. Greenfield defined a persister as the rabbi who served in the pulpit profession. All others were classified as nonpersisters. One hundred ninety-four nonpersisters and 125 persisters responded.

The author hypothesized that rabbis ordained at Yeshiva University who remained in the pulpit were significantly represented by the MBTI types ESFJ and ENFJ as compared with other combination of types. He also predicted that the non-persisting rabbis would demonstrate greater type dispersion than the persister group.

The hypothesis relating to significant representation of ESFJ and ENFJ among persisters was upheld. The dispersion among nonpersisters was not upheld. ESFJ and ENFJ types were most prominent for persisters and nonpersisters.

Helson and Crutchfield (1976), using the MBTI and other instruments, described five types of creative mathematicians. The types were developed through subject self-descriptions of professional interests and research styles, along with personality and background correlates.

The 34 male subjects, selected through a nomination procedure, represented a sample of creative workers in various fields of mathematics. Of the 34 subjects, 12 were tested by one of the authors while the others participated in the study by mail.

Five types of mathematicians were identified. Using the MBTI, men in the Types III group were described as gaining pleasure from mathematical research. They were not interested in leadership or practical matters.

Type IV men were found to be subtle, clever, and conscientious. However, they were also conflictful,

impulsive, and lacking in endurance. They used ingenuity and charm to get ahead.

In 1971, Helson compared a group of 45 creative women mathematicians with a sample of women PhDs in mathematics. She described their personalities, research styles, and backgrounds. The subjects were selected from prominent colleges throughout the United States.

Subject creativity was rated by professionals from their fields of specialization. Characteristics described included intelligence, personality characteristics, interests, cognition and aesthetics, mathematical style, personal and professional history. The MBTI was used to describe personality characteristics.

The MBTI showed women mathematicians to be strong introverts and intuitives. The difference between thinking and feeling was slight. No difference on any type, describing the creative and the comparison subjects, reached the .05 confidence level.

Buhmeyer and Johnson (1977) administered objective psychological tests and biographical questionnaires to 67 physician extender students. Tests were administered to students after matriculation and before classes began. Data gathered from five consecutive classes did not differ significantly. The most common type was ESTJ. The authors noted that this type was oriented to patient care. They refer to a study by Meyers and Davis (1964) indicating that practicing physicians are commonly ESTJs.

In 1990, Apostol and Marks studied correlations between career interests as measured by the Strong-Cambell and the Myers-Briggs introversion-extroversion scale. Subjects included 219 college students enrolled in a career development course. The measures of career interests were the General Occupational Themes (GOT) of the Strong-Campbell Interest Inventory (SCII-IE). For the 130 women studied, all correlations between the SCII-IE and GOT were statistically significant while one correlation between the Myers-Briggs IE and the GOT was significant. The 89 male subjects showed significant correlations between SCII-IE and GOT, except Realistic. Males showed no significant correlation between Myers-Briggs EI and GOT.

Using the Myers-Briggs Type Indicator in 1991, Cooper and Miller studied the learning style of students and the teaching style of faculty members within a college of business. Differences in the learning style-teaching style congruency as compared with student academic performance and evaluations of course and instructor were significant. Differences in course grades were not significant.

The Measurement of Job Satisfaction

Reasearchers began publishing studies on occupational satisfaction among employees in the 1940's. Popularity in job satisfaction research seemed to coincide with the growth in research on interest patterns among employees. Occupational satisfaction or dissatisfaction has often been

used to correlate with and validate the findings of studies on worker characteristics and vocational choices.

In 1942, a study was conducted by Sarbin and Anderson regarding the correlation of measured interest patterns and occupational dissatisfaction. The hypothesis studied stated that adults expressing dissatisfaction with their current occupations show no primary pattern of interest, as measured by the Strong Vocational Interest Blank, for the group of occupations in which their current occupation belongs.

Hoppock's (1935) definition of job satisfaction was accepted for this study. It defined job satisfaction as "any combination of psychological, physiological or environmental circumstances that causes a person truthfully to say 'I am satisfied with my job.'" (p.47)

Convinced of a reasonable assumption of subject honesty and an acceptable index of occupational satisfaction, the authors proceeded to classify job related complaints from 100 non-college adults. The subjects were clients of the University of Minnesota Testing Bureau. Classifications of subject complaints included dissatisfaction with occupational field, dissatisfaction with present job, dissatisfaction with present job because of future prospects, and no specific dissatisfaction.

Using this information with that from the Strong Vocational Interest Blank and the Minnesota Occupational Rating Scale, it was concluded that adults complaining about

occupational dissatisfaction generally show interest patterns incongruent with their present occupations.

Kates (1950a) believed the assumption that a significant relationship exists between vocational interests and job satisfaction needed substantiation. He developed a study using the Hoppock, the Strong Vocational Blank, and the Rorschach Test with 25 New York City policemen. He also conducted a personal interview with each subject.

In making occupational comparisons, using information from previous research, he found the degree of job satisfaction among these policemen to be significantly greater than that of office clerks, significantly lower than that of nursing students, and insignificantly lower than the job satisfaction of engineering students. No significant relationship was found between the degree of measured police interests and satisfaction with police work.

Kates (1950b) also investigated job satisfaction with vocational interest, and Rorschach responses of 100 men in federal government clerical positions. The study had three hypotheses related to worker satisfaction. The first hypothesis stated that the job satisfaction of office clerks is positively related to interests similar to those of successful office workers. The study did not support this assumption.

It was also assumed that the job satisfaction of clerks was not associated with the number of signs of maladjustment indicated on the Rorschach. This hypothesis was confirmed.

Lastly, the assumption that work dissatisfaction of clerks with interests of successful workers was not related to the number of Roschach maladjustment signs was also confirmed.

In 1965, Hulin and Smith gathered and analyzed five areas of job satisfaction in work, pay, promotion opportunities, co-workers, and supervision with 185 male and 75 plant workers. These factors were then compared with independent variables of age, job tenure, company tenure, job level, salary, and salary desired minus salary received. Multiple-regression techniques were used to study the hypothesis that age and tenure bear a u-shaped relationship with job satisfaction. The hypothesis was not supported.

Schletzer (1966) examined the Strong Vocational Interest Blank as a predictor of job satisfaction. He studied 185 male graduates in medicine, law, dentistry, mechanical engineering, accounting, and journalism. The hypothesis stated that job satisfaction in a certain occupation is related to congruent interest in that occupation.

The study, administered by mail, included three job satisfaction inventories, a personal data sheet and the SVBI. Job satisfaction inventories included the Hoppock Job Satisfaction Blank, the Brayfield-Rothe Job Satisfaction Blank, and the Job Dimension's Inventory.

The study found a lack of relationships for both earlier and later testing of interests and for all job

satisfaction measurements. The hypothesis was not supported.

Recent studies have examined specific factors possibly influencing job satisfaction. In 1939, Gerhart studied the importance of dispositional factors as determinants of job satisfaction. Using 809 subjects from the National Longitudinal Surveys of Labor Market Experience and the Job Characteristics Inventory, the Dictionary of Occupational Titles and a single-item global satisfaction measure, results indicated that changes in situational factors such as job complexity are important predictors of job satisfaction. Nevertheless, the study also showed that measurement problems preclude the predictive power of dispositional factors.

In a 1990 study, Lee, Ashford and Bobko examined the moderating role of perceived control on the relationship between Type A behavior and job performance, job satisfaction, and somatic complaints. Their subjects included 59 industrial hygienists and 35 registered nurses. Using a modified version of the Thurstone Temperament Schedule's Activity Subscale and the Job Diagnostic Survey, subjects with high levels of Type A behavior with high perceived control perform better and have greater job satisfaction than those with low perception of control. Nevertheless, the former group showed more somatic complaints than the latter group.

Reese, Johnson, and Campbell (1991) studied teacher job satisfaction and job stress as related to age, teaching experience, and school size. The study utilized the Job Satisfaction Scale and the Job Related Stress Scale with 229 secondary school physical education teachers. Results indicated that school size above 1500 students has an adverse effect on job satisfaction and job stress and that years of teaching is not a significant factor in job satisfaction or job stress.

In 1991, Goh studied the perceptions of 110 MBA students regarding their interpersonal work style, career interests, supervisory behavior, and job satisfaction. Looking for sex differences, he found women subjects viewing themselves as less assertive in work situations. Women believed they emphasized home life over their career success and advancement to a greater extent than men. Females also had lower job satisfaction than males while being supervised by males.

Smart and Zeltmann (1989) studied the institutional and departmental satisfaction of 1,256 newly employed women faculty. Using the exploratory data analysis method of median polishing, results indicated that women's satisfaction differed by both institutional type and discipline type. Higher levels of job satisfaction were shown by women in "pure" fields at liberal arts institutions as compared with women in "applied" fields.

The measurement of vocational satisfaction has been a focus of study since the 1940s. Its continued development and use in research has been intertwined with that of vocational interests. Studys cited included those attempting to examine possible influencing factors such as personality, sex, and situational differences.

In these studies, Hoppock's Job Satisfaction Blank appears to be one of the earliest measurements of job satisfaction developed and used for research. Other more recently developed instruments, apparently satisfactory for research purposes, are now available. Most appear to be used for vocational research in business and non-academic settings.

Apparently the most popular of these more recently developed instruments is the Job Descriptive Index (JDI). The JDI has been used primarily in business research such as the study by Weiner and Klein (1978) in which the hypothesis was supported that congruency of vocational interests with present occupation was positively related to job satisfaction for long job-tenured employees and was unrelated to satisfaction for short job-tenured employees. However, the JDI has also been used in the academic setting. Holt (1981) used it to assess job satisfaction in her study of the relationship of need fulfillment to job attitudes in college faculty members.

There is a growing awareness that job satisfaction is one of the great concerns of life. As Roe (1956) declared,

"In our society there is no single situation which is potentially so capable of giving some satisfaction at all levels of basic needs as is the occupation."

Job Satisfaction and Science Teachers

School teachers in America have become subjects of research interest during the last decade. Reasons for such interest include increased public and political pressures on school systems and their teachers, growing dissatisfaction with teacher performance, and the diminishment of privileged social status once enjoyed by teachers (Duke, 1984). Contending with complex bureaucratic systems, the complexities of student-parent-teacher relations, and increasing administrative expectations are often overwhelming. Job related stress, confusion, and disillusionment have taken their toll on teacher morale, attendance, and performance (Chapman, 1983; Pellicer, 1984).

Considering present trends, measurement of job satisfaction among science teachers in America has taken on increased importance. According to Champagne & Hornig (1987), the number of college students expecting to become science teachers decreased 60% between 1971 and 1981. Their research also showed 90% fewer physics graduates became high school teachers than a decade earlier.

In 1982, the National Science Teachers Association conducted a random sampling of science teachers, principals, and teacher-education program officials and discovered a 68% reduction in the number of newly employed secondary school

science teachers (Walton, 1982). According to the study summary, "If the present exodus of qualified science . . . teachers from secondary schools continues, the nation will have a net loss of 35% by 1992."(Walton, 1982, p. 14). Also, the study indicated that 1 in 4 of younger faculty members were planning to leave the teaching profession. Guthrie and Zusman (1982) reported the proportion of science majors, at the University at Berkley, interested in teaching was "microscopic" (p. 28).

Studies also indicate that teachers are attracted to the higher salaries and greater benefits offered by private industry, leaving school divisions facing the delimita of recruiting science teachers from a dwindling supply and then attempting to retain them (Guthrie & Zusman, 1982; Walton, 1982).

Although there has been recent interest in teacher satisfaction, most research appears to focus on academic areas other than science or includes science teachers as part of a total population of teachers. In such studies, science teachers tend to lose their identification and uniqueness. For example, Chapman (1983), using Holland's model of vocational choice and a self-developed job satisfaction scale composed of two items, investigated the extent to which career satisfaction among teachers is related to selected skills, values, and professional accomplishments. Subjects were categorized as elementary or high school teachers. Satisfaction among high school

teachers was related significantly to self-rated skills and abilities. For elementary teachers, career satisfaction significantly related to the importance they assigned to selected criteria of professional success. Both groups indicated that job satisfaction was related to teacher's professional achievements (Chapman, 1983).

Another study, The Richland One Project (Pellicer, 1984), focused on the improvement of job satisfaction among teachers in five Richland, California high schools. A Likert scale was used to identify items of concern to teachers. Such items, shown to be important to teachers surveyed, included low salaries, high student/teacher ratios, inadequate facilities, excessive clerical work, inadequate planning time, unruly student behavior, inconsistent administrative support for discipline, student reading problems, and lack of community and parental support. The Project concluded that, "Principals . . . must find ways to improve working conditions for teachers by removing job dissatisfiers that drain the joys of teaching" (p.46).

Elementary natural science teachers have also been the subject of research. In 1977, Stedman and Breen conducted a study using twelve first grade natural science teachers. Teachers, using the Strong Vocational Interest Blank, were classified as having high interest or low interest. Randomly selected students of these teachers were given The Survey of School Attitudes. Results indicated a significant

difference between the mean scores of students in high interest natural science teacher classrooms as compared with scores of those students with low interest teachers.

In addition, studies relating to job satisfaction of science teachers often focus on personality types. The assumption appears to be that if a particular personality type characterizes subjects in the field, that attribute contributes in some way to their job satisfaction and success. This is exemplified in a study by Kazi and Piper (1983) comparing personality attributes of science teachers and medical technologists. Using the Vocational Preference Inventory, this study indicated no significant difference between these two groups in extroversion. Both were characterized by the personality profile of IAS (Intellectual-Artistic-Social).

More recently, Quaglia, Marion and McIntire (1990) studied the relationship of teacher satisfaction to perceptions of school organization, teacher empowerment, work conditions, and community status. Subjects included 776 teachers in Maine schools. Results indicated significant differences between satisfied and dissatisfied teachers regarding attitude towards students, efficacy, empowerment, working conditions, and social status. Results indicated that satisfaction is enhanced by increased psychological growth while satisfying hygiene needs only maintains teachers in the non-dissatisfied state.

In 1990, Bein, Anderson and Maes examined job satisfaction of secondary school teachers as correlated with locus of control. Job satisfaction was measured by the Job Diagnostic Survey and locus of control by the Teacher Role Survey. Results indicated the teachers with a greater sense of control have significantly greater job satisfaction.

Job satisfaction as related to teachers has been a topic of interest in American education for the past two decades. Interest in job satisfaction among science teachers has spurred research at both the elementary and secondary levels using primarily surveys and descriptive studies (Stedman & Breen, 1977; Guthrie & Zusman, 1982; Walton, 1983). Projects, such as the Richland One Project, have also been implemented to research and correct specific problem areas in teacher satisfaction. Although a few studies have studied science teachers as a specific population, science teachers are often studied as part of the larger teaching population such as in Chapman's (1983) study of career satisfaction among teachers. Such research ignores the uniqueness inherent in being a secondary science teacher with its own challenges and rewards. Also, although studies relating to elementary science teachers, as does Stedman & Breen's 1977 study, add to the understanding of a particular population of teachers, the question remains whether results from such research is applicable to secondary science teachers.

It is also noted that, as in Kazi & Piper's 1983 study, research often concentrates on personality traits. It seems to be assumed that if personality is congruent with job placement, job satisfaction will result. Due to the many personal and work place variables possibly influencing job satisfaction, such studies may be limited in perspective.

Summary

The results of the sample of the research cited in this study indicate a theoretical and practical foundation for additional study. It also reveals a direction in research and application of results in examining personality-environmental factors related to job satisfaction of secondary natural science teachers.

Jung's Theory of Personality Types offers clarity and structure to an area of study often riddled with subjective, complex, and little understood concepts. While acknowledging limits in descriptive variations, in consideration of pathological involvement, and in subject honesty, the theory remains useful in adding order and consistency to what appears to be a random variation in behavior. It is used not only as a theoretical basis for this study but, as incorporated in the Myers-Briggs Type Indicator (MBTI), is used in instrumentation.

The MBTI has been used with confidence to study personnel in specific professions. Its use as an acceptable instrument to research Jungian typology has increased recently. However, no studies using the MBTI involving

teachers exclusively were available to this researcher. Nevertheless, Myers and McCaully (1989) have compiled information indicating that secondary science teachers tend to have the INTJ personality type.

Holland's Theory of Vocational Choice has been extensively used primarily to support research on male workers. Nevertheless, Hanson and Johansson (1972) found data gathered from female subjects was consistent with the correlations of the Holland-based interest scales and occupational scales already existing. Although debate continues as to the predictive strength of instruments based on the Holland theory, results such as those reported by Scott and Sedlacek (1975) exceed chance.

Holland (1985) reported that the IRS code described natural science teachers. However, the extent to which vocational interest leads one into a vocation is debatable. Questions remain unanswered and open to research.

During the 1940's, research on various dimensions of occupational satisfaction began to be published. Since then the popularity of job satisfaction research seemed to coincide with the growth in research on interest patterns among employees.

Prevailing concerns in job satisfaction research includes instrument sensitivity and subject honesty. Another concern in such research is the tendency to generalize findings from a specific population to a

different population. Such factors need consideration in research design and reporting.

In spite of continued interest in job satisfaction research, studies using teachers appear to focus primarily on areas other than science. When science teachers are a subject of study, the survey seems to be the instrument of choice. The accuracy of such studies is sometimes in question because of apparent casual reporting methods and/or little information offered on data gathering.

Chapter 3

Collection of Data

Sample Population

The population for this study included eighty-eight presently employed secondary school natural science teachers teaching science full-time in Virginia Commonwealth school districts. School districts participating in this study included the cities of Newport News, Hampton and Poquoson, and the counties of York, Henrico, Gloucester, and Williamsburg-James City. Numbers of volunteer participants from each school or school division depended on numbers of teachers available and teacher response. Data presented in Table 1 presents certain demographic variables of the sample population.

Instrumentation

Each of the volunteer subjects was asked to complete the Vocational Preference Inventory (VPI), The Myers Briggs Type Indicator (MBTI), The Job Descriptive Index (JDI), and a biographical questionnaire. Data collected was analyzed for job satisfaction as related to environmental-personality type as measured by the VPI, and personality type as measured by the MBTI, and certain demographic variables.

1. The Myers-Briggs Type Indicator

The Myers-Briggs Type Indicator (MBTI) was used as an instrument in this study. It is a self-administered, construct oriented, objective assessment of personal preferences regarding perception and judgement. It is based

Table 1
 Demographic Data From Responses of Secondary School Natural
 Science Teacher Volunteer Subjects
 N = 88 (Age N = 87)

Age	Oldest Subject	60
	Youngest Subject	22
	Mean	42
Sex	Males	36
	Females	52
Years as Natural Science Teacher	Most Years	33
	Least Years	1st
	Mean	14*
Years in Present Position	Most Years	33
	Least Years	1st
	Mean	12*
Total Years in Education	Most Years	33
	Least Years	1st
	Mean	16*
Highest Degree Earned	Highest	Masters (N = 20)
	Lowest	Bachelors (N = 68)

* Rounded to Nearest Whole Number

on the personality theory of C. G. Jung (1923) describing preferences as Extroversion vs Introversion, Sensing vs Intuition, Thinking vs Feeling, and Judgement vs Perception. The substantive, structural, and external considerations involved in the construction and evaluation of the MBTI relied on a slightly modified version of Jungian theory (Coloney, 1989).

The MBTI is published in several forms designed for children and adults. The form used for this study was the G Form with an administration time of 20-30 minutes with scoring completed by the researcher. Responses to forced-choice items determines the difference between points on two scales indicating respondents' preferences. Preferences, in turn, are indicated by a letter designation and a number indicating the strength of the preference. The four preferred personality sub-types are assumed to interact producing one of sixteen psychological types.

Part I of the MBTI includes 64 questions regarding emotions and behavior. The subject is instructed to indicate which answer comes closer to describing how he feels or acts. Part II includes 92 descriptive word pairs instructing the subject to select the word most appealing to him (Briggs, 1987).

Split-half reliability coefficient studies of the MBTI, as reported in the Myers-Briggs Manual, yielded coefficients of .80 or more. According to Carlson (1985), more recent

studies including test-retest reliabilities also found favorable correlations.

Construct validity studies on the MBTI include interest correlations, criterion-related studies, and studies using treatment settings. In reviewing these studies, Carlson (1985) found a general support for hypothesis concerning underlying theory overlap. Carlyn (1977) reported in his review of available studies "that the individual scales of the Myers-Briggs Type Indicator measure important deminsions of personality which seem to be quite similar to those postulated by Jung" (p. 471). Oliver (1984) found evidence at the item level supporting MBTI validity. He stated that "the MBTI can be used with confidence to distinguish separate personality types in terms of four dichotomous deminsions" (p.256).

2. The Vocational Preference Inventory

The Vocational Preference Inventory (VPI), developed by John Holland, was used in this study to assess personality and vocational interests. As a personality-interest inventory, it is comprised of 160 occupational titles divided among eleven scales. These scales include Realistic, Investigative, Artistic, Social, Enterprising, Conventional, Self-Control, Masculinity-Femininity, Status, Infrequency, and Acquiescence. Scales and their weightings are compatible with codes found in Holland's Occupational Finder (Holland, 1978) and Dictionary of Holland Occupational Codes (Gottfredson, Holland, & Ogawa, 1982).

To complete the VPI, subjects indicate whether or not they like the 160 occupations presented. According to Shepherd (1989), this instrument is easily administered, scored, and interpreted. Taking 15 to 30 minutes to administer, the VPI is one of the more time and cost efficient interest inventories.

The VPI is founded on Holland's theory that broad typological classes account for most human interests, traits, and behaviors. In developing his theory, Holland (1985) founded certain basic principles.

They Include:

1. The choice of a vocation is an expression of the personality.
2. Interest inventories are personality inventories.
3. Vocational stereotypes have reliable and important psychological and sociological meanings.
4. Members of a vocation have similar personalities and similar histories of personal development.
5. Having similar personalities, people in the same vocational group will respond to many situations and problems in similar ways.
6. Vocational satisfaction, stability, and achievement depend on congruence between one's personality and the work environment.

Research on the VPI indicated that reliability estimates are respectable with moderately high internal consistency. Moderate test-retest estimates have also been

established (Pickering, 1985). The manual (Holland, 1978) reports correlations between scales ranging from .55 to .96 for males and .65 to .97 for females. Evidence indicated the interest scales have moderate validity for predicting occupational membership and field of training.

3. Job Descriptive Index

The JDI is considered to be one of the most widely used and most carefully constructed instruments measuring job satisfaction presently available. Originated by the Cornell Studies of Satisfaction, the JDI uses 72 items to define five separate components of job satisfaction. It includes the following scales: (1) Work on the present job, (2) Present Pay, (3) Opportunities for Promotion, (4) Supervision on Present Job, and (5) People on your Present Job. Each component is measured with nine or eighteen adjectives differentiating between perceptually good and bad jobs. These are scored yes = 3, ? = 1, and no = 0 for positively discriminating items and yes = 0, ? = 1, and no = 3 for negatively discriminating items (Gillet, 1975)(Crites, 1987)(Yeager, 1981).

Because subscales have been found to be discriminately different, to have no general factor, and to have no high correlation despite their high reliabilities, the authors do not recommend computation of a total score (Crites, 1987).

The theoretical foundation for the JDI assumes that it will reflect, to some degree, each subject's frame of reference and reflect actual job-to-job and

situation-to-situation differences in worker activities. Also, it is assumed that the end points of the worker's subjective job continuum can be reflected in the developed scales (Smith, 1975).

According to Iris & Barrett (1972), the JDI has consistently been shown to be highly correlated with independent variables which are theoretically meaningful, including job satisfaction. The concurrent validity of the JDI seems to be well supported. Strong convergent and discriminant validity is also reported (Kerr, 1987). Smith et al. (1975) reported an average corrected reliability coefficient for the five scales of .79 for split-half estimates of internal consistency. Higher internal reliabilities for internal consistency were found for each scale: work (.84), pay (.80), promotion (.86), supervision (.87), and co-workers (.88).

Research Design

Borg and Gall (1989) indicate that the examination of possible relationships among established variables is best accomplished using correlational designs. Such a design is not appropriate for experimental studies examining cause and effect relationships.

The specific research design of this study was correlational. Its purpose was to examine the degree of relationships among certain vocational interests, personality traits, and job satisfaction within a specific population of secondary school natural science teachers.

Scores were obtained on variable measures, paired and statistically correlated for statistical significance.

Special Hypotheses

The following hypotheses was tested:

1. There will be a statistically significant positive relationship between the predominant basic preference, INTJ, as reported by secondary school natural science teachers using the Myers-Briggs Type Indicator and their reported job satisfaction as measured by the Job Descriptive Index.

2. There will be a statistically significant positive relationship between congruence of the IRS Holland personality-environmental code and job satisfaction reported by the secondary school natural science teachers studied as measured by the Vocational Preference Inventory and the Job Descriptive Index.

3. There will be a statistically significant positive relationship between job satisfaction and differentiation as reported by the secondary natural science teachers studied and measured by the Job Descriptive Index and the Vocational Preference Inventory.

4. There will be a significant correlation between the demographic variables of subject age, sex, years as natural science teacher, years in present position, and total years in education, and degree earned and job satisfaction as reported by the secondary natural science teachers studied and measured by the biographical questionnaire and the Job Descriptive Index.

Statistical Analysis

This study's statistical analysis was designed to examine the relationships among the given variables revealed through the VPI, MBTI, JDI, and the biographical questionnaire. Particular attention was given to the correlation between congruence, differentiation, and job satisfaction.

The Pearson Product Moment Correlation was used to examine the intercorrelations for all variables, studied in special hypothesis II, III, and IV, giving a general overview of the strengths of variable correlations with directionality and degrees of confidence. A multiple regression analysis studied hypothesis I using each of the Myers-Briggs subtypes as dependent variables. Each dependent variable was examined as to its possible significant relationship job satisfaction. A combined step-wise regression was used to examine all variables. All analysis was computed using the Statistical Analysis System (SAS).

Ethical Considerations

An appeal was made to the Dissertation Committee and the Human Research Committee of the College of William & Mary for approval of the dissertation before implementing the study.

Prior to the beginning of the study, the first and third chapters of the dissertation proposal was made available to officials of each school system. Written

approval for the study was granted by appropriate school officials. Written consent statements were signed by all participants.

To maintain confidentiality of the subject's responses to the research instruments, all data was kept in a secure and confidential file. Subjects were assigned identification numbers for recording raw data and information stored by computer was coded by these numbers. A master list of names was maintained separately from the data files.

No identifying personal data was made available to anyone other than the participating subject. Promised follow-up on research results was given promptly and privately.

Chapter 4

Findings

Results from research analysis of data will be presented in Chapter 4. This study investigated the relationship between job satisfaction among secondary school natural science teachers and certain demographic and personality-environmental factors.

Analysis of data for hypothesis 1 was performed by multiple regression. Hypothesis 2, 3, and 4 were analyzed by using the Pearson product moment correlation. Additional analysis was provided by using descriptive summary statistics and the stepwise regression procedure.

Hypothesis 1 proposed that there would be a statistically significant positive relationship between the predominant basic preference, INTJ, as reported by secondary school natural science teachers using the Myers-Briggs Type Indicator and their reported job satisfaction as measured by the Job Descriptive Index. Table 1 shows a nonsignificant ($p > .05$) correlation for each Myers-Briggs subtype with job satisfaction. Approaching significance were the variables J (.0591) and P (.0781). Hypothesis 1 was rejected.

Hypothesis 2 proposed that there would be a statistically significant positive relationship between congruence of the IRS Holland personality-environmental code and job satisfaction reported by secondary school natural science teachers studied as measured by the Vocational Preference Inventory and the Job Descriptive Index. Table 2

Table 1
Hypothesis 1
Pearson Correlation - General Linear Model -
of MBTI-INTJ and Job Satisfaction
N = 83

Dependent Variable E	df	1
	F Value	.12
	PR>F	.7261
	R-Square	.0015
	PR>T	.7261
Dependent Variable I	df	1
	F Value	.00
	PR>F	.9912
	R-Square	.0000
	PR>T	.9912
Dependent Variable S	df	1
	F Value	1.14
	PR>F	.2382
	R-Square	.0171
	PR>T	.2382
Dependent Variable N	df	1
	F Value	.16
	PR>F	.6911
	R-Square	.0019
	PR>T	.6911
Dependent Variable T	df	1
	F Value	.1.32
	PR>F	.2548
	R-Square	.0160
	PR>T	.2548
Dependent Variable F	df	1
	F Value	1.52
	PR>F	.2217
	R-Square	.0184
	PR>T	.2217
Dependent Variable J	df	1
	F Value	3.66
	PR>F	.0591
	R-Square	.0433
	PR>T	.0591
Dependent Variable P	df	1
	F Value	3.18

PR>F	.0781
R-Square	.0378
PR>T	.0781

Note: Acceptable level of significance = $p < .05$

shows that a nonsignificant ($p > .05$) correlation of .0361 was found between congruence of the Job Descriptive Index's measure of General Job Satisfaction and the Holland code IRS. Hypothesis 2 was rejected.

Hypothesis 3 proposed that there would be a statistically significant positive relationship between job satisfaction and differentiation as reported by secondary natural science teachers studied and measured by the Job Descriptive Index and the Vocational Preference Inventory. Table 3 shows the relationship to be nonsignificant ($p > .05$). The hypothesis was rejected.

Hypothesis 4 proposed that there would be a significant correlation between the demographic variables of subject age, sex, years as natural science teacher, years in present position, total years in education, and degree earned and job satisfaction as reported by the secondary natural science teachers studied and measured by the biographical questionnaire and the Job Descriptive Index. Table 4 shows a significant ($p < .05$) negative correlation of .2653 between years as natural science teacher and job satisfaction. A significant ($p < .05$) negative correlation between years in present position and job satisfaction was also found. Other correlations were nonsignificant.

A stepwise regression procedure for dependent variable, job satisfaction, was run three times. The first procedure included the MBTI scales Extraversion (E), Introversion (I), Sensing (S), Intuition (N), Thinking (T), Feeling (F),

Table 2
Hypothesis 2
Pearson Correlation of Holland Code IRS (N = 87)
and Job Satisfaction (N = 83)

	Job Satisfaction	Congruence
Job Satisfaction	$r = 1.000$ $p = .0000$	$r = .0861$ $p = .4421$
Congruence	$r = .0861$ $p = .4421$	$r = 1.000$ $p = .0000$

Acceptable level of significance = $p < .05$

Table 3
Hypothesis 3
Pearson Correlation of Differentiation (N = 87)
and Job Satisfaction (N = 83)

	Job Satisfaction	Differentiation
Job Satisfaction	$r = 1.000$ $p = .0000$	$r = .0711$ $p = .5253$
Differentiation	$r = .0711$ $p = .5253$	$r = 1.000$ $p = .0000$

Acceptable level of significance = $p < .05$

Table 4
Hypothesis 4
Pearson Product Moment Correlation
of Demographic Variables and Job Satisfaction (Age N = 82),
Other Variables (N = 83)

Age	r = -.1830 p = .0999
Sex	r = -.0013 p = .9908
Years as Natural Science Teacher	r = -.2653 p = .0154*
Years in Present Position	r = -.2716 p = .0130*
Total Years in Education	r = -.1485 p = .1802
Highest Degree	r = -.1429 p = .1975

*Level of significance $p < .05$

Table 5
 Stepwise Regression Procedure for Job Satisfaction
 Including Each MBTI Preference

Step	Variable Entered	Partial R**2	Model R**2	C(P)	F	Prob>F
1	J	.0433	.0433	5.0848	3.6648	.0591*
2	F	.0453	.0886	3.1017	3.9780	.0495*

* = Significance level for entry into model $P < .15$
 J = Judging scale on the MBTI
 F = Feeling scale on the MBTI

Judging (J), and Perceiving (P). As shown on Table 5, scales J and F were found to be significant ($p < .15$). R Square for j was .0433. With the addition of F, R Square became .0886. All remaining scales were nonsignificant and discarded.

The second stepwise procedure included each demographic variable, congruence, and differentiation. The demographic variables included age, sex, highest degree earned, years as natural science teacher, years in present position, and total years in education. As shown in Table 6, years as natural science teacher (SY) and total years in education (TY) were significant at the .1500 level of significance. R Square for SY was .0530. With the addition of TY, R Square became .0791. All other variables were nonsignificant and discarded.

The third stepwise procedure included differentiation and congruence. Each was nonsignificant at the .15 level and, thus, were discarded.

In summary, the analysis of the data indicated that hypothesis 1 of this study proposing a statistically significant positive relationship between the predominant basic preference, INTJ, as reported by secondary school natural science teachers using the Myers-Briggs Personality Type Indicator and their reported job satisfaction as measured by the Job Descriptive Index cannot be accepted. In this study, none of the variables proved to be significantly ($p < .05$) correlated with job satisfaction.

Table 6
 Stepwise Regression Procedure For Job Satisfaction
 Including Demographic Variables, Congruence, and
 Differentiation

Step	Variable Entered	Partial R**2	Model R**2	C(P)	F	Prob>F
1	SY	.0530	.0530	2.4723	4.4203	.0387*
2	TY	.0262	.0791	2.2772	2.2156	.1407*

Significance level for entry into model $p < .15$
 SY = Years as natural science teacher
 TY = Total years in education

Although not directly related to a stated hypothesis, the MBTI scales were also included in a stepwise regression procedure to find those scales having the strongest influence on job satisfaction. Results indicated Judging had the strongest significant ($p < .15$) influence followed by Feeling. All other scales were nonsignificant.

Hypothesis 2 proposing a statistically significant positive relationship between congruence of the IRS Holland personality-environmental code and job satisfaction reported by secondary school natural science teachers studied as measured by the Vocational Preference Inventory and the Job Descriptive Index cannot be accepted. In addition, the congruence variable was entered into two stepwise regression procedures, first with all demographic variables and differentiation, and then with differentiation alone. Congruence was discarded during both procedures because of nonsignificance at the .15 level.

Hypothesis 3 proposing a statistically significant positive relationship between job satisfaction and differentiation as reported by the secondary school natural science teachers studied and measured by the Job Descriptive Index and the Vocational Preference Inventory cannot be accepted. Also, when differentiation was included in a stepwise regression procedure first with all demographic variables and congruence and then with only congruence, it was discarded from the procedure because of nonsignificance.

Hypothesis 4, proposing a statistically significant correlation between the demographic variables of subject age, sex, years as natural science teacher, years in present job, total years in education, degree earned and job satisfaction as reported by the secondary school natural science teachers studied and measured by the biographical questionnaire and the Job Descriptive Index, can be accepted in part. A statistically significant negative correlation was reported with years as natural science teacher and with years in present position.

When analyzed using the stepwise regression procedure, years as natural science teacher was reported as the demographic variable having the strongest significant ($p < .15$) influence on job satisfaction followed by total years teaching. Considering the previous finding of a significant negative correlation ($p < .05$) between years as natural science teacher and job satisfaction and an insignificant negative correlation ($p > .05$) between total years teaching and job satisfaction, a negative correlation is indicated. All other reported variables were discarded due to nonsignificance.

To contribute to the data base for possible further research, Table 7 shows summary statistics for each variable. Included are the mean age of 42 with the youngest subject being 22 and the oldest 60. The mean number of years teaching science was 13 with the least experienced teacher being in the first year and the most experienced

Table 7
Descriptive Data

	N	Mean	Standard Deviation	Minimum Value	Maximum Value	Variance
A	87	42.0690	9.2331	22.0000	60.0000	85.2510
SY	88	13.6818	9.2034	0.0000	33.0000	84.7022
PY	88	10.8068	8.4864	0.0000	33.0000	72.0197
TY	88	15.5569	9.0349	0.0000	33.0000	81.6289
D	88	1.5454	0.5008	1.0000	2.0000	0.2508
E	88	12.2272	6.8190	0.0000	26.0000	46.4995
I	88	14.3295	7.1160	2.0000	34.0000	50.6373
S	88	15.9659	9.0712	0.0000	34.0000	82.2862
N	88	10.6477	6.8532	0.0000	25.0000	46.9664
T	88	13.7500	8.1554	0.0000	33.0000	66.5115
F	88	8.4091	5.4807	0.0000	20.0000	30.0376
J	88	17.5795	7.3324	1.0000	28.0000	53.7637
P	88	9.7954	7.3628	0.0000	29.0000	54.2105
VPI	87	5.8391	1.8355	1.0000	8.0000	3.3691
GJS	83	42.5542	9.5843	16.0000	54.0000	91.8598
X	87	9.1034	3.1105	3.0000	14.0000	9.6752

Code: A = Age
 SY = Years teaching natural science
 PY = Years in present position
 TY = Total years in education
 D = Highest degree earned
 E = Extraversion
 I = Introversion
 S = Sensing
 N = Intuition
 T = Thinking
 F = Feeling
 J = Judging
 P = Perceiving
 VPI = Congruence
 GJS = Job Satisfaction
 x = Differentiation

with 33 years. Years in the present position ranged from first year teachers to 33 years.

Chapter 4 presented the findings of this study. Chapter 5 will review the findings, present conclusions derived from the findings, and indicate implications for educational practice and future research.

Chapter 5

Summary, Conclusions, and Implications

This chapter will present a summary of the study, conclusions derived from the findings, and implications for educational practice and research.

Summary

The intent of this study was to examine the relationship among certain personality traits, vocational interests, and demographic factors with job satisfaction as reported by volunteer secondary school natural science teachers.

Job satisfaction was described as how one perceives rewards from employment as measured by the Job Descriptive Index (JDI). The Job in General measurement of the JDI was used to describe job satisfaction.

Congruence was defined as the similarity between one's personality type and the working environment as described by Holland's personality-environmental types and measured by the Vocational Preference Inventory (VPI). Scales described by the VPI and used in this study included Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. The Compatibility Index was used to calculate congruence by using Holland's primary, secondary, and tertiary personality subtypes.

Differentiation was defined as personality strength as measured by the difference between the strongest and weakest Holland personality-environmental subtypes. Scales used to

determine differentiation were the same used to determine Congruence as measured by the VPI.

Personality types described by the Myers-Briggs Personality Type Indicator (MBTI), an objective assessment of personal preferences regarding perception and judgement, were also used in this study. The MBTI described subject preferences Extroversion vs Introversion, Sensing vs Intuition, Thinking vs Feeling, and Judgement vs Perception.

Four hypothesis were tested. The first hypothesis stated that there is a statistically significant positive relationship between the predominant basic preference, INTJ, as measured by the MBTI and reported job satisfaction. The second hypothesis stated that there is a statistically significant positive relationship between congruence of the Holland IRS code and reported job satisfaction among these same teachers. The third hypothesis stated that job satisfaction and differentiation have a significantly positive relationship among these subjects. The fourth hypothesis stated that there is a statistically significant correlation between certain demographic variables, including age, sex, years as natural science teacher, years in present position, total years in education, and highest degree earned, and job satisfaction among the subjects.

A review of related literature was conducted and presented. Literature was reviewed in the areas of Jung's Theory of Psychological Types, Holland's Theory of Vocational Choice as applied to scientists, the Myers-Briggs

Type Indicator as applied to professional personnel, the measurement of job satisfaction, and job satisfaction and science teachers. The review of related literature presented mixed findings regarding the correlation between job satisfaction and science teacher personality-environmental traits. Little research was found specifically studying science teachers. Research found primarily used teachers from other academic fields or teachers in general as subjects. Research regarding the relationship between demographic variables and job satisfaction among teachers indicated no correlation while suggesting the need for further study.

The population for the study consisted of 88 volunteer secondary school natural science teachers teaching science full-time in public schools. Teachers participating in the study were primarily from the Hampton Roads area of Virginia. The exceptions were nine participating teachers from Henrico County located in central Virginia. Natural science, for this study, included the subject areas of life science, earth science, biological sciences, chemistry, and geology. Secondary teachers included teachers of life and earth science classes in the intermediate and middle schools and teachers of the various natural sciences in high schools.

Personality-environmental data was collected using the Vocational Preference Inventory and personality preferences were described by the Myers-Briggs Type Indicator. The

measure of job satisfaction used was the Job in General measure of the Job Descriptive Index. Demographic information was collected through a Biographical Information form. Volunteers for this study were invited to request feedback on the results of their surveys. Most requested such feedback.

Demographic data revealed that the typical subject was 42 years old, had taught a total of 15.6 years, had taught science for 13.7 years, and had been teaching in the present position for 11.8 years. Among the subjects were 36 males and 52 females.

Collected data was analyzed and tested statistically using a descriptive summary of statistics, the Pearson product-moment correlation, multiple regression, and the stepwise regression procedure. The Statistical Analysis System (SAS) was used to compute the statistics. Statistical significance was at the $p < .05$ for all computations except the stepwise regression procedure which used $p < .15$.

Conclusions

Multiple regression was used to examine the correlation between MBTI scales and job satisfaction. With each preference examined individually, the relationship between the reported INTJ preference among natural science teachers and job satisfaction was nonsignificant. Of the scales composing this type, only the variable Judging (J)

approached significance at .0591. Of the remaining scales Perceiving (P) approached significance at .0781.

Findings of this study, indicating the nonsignificance of correlations between the INTJ personality type and job satisfaction, may appear to contradict the compilations of Myers and McCaully (1989). However, it can be noted that the means of the strongest four preferences, found in this study, included I (14.395), S (15.966), T (13.7500), and J (17.9795). This type (ISTJ) when compared with Myers & McCaully, s (1989) INTJ shares all but one preference. If one is to assume a similarity of personality traits among the teachers studied with no personality preference significantly affecting job satisfaction, it may be assumed that other factors are affecting job satisfaction as noted in studies by Gerhart (1989), Lee, Ashford, & Bobko (1990), and Reese, Johnson, and Campbell (1991).

The Pearson product-moment correlation was used to examine the relationships between differentiation, congruence using the IRS Holland code, and job satisfaction. Each variable was correlated with the Job in General measurement of the JDI. The results indicated no statistically significant relationship between differentiation and job satisfaction. Also, no statistically significant correlation was found between congruence and job satisfaction. These findings do not agree with research conducted by Wiggins (1976)(1984) using educators in other academic areas. However, again it shows

possible differences in variables affecting the science teachers studied as compared with educators in schools in different geographical areas and in different academic subjects.

The Pearson product-moment correlation was used to examine the relationship between each demographic variable and job satisfaction. Among the variables tested, a significant negative correlation was found between years as natural science teacher ($p=.0154$) and years in present position ($p=.0130$). This indicates that the more years the surveyed teachers taught in the same position and in the area of natural science the less job satisfaction they experienced.

The stepwise regression procedure was used to examine subsets of variables having the greatest influence on job satisfaction. Level of significance was $p<.15$. The preferences of the MBTI were examined. Judging (J) was found to be of the greatest influence followed by Feeling (F). Other preferences were nonsignificant. The demographic variables along with differentiation and congruence were also analyzed. Years as science teacher was the factor of greatest influence on job satisfaction followed by total years in education with findings indicating a negative correlation. These results do not agree with studies by Wiggins (1976), and Wiggins, Lederer, Salkowe & Rys (1983) which found no significant correlation between demographic factors and job satisfaction. Again,

the possibility is raised that different variables and uncontrolled variables in these studies result in different findings.

Implications for Educational Practice

The findings of this study appear to confirm the existence of a serious shortage of qualified science teachers in America's public schools. As school systems contend with this shortage, the need to understand the components of job satisfaction intensifies. However, what personal characteristics lead to job satisfaction for secondary science teachers remains unclear.

This study indicates that the ISTJ personality type, as measured by the MBTI, is the strongest type among the subjects studied. However, only the J preference was a statistically significant factor correlated with job satisfaction. This suggests that those teachers liking a planned and organized approach to life and tending to want things settled and decided have the greatest chance of job satisfaction in teaching secondary school natural science.

Thus, it might be beneficial in the selection process to include the MBTI as an assessment instrument to examine certain preferences. This should be done with caution, understanding that this is only one of many possible considerations, beyond the scope of this study, that may influence job satisfaction.

Also the findings of this study indicate that continuing to teach secondary natural science and continuing

to teach in their present positions, may negatively effect job satisfaction. Implications exist for staff development and career options. Staff development and staff assignments consistent with the changing needs of experienced teachers should be provided. The differing special needs of new and experienced teachers should be considered to foster job satisfaction.

Implications for Research

The following implications for research are based on the limitations stated in Chapter 1.

1. Research is needed to examine the specific needs of secondary school natural science teachers as compared with teachers of other subject areas.
2. Research is needed to further identify personality-environmental factors significantly correlated with job satisfaction.
3. Research is needed to continue examining the employment and professional development procedures of secondary school natural science teachers in relation to job satisfaction.
4. Research needs to continue to examine the effects of demographic factors on natural science teacher job satisfaction.
5. Research is needed to further examine geographical location, public moral and financial support, and supervisor leadership style as factors influencing job satisfaction in the work environment.

6. Continued research needs to focus on known variables influencing job satisfaction and on finding factors as yet undiscovered.

7. Research is needed to examine the influence of methods of subject selection in job satisfaction research outcome as they effect factors such as honesty and personal bias.

8. Research is needed to further investigate the differing personal and professional needs of new and experienced teachers.

9. Research is needed to refine existing instruments measuring job satisfaction and develop new methods of measurement establishing more control over known variables.

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