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Personality Type and Success in an Online Learning Environment

For the degree of Doctor of Philosophy

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PERSONALITY TYPE AND SUCCESS IN AN ONLINE LEARNING  
ENVIRONMENT

A Dissertation

Submitted to the Faculty

of

Purdue University

by

Linda L Mellish

In Partial Fulfillment of the

Requirements for the Degree

of

Doctor of Philosophy

May 2012

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My thanks is to God for giving me the skills and the tenacity, for opening doors and giving me the sense to go through and for slamming some so I would not...To my lovely family, all of you who are present in body and some now only in spirit, Michael and Emily especially – thank you for standing by me throughout; I am so fortunate to have you in my life. I am humbled by your faith in my abilities and your encouragement to help me persevere...I also thank my future students for it was with you in mind that I entered into this PhD program – and boy, do we have a lot to share!

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## ABSTRACT

Mellish, Linda L. Ph.D., Purdue University, May 2012. Personality Type and Success in an Online Learning Environment. Major Professor: George Rogers.

Online learning continues to be a growing frontier in higher education with increased demand and enrollments reported annually (Allen & Seaman, 2010, 2011). Discovering best practices and methods of instruction as well as assisting students in determining their highest possible level of success in this type of learning environment has been the focus of much recent research. This study investigates the relationship between success in an online academic environment and student personality type as assessed by the Myers-Briggs Type Indicator®.

Specifically, the present research focused on the following research questions: (1) Is one personality type more likely to enroll in an online course? (2) Is there a positive relationship between academic success (i.e., a passing grade) and a specific personality type? (3) Is there a positive relationship between academic failure (i.e., a failing grade) and a specific personality type? These questions are important to examine given the popularity of online learning because their answers help enable optimal fit between student and learning environment. The sample frame consisted of 1201 students from a variety of academic majors seeking to fulfill a degree requirement through a course offered in an online learning environment. The sample contained 102 students seeking

degrees in eleven colleges in a large Midwestern university. Fifteen of the sixteen possible personality-type categories differentiated by the MBTI® were represented, and thirty-six online learning environments were exemplified.

The results indicate the likelihood of enrollment did not differ by personality type; further, there was no positive relationship between academic success and one personality type. A relationship between academic failure and a given personality type could not be assessed due to the grade range restriction reported. No failing grades were indicated by participants.

A post-hoc analysis using recursive partitioning did indicate several interesting breaks in the data by college and gender, which may prove useful for further analysis. Additional recommendations for future research are discussed.

## CHAPTER 1. INTRODUCTION

Chapter one provides a brief overview laying the foundation for this research study; depicting the ebb and flow of education from its early beginnings to present American tradition. Also discussed are the definition of scope, research questions, assumptions and limitations. Chapter one concludes with a brief overview of the project.

### 1.1. Background

The idea for this study surfaced from observation of the academic advisor/faculty advisor – student relationship. Students looked to their academic advisor and faculty for advice about course options and their potential success in those courses. At the time this observation was noted, online learning was new in terms of a promising venue for learning; creating opportunities to some students where none existed and augmenting learning for those currently in higher education. A noticeable gap was apparent when attempting to access research, typologies, and types of tools that would help advisors in providing information to students individually. The goal then became assisting others in the advising capacity in academia by providing a tool that would at the very least point more toward ‘yes’ or more toward ‘not a good idea’ when students need to make that choice.

## 1.2. Significance

Allen & Seaman (2010) presented their findings in their eighth annual report entitled *Class Differences: Online Education in the United States, 2010*. Results reflected the current economic status in the United States and its impact on higher education in both face to face and online mediums. Specific findings included:

1. Two-thirds of for-profit institutions say online learning is a critical part of their long term strategy
2. One-half of institutions report that the economic downturn has increased the demand for face to face course offerings
3. Three-quarters of institutions report the economic downturn has increased the demand for online offerings

In a subsequent report entitled *Going the Distance: Online Education in the United States, 2011*, Allen & Seaman (2011) the following findings were noteworthy:

1. Enrollment in online learning environments increased by almost one million students over last year. With 2010 being the most current for numbers 6.1 million students enrolled in at least one online course.
2. The 10% growth for online enrollments far exceeds the 2% growth rate in overall higher education.
3. This marks the largest ever year to year increase with now thirty-one percent of all college and university students taking at least one online course.

Comparison between the 2010 and the 2011 reports yield a noteworthy point of interest perhaps exhibiting acceptance of the online learning environment in higher education.

While both address the long-term strategy with investing in online learning, the number of students accessing this environment, proposed federal regulation for online growth, the definition of online learning, whether learning outcomes are comparable online or face to face, as well as the future of online enrollment growth; the 2011 report differentiates in a

decidedly important topic. This annual report addressed the acceptance of online learning by faculty as well as the training higher education is adopting for those faculty teaching in this environment.

According to the US Department of Education's (USDE) National Center for Education Statistics (1997), 14.3 million students were enrolled in courses in higher education with 758,640 of them formally enrolled in distance education courses in the academic year 1994-1995. The target audience for these courses included undergraduate and graduate students. Participants were not all degree seeking. Thirty-nine percent of institutions targeted professionals seeking recertification, and 49% targeted other workers seeking skill updating or retraining (USDE). Sixteen percent targeted individuals with disabilities, and twelve percent targeted military personnel (USDE). Non-English-speaking individuals and Native Americans/Alaskan Natives on tribal lands were targeted by three and seven percent, respectively.

The International Data Corporation (IDC) (1999) reported that 2.2 million college students would be enrolled in distance learning courses by 2002, up from 710,000 in 1998. The IDC (1999) also revealed in this publication an increase of 22 % in distance education course offerings at four-year colleges in 2002; a jump from 62% in 1998 to 84% in 2002. At the institution involved in this study, the trend was following along with this reported trajectory; that is, until the economic downturn.

The Institute for Higher Education Policy (IHEP) (1999) conducted a study of research relating to distance learning courses. The conclusions were that "there is a relative paucity of true, original research dedicated to explaining or predicting phenomena related to distance learning" (IHEP, p. 2) and that "the overall quality of the

original research is questionable and thereby renders many of the findings inconclusive” (IHEP, p. 3). The list of shortcomings of the research regarding the effectiveness of distance education, include: lack of control for extraneous variables, failure to use randomly selected subjects, questionable validity and reliability of instruments, and lack of control for feelings and attitudes of students and faculty (IHEP). Additionally, a noticeable gap can be found in the research pertaining to the variety of differences among students (learning styles and/or personality types) utilizing the online avenue of education (Bishop-Clark, Dietz-Uhler, & Fisher, 2006-2007, p. 492). Papp (2001) stated “need notwithstanding, distance learning providers have not spent much time investigating whether or not this new pedagogy is suitable for everyone and how to assess who might benefit from it” (p. 14). Students need to take into consideration their best method of learning prior to attempting a course online (Hillstock, 2005).

### 1.3. Statement of Problem

The problem is to address the gap in research providing the students and advisors with a tool that would assist them in the possible consideration of the *best* learning environment for the individual student. Characteristics taken into consideration will include their personality as measured by the Myers-Briggs Type Indicator® (MBTI).

### 1.4. Research Questions

Specifically, the research questions pertinent to this study are as follows:

1. Is one personality type as indicated by the Myers-Briggs Type Indicator® more likely to enroll in an online course?

2. Is there a relationship between academic success (passing grade) and a specific personality type as indicated by the Myers-Briggs Type Indicator®?
3. Is there a relationship between academic failure (failing grade) and a specific personality type as indicated by the Myers-Briggs Type Indicator®?

(H<sub>0</sub>) = No relationship exists between students' personality type and success in an online course.

(H<sub>1</sub>) = A relationship does exist between students' personality type and success in an online course.

### 1.5. Assumptions

1. Participants, academic and faculty advisors would benefit from the development of a typology assisting students in choosing or declining from participating in online learning.
2. Participants responded accurately and honestly to each survey utilized in the study.
3. Participants completing the MBTI® have developed personality preferences that can be measured by the MBTI®.
4. Participants reported accurately the grade they expected to receive in the online course.
5. Research methods selected for this study were conducive to answering the research question.

### 1.6. Limitations

This study was conducted under the following limitations:

1. Voluntary population for the study was derived from all students registered for an online course for the Spring 2011 semester at a Midwest land-grant institution.
2. Participation is subject to those students choosing to participate.
3. The accuracy of the MBTI® in assessing personality type.

### 1.7. Definitions of Key Terms

Asynchronous - in the world of online learning this term addresses the capability of teaching and learning occurring at different times; it would indicate a choice on the part of the student as to when his/her learning would occur (Williams, Paprock, & Covington, 1999).

Distance education – “all forms of education in which all or most of the teaching is conducted in a different space than the learning, with the effect that all or most of the communication between teachers and learners is through a communications technology” (Moore & Anderson, 2005, p. xiii-xiv).

Failure – defined by the standard grading system adopted by the education system in the US where a letter grade of “F” constitutes course failure. In the literature this definition broadens to include grade point average (GPA), attrition and dissatisfaction with the course (Hargis, 2003).

Learning style – an innate preference for how one takes in information best (Kramer, 2001).

Learning style inventory – an assessment tool developed by Kolb, which assesses how students' perceive and process information (Kramer, 2001).

MBTI® - a forced-choice assessment tool based on Jung's personality theory and adapted by Katharine Briggs and Isabel Myers into a self-scoring personality measurement. Several forms of the MBTI® exist, however, Form M was chosen for this study. It is a self-scoring 93 item questionnaire which will determine the individual's dominant preference on each of the four dichotomies: Extraversion vs. Introversion (EI), Sensing vs. Intuition (SN), Thinking vs. Feeling (TF), and Judging vs. Perceiving (JP) (Myers et al., 2003).

Personality preference – one of sixteen personality types or preferences indicated by the completion of the MBTI® (Myers et al., 2003).

Socratic method – a teaching method named for Socrates, whose life mission was the development of critical thinking. This method has been described as “teaching by asking, not telling” (Jarvis, 2006, p. 90).

Success/Passing – for the purpose of this study, success was defined by the perceived letter grade A, B, C, D noted by the participant. In the literature this definition broadens to include grade point average (GPA), retention and satisfaction with the course (Hargis, 2003).

Synchronous – in the world of online learning this term addresses teaching and learning occurring at the same time; it would indicate a set time where the teaching and subsequent learning would occur (Williams, Paprock, & Covington, 1999).

### 1.8. Overview of Study

This dissertation is comprised of five chapters, several tables, figures and appendices. Chapter 2 will provide an overview of literature pertaining to online learning, personality testing, and self-reported grades. It will begin with an overview and proceed to describe more in-depth each of these major components researched in this study. The chapter will provide the evidence necessary to support the need for this study.

Chapter 3 will discuss the research methodology employed in the analysis of the data collection and the demographics/descriptions of participants. It is an in-depth discussion of the quantitative methods utilized.

Chapter 4 will provide a detailed view of the findings this research study yielded. Included in this view will be the online courses utilized in the study along with any relationship (positive or negative) determined by the analysis of the data.

Chapter 5 contains a summary of the entire document including, but not limited to, conclusions drawn from the analysis, discussion of those results and their potential impact on the field of online learning, as well as recommendations for future research.

### 1.9. Summary

This chapter presented an introduction, a statement of the problem, purpose of the study, research questions, definitions of terms, assumptions of the study as well as the study's limitations. Through these sections, Chapter 1 exhibits that a study of this type can be beneficial to students choosing to participate in a distance education course, to University administrators assisting students in those decisions and to the distance education community at large.

## CHAPTER 2. REVIEW OF RELEVANT LITERATURE

### 2.1. Approach to this Review

A search of related literature and research studies was conducted dating from 2009 through 2012. The search was conducted at Purdue University's Humanities, Social Science, and Education (HSSE) library utilizing the computerized ERIC and PsyLit databases along with the Google search engine, Google Scholar. The primary descriptors used in the literature search included: Myers-Briggs Type Indicator, MBTI, Personality Types, Personality Assessments, Personality Assessment Tools, Carl Jung, Personality Theory, Online Learning, Grades and Success, Grades and Academic Achievement, Validity and Reliability of Self-Reported Grades, Personality Type and Academic Success, Personality Type and Brain Images, Cognitive Learning and Success.

The literature review will cover the following topics as they pertain to the purpose of this study. The literature review begins with a look at Jungian Personality Theory as it is the basis of most personality assessment tools used in education and is the most “popular and highly regarded personality systems today” (Chapman, 2005). A discussion of Personality Assessment Tools is necessary to differentiate those that are applicable for use in research in higher education and those that are not. An emphasis will be placed on The Myers-Briggs Type Indicator® (MBTI) as it is the chosen personality assessment tool for this study. Given that the brain is the Mecca of learning, processing and

disseminating information in the human body, the process or pathway of learning in individuals typed as extrovert or introvert will also be discussed. Since the purpose of this study is to assess success in an online learning environment, a brief synopsis of an online learning environment will follow. Finally, this literature review would not be complete without defining Success in an Academic Setting as evidenced by grade and therefore, academic achievement so, that too, will be defined for the purposes of this study.

## 2.2. The Study of Personality

A pioneer in the study and development of personality theory was Carl Jung. Jung defined these types in his book, *Personality Types*, published in 1921. As evidenced by this literature review, Jung's theory has been widely accepted and applied. As such, it is necessary to have a fundamental understanding of this theory in order to apply it to the literature.

Personality is a human characteristic derived from Deoxyribonucleic Acid (DNA), which determines “which neurotransmitters will govern” the brain (Laney, 2005, p. 21), the environment, and an individual’s response to the events within that environment. Personality traits preclude the preferred method of taking in information, processing it and developing an opinion or judgment about that which has occurred. Because the gene formulas comprising our brain chemicals and neurotransmitters are 99.9 % the same among the human population, scientists can study the “common clusters of traits that produce certain patterns of behavior” (Laney, p. 21). There have been research scientists and psychologists (e.g., Sigmund Freud, Erik Erikson, and D.W.

Fiske) who have invested time and energy into categorizing the human personality either from the perspective of individual differences or similarities within certain groups, or both. They have defined the stages of personality development, the ability of the individual to alter or modify their personality, and the influence of the personality on many, if not all, aspects of the individual's life ranging from choice of study in higher education to choice of career, ability to be a team player to capability of being a life partner. According to these researchers, the impact of one's personality is certainly influential and predictive to "future training and learning performance" (in Kim & Schniederjans, 2004, p. 95).

Personality theories are typically derived through the development or description of core traits or beliefs expressed by an individual (Maddi, 2006). To categorize personalities, *personologists* (those who study the personality of individuals) will identify similarities and differences which are inborn or core to the personality type in order to form their theory. The personologist groups individuals by similarities into same personality categories, while the difference, obviously, differentiate personality categories. *Personologists* are also interested in the periphery of personality or the learned differences and similarities among people; but it is the core of the personality, the inborn or unlearned similarities and differences and therefore, uninfluenced features, which characterize each personality classification (Maddi, 2006).

### 2.3. Jung and Personality

Jung is one such psychologist who set out to describe in an orderly fashion the ways in which people differ. Jung described these differences and their meaning in his

book, *Personality Types* (1921). In Jung's theory, Jung considered the ways people collect information, process that information and subsequently make judgments differently from others (Bishop-Clark et al., 2006-7). The practical applications of Jung's theory "shows how our differences in experiencing events and making decisions can be valuable rather than divisive, and can be used constructively...to promote personal development ...to manage conflict and ... to increase human understanding worldwide" (CAPT®, Inc. n.d.). In pointing out the differences in human personalities, Jung sought to bring about methods of working through those differences to solutions.

The personality typology developed by Jung began with the differentiation between *introversion* and *extroversion*. Jung was the first to summarily quantify the meaning of the two. Jung's research, conducted through psychoanalysis, did not conclude that introverts are shy while extroverts are boisterous. It went much deeper to a fuller definition of those terms. Introverts are those who seek definition, re-energizing and clarification of information from within; extroverts, on the other hand, seek definition, re-energizing and clarification of information from outside sources (Laney, 2005; Neuhauser, 2002; Strack, 1999). Thus began a whole new focus toward understanding the ability of the individual, how they take in information, make a judgment about it and act on it.

Boeree (2006 retrieved from <http://webspace.ship.edu/cgboer/jung.html> on October 28, 2008) stated that there are preferences or dominant ways in which individuals deal with the world. Humans are more comfortable with or better at dealing with the world through their dominant method and therefore make a conscious decision to utilize this method over and over. Jung (1921) called these *functions* and there are four

of them. All four are present in every individual, what matters is the preference or dominant function. The others are either supportive in nature or less developed and, therefore, less recognized or relied on for use. The first function identified is *sensing*. Here an individual relies on what they see and hear to gather information needed to make a decision. The second is *thinking*. An evaluation process is present as information is encountered. The third is *intuiting*. This is a knowing based on the gathering of information and compiling all of it prior to making a judgment. Finally, the fourth is *feeling*. This is making a judgment based on emotion.

The definition of these components of the personality became new knowledge in the field and development of Personality Theory (Boeree, 2006). The impact of this new knowledge was far reaching, with such impact that Jung's other achievements in the field of psychology paled with the development of personality typology (Boeree). In order to utilize it, however, one's personality had to be assessed more easily than through years of psychoanalysis. This was the vision seen by Myers and Briggs as they quantified the personality dimensions defined by Jung. The development of the MBTI® meant that personality types, once assessed, could be used to assist the individual in the selection of a career (Kennedy & Kennedy, 2004), to improve the workings of a team (Varvel, et al., 2004) and, perhaps, to better understand the implications of choosing to learn in an online environment as examples. Prior to taking an in-depth look at the MBTI®, however, a look at other personality assessment tools may prove useful.

#### 2.4. Personality Measurement Tools

It is one thing to recognize the differentiation in personality types. It is another, all together, to be able to assess that difference and assist others in applying it to decision making situations. Many of the personality assessment tools have been devised based on the study of Jung's personality types. Examples of those include the MBTI®, the Millon Index of Personality Styles™ (MIPS), and The Keirsey Temperament Sorter® (KTS). Alternatives based on the research of other scientists include the following as examples, the Big Five, designed by two teams of psychologists Costa/McCrae and Norman/Goldberg in the 1970s (John, 2009) and The Strong Interest Inventory developed by Strong in the 1920s (Jones, 2009). Assessments seem to be situational in development or with the guise of establishing one's variation on a well-known instrument or theory. A fundamental dimension throughout personality measures is the introvert/extrovert continuum. Not only is this dimension included in most personality models, it is also conceptualized very similarly in terms of construct (Johnson et al., 1999). As research continues, the applicability of each assessment may not be more widespread; however, their initial development was *situation-specific*.

#### 2.5. Description of MBTI Dimensions

Jung's personality model emphasizes the "entire" personality including periphery traits (Maddi, 2006) described earlier, which are changeable as an individual develops, learns and is influenced by outside experiences. It does not focus on the core unchangeable characteristics associated with personality. The significance of this point relates to the reliability of the MBTI as a psychometric tool. The type descriptions (see

Table 2) do reflect a model of development encompassing an entire lifespan (Myers et al., 1998). The MBTI is not indicated for reliable use with those individuals thirteen years of age or younger (Myers et al., 1998, p. 106). “Personality Type” can, however, be measured reliably with individuals who are eighteen years of age and older. While completion of the MBTI results in a four dimension preference of personality type, it is classified as a preference, indicating a predominant inclination.

Table 2.1 *Descriptions of the MBTI Paired Dimensions*

| Scale | Description  |
|-------|--|
| E – I | Measures how and where one receives their energy.<br><br><i>Extroverts</i> draw energy from the external world of people and things; <i>Introverts</i> draw energy from their inner world of ideas.  |
| S – N | Measures how a person perceives and processes information. <i>Sensing</i> individuals focus on that which is observable, factual; narrow focus. <i>Intuitive</i> individuals perceive information based on meanings, relationships, or possibilities; big picture. |
| T – F | Decisions are made by <i>thinkers</i> based on logical fact; <i>feelers</i> are very attuned to their feelings and those of others making their decisions based on that.   |
| J – P | Describes their lifestyle and orientation to the outer world – and is based on T or F component – <i>Judgers</i> are orderly and work in a linear fashion; <i>Perceivers</i> prefer flexibility and spontaneity in life.   |

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(Bishop-Clark et al., 2006-2007)

There are 16 possible types indicated by the MBTI (see Table 2). The remaining non-preferred dimensions are, according to Wheeler (2001), “still present in the personality and the individual may be quite competent using them” (p. 4).

Table 2.2. *The Sixteen Types of Personalities Noted Through the MBTI*

|      |      |      |      |
|------|------|------|------|
| ISTJ | ISFJ | INFJ | INTJ |
| ISTP | ISFP | INFP | INTP |
| ESTP | ESFP | ENFP | ENTP |
| ESTJ | ESFJ | ENFJ | ENTJ |

Note; Adapted from *MBTI Manual: A Guide to the Development and Use of the MBTI Type Indicator* (p. 64) by I.B. Myers, M.H. McCaulley, N.L. Quenk and A.L. Hammer, 2003, Mountain View, CA: CPP, Copyright 2003 by P.B. Myers and K.D. Myers. Used with permission for adaption from CPP.

While individuals assessed with a specific personality type may, in fact, find themselves to be more *science-minded* or attracted more toward a particular field of study, it does not hold true that only those individuals could learn those topics of study nor perform well in them (Clark and Riley, 2001). Research has found, for example, that those individuals assessed as NT types are more attracted to the fields of engineering and physical science; SF types are more attracted to nursing and education; NF types are more attracted to the humanities and behavioral sciences; and ST types are more attracted to biological sciences.

## 2.6. Millon Index of Personality Styles (MIPS)

The Millon Index of Personality Styles™ (MIPS) was developed in 1994, long after Theodore Millon made his impact in clinical psychological assessment and treatment of personality disorders. MIPS is a 180-item true/false questionnaire designed for use with those individuals 18 years of age or older for the assessment of normal-range personality traits. This questionnaire is designed to be completed in about 30 minutes

with results needing to be analyzed and interpreted by someone trained in the use of this tool (Lampe, 2004; Strack, 1999). There are 24 substantive scales of the MIPS.

The four pairs of Cognitive Modes of the MIPS as described by Strack (1999) are easily recognized by those familiar with the Myers-Briggs Type Indicator®. They include Extraversing – Introversing; Sensing – Intuiting; Thinking – Feeling; Systematizing – Innovating. The Cognitive Modes investigate the style in which the participant processes information. The first two explain how information is gathered; the latter two indicate how that information is processed. There are three pairs of Motivating Aims, Enhancing – Preserving; Modifying – Accommodating; Individuating – Nurturing. Think of these as identifiers of the individual's response to reinforcement from the world. To what extent is the individual responsive to positive reinforcement (Enhancing) or to what extent will the individual go to avoid negative reinforcement from their environment (Preserving)? Is the individual active (Modifying) or passive (Accommodating) in their approach to the world? Similar to Jung's introversion/extroversion scale, Millon created the final of the three pairs, Individuating – delineating the primary source of reinforcement as coming from oneself or Nurturing – where reinforcement comes from others. According to Strack (1999), Millon has re-termed the MBTI's Judging-Perceiving Scale to Systematizing-Innovating to better accommodate the sheer volume of information individuals now process daily in this age of information. It is not apparent from the research reviewed how this re-termining of the MBTI's Judging-Perceiving scale has actually captured or measured the increased volume of information processing component of one's personality.

Concluding the description of the MIPS is the definition of the five pairs of Interpersonal Behaviors Scale. This portion of the MIPS assesses the individual's *style of relating to others*. For those familiar with Millon's 10 personality disorders, they are recognized as the normal-range variations (NRV) of those disorders as follows: Retiring-Outgoing NRV of Schizoid-Histrionic; Hesitating-Asserting NRV of the Avoidant-Narcissistic; Dissenting-Conforming NRV of the Antisocial-Obsessive/Compulsive; Yielding-Controlling NRV of the Self-Defeating/Masochistic-Sadistic; and, finally, Complaining-Agreeing NRV of the Negativistic/Passive-Aggressive vs. Dependent personality disorders. The Interpersonal Behaviors Scale seems to suggest that there is a normal range of disorder an individual can exhibit as opposed to a normal range of an individual's personality wherein no disorder is evident and therefore not categorized as such. Table 3 shows the composition of the Millon Index of Personality Styles.

Table 2.3. *The Millon Index of Personality Types*

| Validity Indicators  | Motivating Aims   | Cognitive Modes  | Interpersonal Behaviors   |
|--|---|--|---|
| <i>Consistency Positive Impression-Negative Impression</i> | Enhancing Preserving Modifying Accomodating Individuating Nurturing Systematizing | Extraversing Introversing Sensing Intuiting Thinking Feeling Yielding Innovating | Retiring Outgoing Hesitating Asserting Dissenting Conforming Controlling Complaining Agreeing |

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Note: Adapted from *Essentials of Millon Inventories*, (p. 205) by S. Strack, 1999, New York, NY: John Wiley

& Sons, Inc.

The similarities between the MIPS and the MBTI on the surface seem to be many. A few are given as examples; however, the focus of this discussion will be on the differences. Both the MIPS and the MBTI are based on Jung's personality theory. Both assessments are purported to be developed for the predicting of normal-range personality traits. Both tests allow for the possibility of one in sixteen personality types to be declared following completion of the questionnaire.

The scoring that allows the participant to obtain their personality type is the significant difference in these assessment tools as is the focus of the results provided. The MIPS assesses how an individual handles quantities of information, the MBTI assesses how an individual interacts with others (Strack, 1999). Other differences include the fact that the MIPS, while developed for use with the normal population, is still recommended for participants in a semi-clinical setting with a counselor or personnel psychologist assisting normal-functioning adults in their decision-making process based on the amount of information they are receiving, or as a screening assessment during an interview process, or as an application for the development of work teams in an organization (Milton, 1997). As previously stated, the MBTI might also be used in a similar manner; however, it has overwhelmingly been used in research conducted in higher educational classroom settings (Myers et al., 1998). The scales for the MBTI are polarized dichotomies with no room for an in-between answer. The MIPS, however, has 24 continuous scales which are "categorized as four pairs of Cognitive Mode scales, three pairs of Motivating Aims scales, and five pairs of Interpersonal Behavior scales" (Lampe, 2004, p. 4). As reported in Strack's (1999) book, *The Essentials of Millon Inventories*

*Assessment*, “the correlation between the Cognitive Modes Scale and the MBTI is reported to be  $r=.71$  to  $r=.75$ ” (p. 216). This is high; however, the Cognitive Modes Scale is only one of the 24 continuous scales contained within the MIPS, and the most similar to the MBTI.

### 2.7. Scoring Differences between the MIPS and MBTI

The scoring differences between the MIPS and the MBTI was reported to be significant, in that, the MIPS allows for a “relative strength or weakness of the measured trait for the participant” (Lampe, 2004, p. 4); the MBTI does not. A T-score metric is used to convert the raw score participants receive having completed the MIPS (Lampe, 2004). The MIPS contains 24 continuous scales and each has a standardized mean of 50 and a standard deviation of 10. A T-metric score of 50 or above indicates that the participant exemplifies the trait, a score below 50 means they do not. With a T-score metric, a mean of 50, and a standard deviation of 10, the relative weakness is measured in what falls below and the relative strength in what lies above the mean. With this scoring method, a participant will exemplify a *weak* or *strong* tendency within the same trait. It is in this differentiation of *weak* or *strong* that a significant difference in the assessment tools can be found. Any participant with an assessment of 50+ is considered as exhibiting prevalence for that trait: 69 would be considered a high prevalence score and 89 would be considered very high for prevalence score (Strack, 1999). Scoring of the MIPS can be done via computer software, mailed in or hand-scored (which requires a weighted scale). A single-page profile or a full narrative analysis can be provided and interpreted by a trained professional for the individual. Also, the Validity Indicators

(noted in Table 3) are scored by single points and provide an overall indication of an individual attempting to create a positive or negative impression through their responses and a value for the level of consistency of responses in their answers. These particular indicators seem to be more a measure of honesty of the individual test-taker as opposed to validation of the assessment instrument itself. The fact that the consistency indicator, as described by Strack (1999) is such a focal point of the instrument interpretation attests to the clinical nature of this instrument and the setting in which it was designed for use. The five-step procedure for test interpretation begins with checking the Validity Indicators. If the Validity Indicator scores are out of acceptable ranges, the analysis process is halted. It is only when they are within acceptable ranges that analysis of the remaining scales proceeds (Strack, 1999).

Lampe's 2004 article was written in response to another study to illustrate the effectiveness or appropriateness of the use of the MIPS in assessing accounting students' personalities as opposed to the MBTI. He promoted the use of the MIPS due largely to the continuous scaling method and the fact that those who scored at 50 or above would be less likely to *waffle* between the trait pairs in terms of their responses/reactions to others. The issue of the polarity with the MBTI scoring does draw criticism and will be addressed in the following section, suffice it to say Myers and Briggs do have a response to this criticism saying the rendering of the personality type post MBTI is referred to as one's *predominant* mode. It is the method one subconsciously utilizes when presented with an influx of information requiring a decision/judgment. This is not to say that other

methods are not known to the individual or even that this mode is mutually exclusive. It is to say, it is predominant or preferred.

#### 2.8. Choice of Myers-Briggs Type Indicator

Other assessment tools have been developed based on Jung's theory as well as other theories of personality, however, they have not been chosen to be discussed nor used for the purpose of this study for two reasons: 1) they are either statistically unproven in their reliability and validity or 2) they are inapplicable to research in higher education due to their designed intent of use.

As previously mentioned, the pioneer of personality theory was Jung. His theory has been widely accepted, applied and eventually assessed through the development of the Myers-Briggs Type Indicator. Jung also studied student learning styles (Ehrman & Oxford, 1990) and spent many years researching how individuals learn best. It was the compilation of all of Jung's (1921) research, the fact that the MBTI is based on his theory, and the magnitude of its use in the study research in higher education that led to the selection of this assessment tool for the purpose of this study.

#### 2.9. History of The Myers-Briggs Type Indicator and its Use in Higher Education

Beginning in the 1940s the daughter/mother team of Isabel Myers and Kathleen Briggs began quantifying the personality theory proposed by Carl Jung. The reader will recall that Jung described the human being as individual in many ways with the "same multitude of instincts to drive from within" (in Denham, 2002, p. 2). Essentially, our

chosen *preference* of ‘function’ is what is at the heart of this assessment tool. It is our *preference* that is typed by the MBTI.

This model and its derivative psychometric tool, the MBTI, have been utilized in over 4000 research studies, journal articles, and dissertations since the publication of the first instrument in 1962, according to Myers et al., 1998. Since 1985, there have been on average more than 200 academic articles published annually utilizing the MBTI according to Hammer (1996). The MBTI, is, according to Bishop-Clark et al., (2006-7) “one of the best researched and most widely accepted of the instruments measuring cognitive style and personality” (p. 493). Research utilizing the MBTI has been conducted mainly in the areas of counseling, education, career guidance, and teamwork. Many have researched the topic of student satisfaction pertaining to online learning (Rodriguez et al., 2005) and learning styles in relation to online learning (Ally & Fahy, 2005; Gunawardena & Boveried, 1993; Hillstock, 2005; Papp, 2001). Rodriguez, et al., (2005) found that students’ comfort with technology in an online course related to their satisfaction with the course experience, which related to their motivation and ultimately their perception of quality of the education received.

As noted by Bremner (2007), educational researchers such as Aragon (2004), Borg and Shapiro (1996) and Ehrman and Oxford (1989) have become very interested in studying “the MBTI personality type as an indicator of learning style” (p. 3). Others, such as Bushnell (1990), Pittman (1993), and Plog (1980) have focused their studies on MBTI personality type as an indicator of “attrition and retention” (p. 3). Additionally, Ehrman and Oxford (1995) and Li and Qin (2003), have studied the MBTI personality type as a “predictor of success in a variety of fields” (p. 3). This is noted to point out the

continuous use of and applicability of the Myers-Briggs Type Indicator as it pertains to predicting outcomes in the field of higher education.

#### 2.10. The Myers-Briggs Type Indicator and Online Learning Performance -- A Study of Freshman Chemistry Class

Less research has been conducted correlating the personality as assessed by the MBTI and relating that to distance learning performance. Two such studies were uncovered. The first conducted in 2001 by Clark and Riley, concurred that research assessing the influence of personality type on successful or unsuccessful learning "has been virtually unexplored" (p. 1406); that continues to be the case through this review of literature. In their study, Clark and Riley were looking for a predictive indicator providing evidence of future success for students enrolled in a science curriculum, namely, chemistry. The subjects comprised of 407 students studying the freshman level chemistry class sequence, serving as the sample group and 678 other students serving as the base group. The entire student population studied was 1085. The base group consisted of students in general physical science courses including physics, chemistry designed as a terminal course for nursing, agricultural science and human science students, honors chemistry and astronomy. Seven instructors of the sample group students participated along with twenty-three faculty members from the base group. The MBTI, form G was used to assess the personality type of all participants.

A standard score was assessed for each of the students in the sample group; grades were pooled into one class establishing a class average of 70 and a standard deviation of 10. Clark and Riley (2001) did this so that later in the study they would be able to rank order the students according to their percentage of grades similar to the way

in which a professor might relegate a class grading distribution. The sample group's personality types and relative percent grade were entered into a statistical program and a two-factor ANOVA was conducted "comparing each type's average grade to the overall class average and to averages of the other individual types" (Clark and Riley, p. 1407). A comparison of the sample and base group's personality type distributions were performed using the Selection Ratio Type Table (SRTT) program. The SRTT "compares a sample group to a base group using a chi-square analysis on dependent groups and identifies types and individual functions that are statistically distinct from the base group at the .05, .01, and .001 levels" (Clark and Riley, p. 1407). Clark and Riley found that the personality type distribution of the sample group was not significantly different from that of the general population of the combined groups. There were two exceptions, the ISFJ and the ESFJ personality types were represented by smaller percentages in the sample group and higher percentages in the base group.

There were, however, significant differences between the average scores of some personality types and the standardized class average: Clark and Riley (2001) found "The ANOVA showed that the INTJ students significantly outperformed 3 types at the 95% level and 11 of the remaining 12 types with 99% confidence" (p. 1409). Those students with a personality type of INTJ "significantly out-scored all other students except for the ENTJ" (p. 1409) students. Clark and Riley did rank order the personality types according to the frequency occurring in the top 10% of the grades; they did the same for the bottom 10% seeking to uncover the personality type most frequently observed in both. Again, INTJ types are in the top 10% and never occur in the bottom 10%. ESFP types are in the bottom 10 % and never occur in the top 10%. These results do indicate personality type

matters for success when looking at grades in college-level chemistry classes. The authors considered further applications suggesting the data may be used to re-evaluate and improve current instructional practices to reach more students successfully. The authors believe it to be a challenge to “create that initial sense of excitement” and push a student whose personality type is not conducive to success in chemistry to be so. It should be kept in mind, however, that Jung noticed and studied the differences in individuals not with the intent of making dissimilar similar, but to distinguish, value and assist individuals in making choices best-suited to them because of those differences. In this way it might be said to have been a strength of this study that Clark and Riley were looking toward instructional practices that would assist those students who did not rise to the top 10% with the INTJ type in finding techniques allowing them to learn what they could from the subject in the environment.

#### 2.10.1. A Study of Freshman Psychology Class

Another similar study was uncovered resulting in the findings that personality preference has little to do with student performance, but did impact student satisfaction (Bishop-Clark et al., 2006-7). In this study, 29 students in two offerings (different semesters) of a psychology class, participated. Since the course was taught by the same professor, with the same tools, requirements and in an online environment, the data obtained from the two groups were combined. The introduction to the course as well as the four class exams was conducted face-to-face; any other interaction was conducted online. Also conducted during that initial meeting was the MBTI. Satisfaction with the course, the instructor, and the online environment was assessed via an end of the semester

evaluative tool, Flashlight's Current Study Inventory. The researchers also held focus groups to obtain satisfaction ratings, however, given that the personality types of the individuals were unknown to those conducting the focus groups these data were not utilized in the assessment of personality factors.

The Bishop-Clark et al., (2006-2007) study measured student performance in a variety of ways. One way was to calculate the *mean* grade of the tangibles required of the course (final discussion grade, final project grade, quiz average, final portfolio grade, exam average, and final grade) and report that based on the four dimensions of the personality used in the MBTI. The results do not seem surprising. In terms of performance differences, “*introverts* performed better than *extraverts* on quizzes and *thinkers* also scored better on quizzes than *feelers*. With regard to the discussion score, *extraverts* scored higher than *introverts* and *intuiting* types scored higher than *sensing* types” (p. 496). Keeping the pairings associated with the MBTI in mind (Introvert-Extrovert; Sensing- Intuiting; Thinking-Feeling; Judging-Perceiving) these various differences were noted in this study. *Extraverts* expressed applying more of what they were learning than *introverts*. *Extroverts* expressed their frustration with relating to others in the online environment. *Introverts* enjoyed working through the assignments and course materials and being allowed to do so at their own pace, more so than their *extroverted* peers. Sensing responders reported a feeling of isolation from others in their class and estimated that they spent more time on the internet and WWW. *Intuitors* expressed their enjoyment of this course over the traditional face-to-face courses. *Feeling* participants also expressed a feeling of isolation from their instructor and peers, more than those with *thinking* preferences. *Thinkers* expressed appreciation for the

course and would even recommend it to others, more so than *feelers*. *Feelers* also expressed spending a lot of time on the course and not being comfortable when participating in online discussions. There were no noted differences between the final pairing of *judging* and *perceiving*, except to say that the *perceiving* responders noted a “higher priority was given for students to take responsibility of their own learning and to apply what they have learned to the real world situations” (Bishop-Clark et al., p. 497-498).

The Bishop-Clark et al., (2006-2007) study is the only research located in the review of literature that categorized the findings by differentiation among the pairings used in the MBTI to report personality type. While the study sample was quite small; the specificity was interesting. The conclusions of this study indicate that while there is little difference in terms of academic performance based on personality type, there is a reported difference in satisfaction based on personality with an asynchronous, web-based online course and environment. Questions have to be asked regarding the number of participants and drawing conclusions as well as the fact that this study was conducted over two semesters giving the instructor the opportunity to *teach differently* the second semester and alter the quality of data collected between semesters. It would have been interesting to see some sort of correlation analyzed between semesters.

## 2.11. Reliability and Validity of the MBTI

### 2.11.1. Internal Consistency Reliability of the MBTI

Myers et al., (1998) described the two assumptions made deriving from observation in the development of the MBTI. The first assumption stated “Persons with a

good command of perception or judgment (i.e., with good type development) are more likely to be clear about their own preferences. They therefore will report their preferences more consistently" (Myers et al., p. 160). If this is so, then results reported by older individuals would be more reliable than those of younger individuals. The second assumption stated "Since the quality of perception and judgment is often evidenced by an individual's level of achievement, it is expected that in samples of persons of comparable age levels, those with higher achievement levels will also report their preferences more consistently" (Myers et al., p. 160). Higher reliabilities in samples of high achieving individuals would be evident when compared with their low achieving peers.

A limitation of the MBTI as expressed by the authors is with the T – F (Thinking – Feeling) dichotomy. The authors stated that "since the acquisition of good judgment is postulated to be the most difficult to develop, the T – F scale is expected to be particularly vulnerable to deficiencies in type development; therefore, the lowest reliabilities in less effective samples are expected to occur on the T – F scale" (Myers et al., 1998, p. 160).

In this third edition of the MBTI manual, reliability and validity of the instrument was measured between Form G and Form M. Form M is the new standard form of the MBTI. It "contains the newest items, the most precise scoring procedure, and the most current standardization samples to produce scoring weights" (Myers et al., 1998, p. 106). The new Form M was designed specifically to improve the precision of reporting within the dichotomies and eliminate separate scoring keys related to gender. An opportunity was also taken in the development of the new form to eliminate those items *not*

associated with typing the individual. Form G contained 32 items not related to typing the individual, but pertaining to research; whereas, all of the items on Form M relate to typing the individual's personality.

Internal consistency reliability (See Table 4) is a measure of how consistent respondents are with their answers on the items of a given scale (Myers et al., 1998; Sekaran, 2003). In this case, both a logical split-half (LSH) and a consecutive split-half (CSH) reliability tests were conducted. In the LSH, the items on the MBTI were split in a logical manner (i.e., purposefully and based on resemblance to other items). Myers et al., reported on page 160 using the following variables for the LSH: item format (word pair versus phrase question), item-to-total correlations, average value of the IRT *b* parameters), subscale coverage and whether the item was an original Form G item or new or revised item.

Table 2.4. *Internal Consistency (Corrected) of Form G and Form M Continuous Scores Based on Split-Half Correlations*

| Sample<br>Form G       | N      | E-I  | S-N  | T-F  | J-P  |
|------------------------|--------|------|------|------|------|
| CAPT Databank          | 32,671 | 0.82 | 0.84 | 0.83 | 0.86 |
| Form M                 |        |      |      |      |      |
| National Sample        | 3,036  |      |      |      |      |
| <hr/>                  |        |      |      |      |      |
| Logical Split-Half     |        |      |      |      |      |
| X Half                 |        | 0.90 | 0.92 | 0.91 | 0.92 |
| Y Half                 |        | 0.91 | 0.92 | 0.90 | 0.92 |
| <hr/>                  |        |      |      |      |      |
| Consecutive Split-Half |        |      |      |      |      |
| X Half                 |        | 0.91 | 0.92 | 0.89 | 0.92 |
| Y Half                 |        | 0.90 | 0.92 | 0.92 | 0.92 |
| Word Pairs             |        | 0.91 | 0.93 | 0.92 | 0.94 |
| Phrases                |        | 0.91 | 0.91 | 0.90 | 0.93 |

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Note; Adapted from *MBTI Manual: A Guide to the Development and Use of the MBTI Type Indicator* (p. 160) by I.B. Myers, M.H. McCaulley, N.L. Quenk and A.L. Hammer, 2003, Mountain View, CA: CPP, Copyright 2003 by P.B. Myers and K.D. Myers. Used with permission for adaption from CPP.

Another measure of internal consistency is the coefficient alpha method (See Table 5).

Coefficient alpha is defined by Myers et al., (1998) as the “average of all of the items correlations” (p. 161). As evidenced by the data provided in the table below, there is no significant difference in coefficients between the methods; respondents are consistent in their answers.

Table 2.5. *Internal Consistency of Form M Continuous Scores Based on Coefficient Alpha*

| Sample          | Gender | N     | E-I  | S-N  | T-F  | J-P  |
|-----------------|--------|-------|------|------|------|------|
| National Sample | M, F   | 2,859 | 0.91 | 0.92 | 0.91 | 0.92 |
|                 | M      | 1,330 | 0.91 | 0.93 | 0.90 | 0.93 |
|                 | F      | 1,529 | 0.90 | 0.91 | 0.88 | 0.92 |

Note; Adapted from *MBTI Manual: A Guide to the Development and Use of the MBTI Type Indicator* (p. 161) by I.B. Myers, M.H. McCaulley, N.L. Quenk and A.L. Hammer, 2003, Mountain View, CA: CPP, Copyright 2003 by P.B. Myers and K.D. Myers. Used with permission for adaption from CPP.

### 2.11.2. Validity of the MBTI

Construct validity is critical for this measure since it was designed to “demonstrate relationships and outcomes predicted by theory” (Myers et al., 1998, p. 171). Results of a confirmatory factor analysis utilizing Form M of the MBTI, yields an *excellent fit* to the four-factor model of Jung’s personality theory. As presented in the MBTI Manual: 3<sup>rd</sup> edition, “the adjusted goodness of fit was .949 and the non-normed fit index was .967. The median of the fitted residuals was -0.08” (Myers et al., 1998, p. 173).

### 2.12. Jungian Psychology and an Online Learning Environment

The importance of Jungian psychology as it relates to online learning can be found in the following description of Jung’s theory:

*de-emphasizes the role of the unconscious and focuses on conscious aspects of personality, decision making, and the effect of personality on understanding* (Wheeler, 2001).

This is important for two reasons: 1) Jungian psychology is shown to relate to the cognitive aspect of learning and 2) distinctly seeks to identify conscious activity as it relates to personality attributes. Learning is a conscious activity. It can be even more critical, therefore, to understand the potential relationship between personality type and a possible effect on success in an online learning environment. Does the added component of learning through technology affect a student's success in an online class? Can that effect be quantified, such that it would prove beneficial to recommend or discourage students from learning in an online environment? Can we view the learning process or the pathway of learning as it pertains to different personality types?

### **2.13. Brain Imaging and Cognitive Pathways Particular to Extroverts/Introverts**

While Jung professed that human behavior was “not random but, in fact, predictable and therefore classifiable” (in Denham & Morrison, Eds. 2002, p. 2) advanced brain imaging technology has provided visible proof of the hard-wired differences and concurrence of that statement in the brains of individuals typed as Introvert and Extrovert based on personality measurements. Laney (2005) found the following based on neurological research

Introverts have more brain activity in general and particularly in the frontal lobes, where problem solving, introspection, complex thinking and planning, and long-term memory retrieval functions are carried out. Extroverts show more brain areas involved with processing sensory information. Because extroverts have less internally generated brain activity, they search for external stimuli to energize them (2005, p. 2).

In her book, *The Hidden Gifts of the Introverted Child*, Laney (2005) explained

the hardwiring differences between Introverted and Extroverted Individuals (See Table 6). Knowing this hard-wired effect may be cause for celebration in the future studies of personality type as it pertains to success in online learning. If the hypothesis of this study is confirmed, this knowledge may explain why a student typed with an *I* (Introvert), and not an *E* (Extrovert), may be more successful in an online learning environment, where students may, as an example, take more time or pace their work completion without external pressure in an environment conducive to an introvert's learning. Laney (2005) confirmed the predictability of the introvert/extrovert measure as the most reliably expected measure of personality over time. Johnson, Wiebe, Gold, Andreasen, Hichwa, Watkins, and Boles Ponto (1999) concurred, defining personality as "a pattern of behavior and reactions that varies among individuals but within an individual is stable over time" (p. 252). Self-reported measures of personality (i.e., MBTI) combined with brain imaging technology such as "magnetic resonance imaging (MRI), positron emission tomography (PET) scans, data from brain-damaged stroke patients, and long-term twin studies" (Laney, 2005, p. xvi) provide us with precision in measurement of physiological factors associated with personality temperament, which can be correlated to many outcomes including pathways to learning.

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Table 2.6. *Hardwiring Differences between Introverted and Extroverted Individuals*

| Introvert  | Extrovert   |
|--|---|
| Integration or processing of information longer due to length of pathways                                      | Process information quickly due to shorter pathways |
| Bodies function slower   | Bodies move quickly                                 |
| More frequent use of LT memory providing a wealth of material, but additional time to reconstruct and retrieve | More frequent use of ST memory                      |
| Can incorporate more emotional/intellectual content relevant to new data                                       |   |
| Tend to shut down in unfamiliar situations   |   |
| Speak after collecting, processing and drawing conclusions about their thoughts and feelings                   |   |
| Highly observant   |   |
| Delve deep into what interests them  |   |
| Require low-stimulation environment to recharge  |   |

Note: Adapted from *The Hidden Gifts of the Introverted Child: Helping Your Child Thrive in an Extro World* (p. 29) by M.O. Laney, 2005, New York, NY: Copyright 2005 by Workman Publishing Company, Inc.

### 2.13.1. Elements of Temperament Design

The elements of temperament design pertaining to those typed Introverted and Extroverted are described thoroughly in Chapter One of Laney's (2005) *The Hidden Gifts of the Introverted Child*. The pieces to this puzzle, which influence, affect and ultimately govern temperament (personality) in each individual is presented in Figure 1.

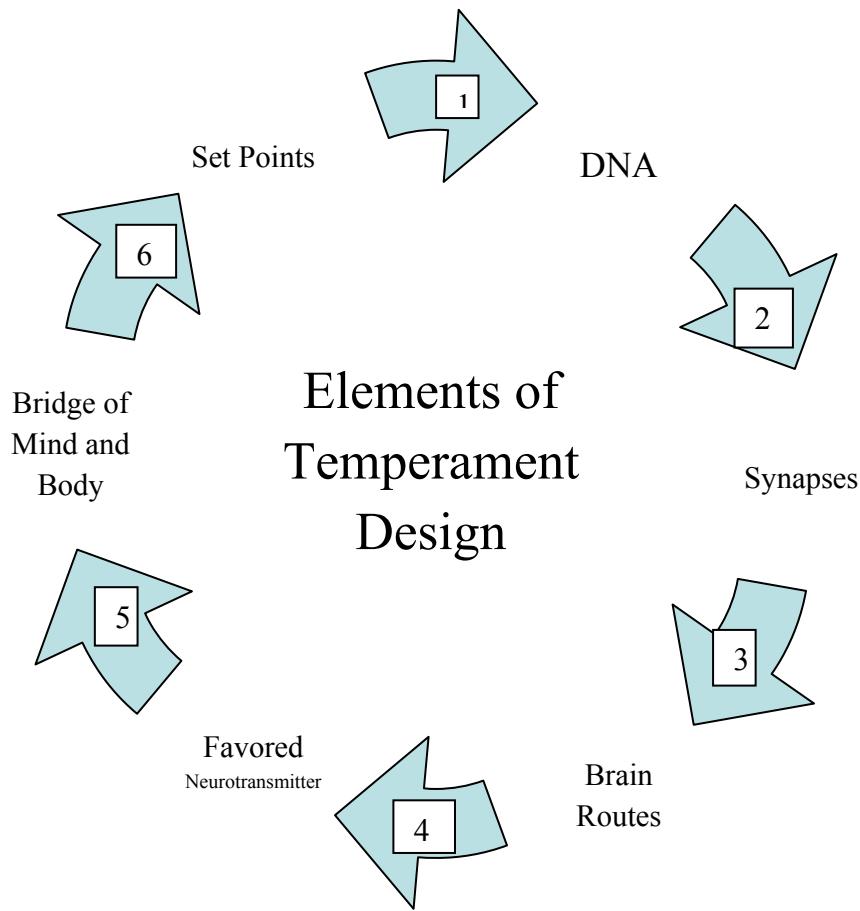


Figure 2.1. Elements of Temperament

Note: Adapted from *The Hidden Gifts of the Introverted Child: Helping Your Child Thrive in an Extro World* (p. 29) by M.O. Laney, 2005, New York, NY: Copyright 2005 by Workman Publishing Company, Inc.

Element #1 is our DNA. Our genes determine the neurotransmitters governing our brain. Element #2 is the sliver of space between each cell, known as synapses. This can be termed the “gaps of possibilities” and they allow neurotransmitters to travel throughout the brain. Interestingly, the brain contains a lock system. Essentially only one neurotransmitter is the key directing that portion of the brain to “fire” or “not.” Firing is the activity in the brain eliciting a behavior or response; if that portion of the

brain remains dormant (i.e., the neurotransmitter was not the correct one) no behavior or response is apparent. Element #3 is the brain route. These are pathways of familiarity created by the consistent and regular firing of neurons. This linking of neurons (cells) creates temperament (personality). Element #4 is our favored neurotransmitter. These dictate the pathway or brain route conducting the brain functioning and behavior. The two neurotransmitters are *acetylcholine* and *dopamine*. Acetylcholine governs concentration, consciousness, alert states, shift in waking/sleeping, voluntary movement and memory storage; it is the favored neurotransmitters of Introverts. Dopamine is the most powerful reward system in the brain. It prompts the “act now, think later” behavior in individuals; it is the favored neurotransmitter of Extroverts. Element #5 creates the bridge between the mind and the body. The favored neurotransmitters, acetylcholine and dopamine, trigger the nervous system linking brain and body. They function on opposite sides of the autonomic nervous system. Dopamine activates in the *sympathetic*, or “fight, fright, or flight,” *nervous system*; whereas acetylcholine activates in the *parasympathetic*, or “rest and digest,” *nervous system*. Introverts are dominant on the parasympathetic side utilizing acetylcholine as its main transmitter. Extroverts are dominant on the sympathetic side, utilizing dopamine as its main transmitter. The final Element #6 is our set points. Homeostasis, or balance, is sought by the body using as little energy as possible. Set points are genetically determined. Laney (2005) noted that Allan Schore, a brain researcher, believed temperament to be molded by these set points along the introvert/extrovert continuum. Stress or boredom is created by operating outside the normal range of our set points. This can be tolerated by both introverts and extroverts for a period of time; however, homeostasis will again be sought.

### 2.13.2. Cerebral Blood Flow (CBF) and Introvert/Extrovert Continuum – A Study

As noted in Lacey's (2005) book, research has been conducted by Dr. Debra L. Johnson and colleagues with the intentions of establishing brain pathways in introverts and extroverts. The pathways were conducted using the brain-imaging positron emission tomography (PET) technology. Interestingly enough, the PET scan showed a visible difference in the amounts of blood flowing to locations in the brain establishing the synapses discussed above. The synapse dictated the “firing” of portions of the brain utilized as the “keys” unlocked by neurotransmitters.

Johnson et al., (1999), conducted this study with eighteen healthy, normal individuals; specifically, ten male and eight female. Subjects were screened for “exclusionary criteria” such as prior psychiatric, neurological, or serious medical conditions. The NEO Personality Inventory – Revised was used to determine the individual’s type on the introversion/extroversion continuum. This personality measure was chosen for its similarity to the Eysenck Personality Questionnaire (Eysenck, 1975), a tool utilized in the medical field for predicting personality based on *biological theories* and because this study was attempting to confirm or refute findings in previous studies conducted by Eysenck and Gray who are leading researchers and theorists on biological theories of personality.

Subjects in this study were simply told to “lie quietly with their eyes closed” (Johnson et al., p. 253). Normal subjects in previous studies have indicated that when given this command their thoughts go to “a series of loosely connected personal recollections and plans for future activities” (Johnson et al., p. 255) in an uncontrolled cognitive state. Additionally, higher blood flow in the bilateral frontal lobe regions

suggested that “introverts might engage in a running monologue in the absence of external stimulation” with more blood flow noted in Broca’s area of the brain interpreted as “self-talk” recalling “events from their past, making plans for the future, or problem solving” (Johnson et al., p. 255). Higher blood flow in the posterior insula, suggests those individuals typed as extrovert were busy interpreting the current sensory information lying still for the PET scan may have initiated.

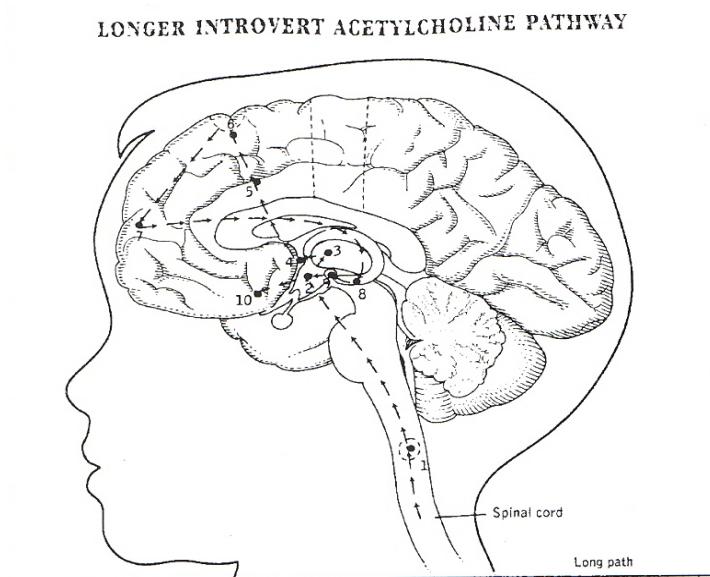
The results of the Johnson et al., (1999) study found that eight regions of the brain associated with the introversion dimension of the personality had “a larger volume” (p. 254) of CBF than the seven regions associated with extroversion. The regions associated with higher volume of CBF in introverts include the lateral extent of the frontal cortex, Broca’s area, the insular cortex, the right temporal cortex, and the anterior nucleus of the thalamus (a new finding). According to Johnson et al., “this greater activity in the anterior thalamic nuclei and frontal lobe regions in introverts likely reflects the introspective nature of these individuals” (p. 255). Does this impact an introverts’ learning and would their environment be more or less conducive to learning given this information? Regions associated with lower volume CBF in extroverts include the anterior cingulated gyrus, right insular cortex, bilateral temporal lobes, and pulvinar nucleus of the thalamus (p. 254-255). “The posterior thalamus and anterior cingulated regions that were found to be more active in extroverts may underlie these individuals high drive for sensory and emotional stimulation” (p. 255). Johnson et al., concluded “The distinction between an inward focus and an outward focus is *very much* the difference between introverts and extroverts” (p. 255).

One limitation of this study may be the resting state of the brain while CBF was measured. Perhaps having the subjects go through some programmed function of learning would be most useful in deciphering the cognitive differences between introverts and extroverts. The authors recognized this potential limitation suggesting memory paradigms.

#### 2.13.3. Effects of Elements on Learning and Reward Routes

Introverts were shown to exhibit higher blood flow in the frontal lobes or *bonnet* of the brain governing the “doing” or voluntary action associated with contemplation and making a decision before acting. The reader will recall, that the neurotransmitter of choice for introverts is acetylcholine; this neurotransmitter “triggers the brain’s ability to focus and concentrate deeply for long periods” of time (Laney, p. 25). Acetylcholine also activates subtle, but powerful reward system traveling a long way “from the brain stem, stimulating aspects of hearing and seeing linked to learning, all the way up to the executive brain functions in the frontal lobes. When human brains are stimulated by acetylcholine they feel alert, enjoy what they’re doing, and are more relaxed” (Laney, p. 30). Introverts seek this reward through this pathway. To extroverts, however, this feeling would be so subtle as to be hardly noticeable directing their desire toward the shorter dopamine pathway which travels to the “boot” or back of the brain “promoting novelty-seeking behavior, quick actions, and the urge to move quickly in order to get more of them” (Laney, p. 30). Extroverts are the “be-ers” taking involuntary action or *reaction* as it were. Recalling Element #6, dopamine to an introvert and acetylcholine to an extrovert is a miss-mark of the set point causing a decision/reaction leading to

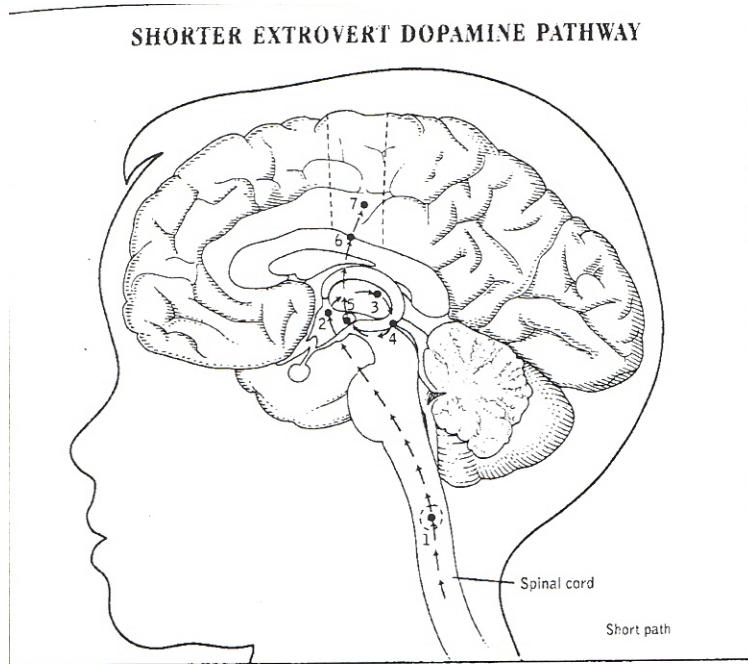
homeostasis or balancing. Figure 2 exhibits the introvert's acetylcholine pathway, and Figure 3 the extrovert's dopamine pathway. Figure 2 allows the reader to observe the longer pathway utilized by introverts, which may explain much about the introverted personality and their associated learning styles and methods; simultaneously, Figure 3 points out the shorter extroverted pathway potentially explaining their quick processing of information, rapid decision-making and need for successive events. The question regarding these documented pathways is whether or not the differentiation has any impact on distance learning based on personality type. While a potentially expensive study, it would be most interesting, and perhaps very telling to study the physiological aspects of temperament with the tools of self-reported measurement and success in learning traditionally and in an online environment.



1. **Reticular Activating System**—Activator: Acetylcholine activates the Front Attention System; signals “Something is interesting.”
2. **Hypothalamus**—Master Regulator: Regulates basic body functions and turns on the braking side of the nervous system.
3. **Front Thalamus**—Relay Station: Receives external stimuli, reduces it, and shuttles it to the front of the brain.
4. **Right Front Insular**—Integrator: Combines emotional skills such as empathy and self-reflection; assigns emotional meaning, notices errors and makes decisions. Integrates slower “what” or “why” visual and auditory pathways.
5. **Left-Mid Cingulate**—Social Secretary: Prioritizes, grants entry into CEO area; attends to the internal world. Emotions trigger the autonomic nervous system.
6. **Broca's Area**—Left Lobe: Plans speech and activates self-talk.
7. **Right and Left Front Lobes**—CEO Processors: Acetylcholine creates beta waves and “hap hits” during high brain activity. Selects, plans, and chooses ideas or actions. Develops expectations. Evaluates outcomes.
8. **Left Hippocampus**—Consolidator: Acetylcholine collects, stamps as personal, stores long-term memories.
9. **Amygdala**—Threat System: Attends to threats with fear, anxiety, and anger. Signals social panic and triggers storage of negative experiences.
10. **Right Front Temporal Lobe**—Processor: Integrates short-term memory, emotions, sensory input, and learning. Triggers voluntary muscles.

**Figure 2.2. Longer Introvert Acetylcholine Pathway**

Note: Adapted from *The Hidden Gifts of the Introverted Child: Helping Your Child Thrive in an Extroverted World* (p. 29) by M.O. Laney, 2005, New York, NY: Copyright 2005 by Workman Publishing Company, Inc.



1. **Reticular Activating System**—Activator: Dopamine activates alert alpha brain waves, “hap hits,” and triggers the Back Attention System which notices any movement.
2. **Hypothalamus**—Master Regulator: Regulates basic body functions and triggers the “Give It the Gas” system.
3. **Right and Left Back Thalamus**—Relay Station: Increases and relays external sensory input to higher association areas.
4. **Right Back Insular**—Integrator: Integrates several regions of the brain including the “where” and “when” visual, and the faster auditory pathway.
5. **Left Amygdala**—Threat System: Triggers fear, anxiety, and anger if a real or perceived threat. Dopamine initiates acting without thought.
6. **Right and Left Front Cingulate Gyrus**—Social Secretary: Party central; stops or starts speaking, triggers interest in others, shifts attention quickly for good cocktail party skills. Focuses on the outside world, pleasure, and what’s new and exciting. Based on emotional signals, the automatic nervous system and speaking are started or stopped.
7. **Right and Left Temporal Lobes**—Processor: Processes and integrates emotions, external sensory input, and learning. Working memory operates here. Sends messages up to the motor area to move muscles.

**Figure 2.3. Shorter Extrovert Dopamine Pathway**

Note: Adapted from *The Hidden Gifts of the Introverted Child: Helping Your Child Thrive in an Extroverted World* (p. 29) by M.O. Laney, 2005, New York, NY: Copyright 2005 by Workman Publishing Company, Inc.

## 2.14. The Online Learning Environment

Online learning began as far back in the literature as 1840 when Pitman developed a correspondence course teaching workers in Business Administration a more efficient method of note-taking called shorthand (Verduin & Clark, 1991). In 1873, Ticknor, “founded the Society to Encourage Study at Home” in the form of correspondent courses designed for women who had the choice of 24 courses in six difference departments (MacKenzie et al., 1965, in Harper et al., p. 588). In 1891, Foster developed an educational pamphlet for workers in mines, teaching the elements of safety (Mood, in Harper et al., 2004). Courses were developed to assist the influx of immigrants into the United States and Canada “to inculcate newcomers into the social, cultural and economic norms of the day” (Sumner, 2000, p. 274). This form of distance learning was in print correspondence; a very time-laden form of education, dependent for many years on a most uncertain postal system. America was firmly entrenched in demanding and providing distance learning through print correspondence upon the development of the United States Postal Service in the 1700s (Harper et al., 2004). See Table 7 for a detailed history.

Retraining the workforce has also been a substantial use of distance education both following the World Wars and now – distance learning is heavily utilized by the National Aeronautics and Space Administration, the Department of Energy, and the Department of Defense in workforce development efforts (Sumner, 2000). In fact, the influx of students and the increase of funds for institutions of higher learning have exhibited a positive relationship regarding distance learning through every economic

downturn, including this 21<sup>st</sup> century economic crisis, since the inception of this form of learning.

With the development of the radio in the late 19<sup>th</sup> century, the computer, video recorder, and the internet in the 20<sup>th</sup> century, an explosion of access to learning occurred in this country and the world. Learning could now occur at any time (asynchronous) and almost any place in the world for the learner with the desire.

Unlimited access opened up the doors of learning to any student seeking an education, retraining or interest. But is distance learning for every student? Can this medium assist all learners in the pursuit of their educational dreams or is it a restrictive medium unintended for some? This review of the literature uncovers data revealing “little or no difference” in terms of the capacity of students learning (Gagne & Shepherd, 2001, in Harper et al., 2004) in the online environment or the more traditional face-to-face learning currently employed by our educational system. However, given the volume of research being conducted in the pursuit of uncovering best practices both for teaching, learning and the kind of student who would be successful in this environment, it seems the educational community is expressing some apprehension toward the online learning environment being equal.

As state laws in the United States required school attendance, society and the government looked to distance learning to increase retention and supplement “in-class instruction” (Harper et al., p. 588). Distance learning has been utilized to “reduce overcrowding and improve teacher to student ratios” (Harper et al., p. 587). Likely, due to the complexity and variability of online course offerings, however, the Government also stepped in passing the Higher Education Law of 1965 in an effort to increase the use

of distance education, while simultaneously limiting the capacity of the applicable audience of learners through restriction of funding for a higher education. The Internet Equity and Education Act (2001) was an attempt to amend the 1965 law allowing an increase in Federal funding for online learning programs; had it passed, the online learning environment would have been available to more students, their tuition supplemented or paid for through grants, Pell loans and financial aid; but the Government did not pass this legislation into law fearing defaults of student loans or abuse of financial aid (Petryni, 1999-2011).

Table 2.7. *The History of Distance Learning*

|             |  |
|-------------|--|
| 1833        | English composition offered correspondence   |
| 1840        | Shorthand offered correspondence   |
| 1843        | Founding of Phonographic Correspondence Society  |
| 1873        | D. E. Correspondence crossed the Atlantic (10,000 students in 24 years)  |
| 1883-1891   | Chautauqua College of Liberal Arts formed with correspondence courses  |
| 1891        | Mining Safety Correspondence Course – Thomas J. Foster – grew to 225,000 students in 1900 to > 2 million in 1920   |
| 1886        | H. S. Hermod's English by correspondence, would become the largest most influential distance teaching organization |
| 1877        | Illinois Wesleyan B.S., M.S., PhD  |
| 1885        | University of Wisconsin  |
| 1892        | University of Chicago  |
| 1901        | Moody Bible Institute over 1 million enrollments world-wide  |
| 1920s       | U.S. relied on radio to teach  |
| 1930s       | Experimental teaching programs produced at Purdue among others   |
| 1950s       | For credit courses offered via television  |
| 1960s       | Development of Satellite technology allowing for greater coverage for instructional television                     |
| 1980s-1990s | Fiber-optic communication systems allowed wide spread use  |
| Mid 1980s   | World Wide Web allows for even greater access  |

## 2.15. Grading as a Metric in a U.S. Academic Setting

Editors Laska and Juarez (1992) wrote that “good grades can open doors to opportunity, while bad grades can and do close them” (p. 4). In other words, “grades are important in academic life, and they can have critical effects on the lives of students. It is, therefore, as important to understand the nature of academic successes as it is to predict it” (Baird, 1972, p. 2). Student grade point averages (GPAs) are used by many companies as a gauge in their selection methods for future employees. Students concern themselves with grades. This is as true in the minds of students in the 21<sup>st</sup> century as it was in the minds of those obtaining an education in the 18<sup>th</sup> century at Yale University where President Stiles indicated to 58 of his students sitting for an examination in the year 1785 received the following grades: “Twenty *Optimi*, sixteen second *Optimi*, 12 *Inferiores (Boni)*, ten *Pejores*. ” Thus began the practice of *grading* students in institutions of higher education. Harvard University followed suit, creating a four-point numerical scale in 1830 and a hundred-point numerical scale in 1837 (Laska & Juarez, 1992, p. 7). Describing the widely used 5- category grading system in the United States of A, B, C, D, F as funneling of “sophisticated” multivariate measures into a univariate outcome, Avner (1970) defined the concept of grading in the following manner: “the academic grade is, from one standpoint, an example of such a univariate measure. A single grade is typically used to summarize a multivariate collection of measurements and judgments of student behavior in a given course” (p. 1).

### 2.15.1. Grading Systems in the U.S.

There are, essentially, two types of grading systems employed in the assessment of learners in the U.S. educational system. One can be termed *comparative grading*, the other is called *mastery grading* (Laska & Juarez, 1992). The comparative grading system is defined by Laska & Juarez as providing “two or more hierarchical categories for the formal evaluation of students. The grading categories may be represented by evaluative words, a hierarchical sequence of numbers, or letters of the alphabet. There are two basic characteristics of this grading system: “1) a fixed period of time for the determination of a student’s grade, and 2) an expectation that all students will not earn the highest grade” (Laska & Juarez, 1992, pp. 4, 5). Imagine the five-category grading system mentioned above. The mastery grading system has only one “meaningful” grading category, which is that the student has been a successful learner. A student assessed within this grading system will not be labeled as a failure as there is always the possibility that he/she will eventually become a successful learner. There is also no fixed period of time associated with learning in this category (Laska & Juarez, 1992).

Adding to the complexity, a choice in comparative grading systems has also been devised into the sub-systems *absolute* and *relative*. In an absolute comparative grading system, each learning task is assigned certain points, at the end of the grading period those points are summed and students whose points fall into a specified range will receive an A; those obtaining points in the subsequent range, will receive a letter grade of B, and so on. In the relative comparative grading system, students are rank-ordered given their academic achievement and grades are assigned based on the students’ rank (Laska & Juarez, 1992). As evidenced by the syllabus for the course selected for study in this

research, the comparative absolute grading system is employed. These grades, however, will be self-reported by the students participating in the study.

#### 2.15.2. Grading Scales in the U.S. Achievement or Public Record

Grade scales can consist of any number of grade categories. Avner (1970) points out that the number of categories, however, determines the grading scale reliability. Using Pearson's tables of volumes, Avner (1970) constructed 5 X 5 contingency tables which represent the number of joint categorizations on two scales having a population correlation of  $p$  and a given sample size N. Avner noted that this construction where  $p = .95$  is nearly as close as the "minimum degree of relationship,  $p = .94$ , necessary for measures of individual accomplishment" noted by Kelly in 1927 (p. 3). In order for  $r_c$ , the correlation coefficient to be maximized for  $p = .95$ , the optimum value is 4 standard deviations.

It is in the interpretation of  $r_c$ , however, that Avner found the *reason* for the grading as the driver of the scale used. Avner (1970) stated, "if grades with maximum reliability and validity are desired and the underlying distribution of performance is normal, grade scales with large numbers of categories must be used" (p. 5). Avner based this on Ebel's findings in his book *Measuring Educational Achievement*, where Ebel calls it a "fallacy to believe that one can reduce the effect of unreliable measures by reducing the number of grade categories. Reduction of the number of categories simply reduces the reliability of the measure still more" (Avner, p. 5). For example, if the scale is used for categorization of a student needing to repeat a course, or one who might continue in a sequence of courses, or a student so advanced as to be capable of skipping a course in a

sequence, and those decisions are made based on a five-category grading scale where the distribution of grades attends to a bivariate normal distribution, the categorization would prove reliable, but may not be valid. Furthermore, scales designed to be used for prediction can often “reduced to an efficient scale for categorization” (Avner, p. 9), but not vice versa. Avner concluded, if “either prediction or both prediction and categorization are required, it is desirable to have a scale with the largest practical N” (p. 9).

Randall and Engelhard (2009), conducted a literature review of the facets in the compilation of grades stating “teachers grades as a construct primarily consist of some unknown combination of student academic achievement (criterion-referenced performance), ability (similar to aptitude, but not student classroom achievement), effort (how hard a student works), and behavior (student conduct in class)” (Randall & Englehard, 2009, p. 2.); the funneling of multi-variate components into a univariate outcome previously mentioned. Their study was to determine if teacher-assigned grades were “influenced by the classroom achievement, ability, behavior, and effort of students” (Randall & Englehard, 2009, p. 3). Previous research uncovered by Randall and Engelhard, found that, indeed, non-achievement oriented facets were considered in the assignment of grades. Effort, ability, participation, preparedness/organization, perceptions of student effort, and concern for moral development all influenced the grading practices of elementary, junior high and high school teachers (Randall & Engelhard). Another research project would be necessary to draw conclusions or make statements about the reliability and validity of inclusion of these facets or even to make a statement regarding their relative position on the five-category grading scale used in the

United States' educational system. These findings are included to make the point that assessment and grading of students is a complex system. As indicated by research conducted by the National Research Council, "multiple measures are needed to serve the assessment needs of an educational system" (Pellegrino, Chudowsky, & Glaser, 2003, p. 220).

According to Allen (2005), the basis of determining if a student is "achieving academic knowledge" is the function of a "summative" assessment in the form of a "letter or numeric" grade (p. 219); Bailey and Tighe (1996) reported that "the primary purpose of secondary level grades and reports [is to] communicate student achievement" (p. 120). Still others report the "major reason for assigning grades is to create a public record of a student's academic achievement that can accurately and effectively communicate to others the level of mastery of a subject and student has demonstrated" (Allen, 2005, p. 219). Friedman and Frisbie (1995, 2000) are proponents of report card accuracy due to the fact that grades will become permanent record on the part of the student, thus the purpose "must be to communicate a valid summary of a student's academic achievement in the subject listed next to the grade on the record" (Allen, 2005, p. 219). Allen's article stresses the necessity of validity of the grade received due to the fact that it is the reflection of academic success achieved by the student. Ken O'Conner (2009) supports these findings regarding the relationship between academic achievement and grades. O'Conner stated "a grade is a symbol (letter or number) on a report card that summarizes student achievement" (p. 1). Although his research emphasizes the reformation of grading in the traditional sense (i.e., eliminating potential subjective influence or components), one cannot mistake the purpose of grades as presented by

O'Conner (2009), he states "It is essential to be clear about the primary purpose of grades, which is to communicate students' achievement of learning goals" (p. 2).

### 2.15.3. Self-Reported Grades – Validity and Reliability

The question of reliability may come to mind as a researcher decides on the use of self-reported information. Will the student report their grade honestly? Research conducted on the reliability, validity and even predictive nature of self-reported grades has determined that this method is reliable, valid and even predictive (Baird, 1976; Kuh, et al., 2001; Kuh, et al., 2007; NSSE, 2009, Pace, 1985; Pohlmann & Beggs, 1972; Volkwein, 2005;) given certain conditions. The addition of conditions, researchers found, needed to be addressed whether research was conducted through longer survey and questionnaires (Kuh, 2001) or through brief self-ratings (Baird, 1976).

In 1976, Baird composed a research monograph entitled *Using Self-Reports to Predict Student Performance* sponsored by the College Entrance Examination Board and the EXXON Education Foundation. In it, Baird presented the most common practices and instances associated with the use of self-reported data in educational settings. Baird discussed the instruments reviewed in the monograph as "relatively specific measures" (p. 1) for obtaining personal data and further defined the instruments reviewed as *brief* tending "to be direct rather than indirect" and "based on self-expressions rather than scales composed of diverse, subtle items" (p. 1). This distinction is important as we learn with later research.

An early study mentioned by Baird, was Walker's (1937) study of students self-reporting their father's occupation as well as their current class standing in a

questionnaire. Walker's study found that self-reported "agreed very well with official records" (Baird, p. 2). Callahan (In Baird, 1976, p. 3) came to conclude that "accuracy was higher for items concerned with present fact, and suggested: ...respondents generally will tend to tell the truth even when it may reflect on their prestige, provided that the question of fact concerns the respondent's present status rather than past events."

Callahan's study was conducted in 1968. The author concluded that this concern with present status may have something to do with long and short term memory, which will not be studied here. In 1967, 1968, and 1969, Walsh (In Baird, 1976) conducted studies with college students assessing the validity of self-report and concurred findings of Callahan's, that "students generally provide accurate reports of their past behavior even when items deal with sensitive issues, failing courses, for example" (p. 3). Walsh also made some significant discoveries: 1) no difference in accuracy of self-report for "interviews, questionnaires, or personal-data banks" were noted and 2) later studies concluded that accuracy was not altered "when students were given financial or social incentives to distort their self-report" (p. 3.). Baird (1976) also reported on Maxey and Ormsby's findings with a sample of 5,775 students self-reporting their nonacademic achievements; interestingly enough, there was a 90% agreement found between student-reported and school-reported achievements. The remaining 10% was accounted for in this manner, six percent "claimed an accomplishment for which the school had no record" and the remaining four percent under-reported their achievement, having to rely on the institution to make the claim (p. 3). Baird (1976) concluded the following conditions must be met to ensure valid, reliable and predictive self-reports. "Self-reports seem to be accurate when they deal with matters that are fairly recent, relevant to the

person's present interest and concerns, verifiable, and, as we shall see in this review, when the questions are phrased in the best way" (p. 4).

Also, included in Baird's (1976) monograph were details pertaining specifically to self-reported grades.

In 1940, Perry (In Baird, 1976) found correlations between school-reported and self-reported grades of .83 for high school students with grades above 80% and a correlation of .66 for those below 80%" (p. 5). In 1952, Dunnette (In Baird, 1976) reported a correlation of .94 between school- and self-reported grades. And in 1963, Davidsen (In Baird, 1976) yielded a correlation of .93 between self-reported and high-school-reported grades in a large sample of students who were applying to college and who knew that their reported grades would be part of the basis for admission (p. 5).

Walsh's (1967, 1968, and 1969) studies to report accuracy was replicated by Richards and Lutz (1968) finding this type of accuracy self-report "correlated .84 and .86 with college reported GPAs among men and women, respectively at 19 four-year colleges" (p. 6). Correlations of  $r = .85$  and  $r = .87$  were also reported at 13 two-year colleges with regard to reported GPAs among men and women, respectively. In 1969, Baird conducted a similar unpublished analysis finding the correlations to be .83 and .86 for men and women, however, throughout these studies, no conditions have been set addressing the issue of gender.

The issue of specificity regarding the questions on the survey was uncovered in a study conducted in 1975 by Armstrong and Jensen (In Baird, 1976). This study was conducted with "2,775 randomly selected applicants to colleges in the Massachusetts State College System" (p. 7). When those students completed their SAT test, they also completed the Student Descriptive Questionnaire (SDQ), which obtained biographical data (self-reported). Like other studies, this SDQ was comprised of questions which

could have been verified through transcripts obtained from the high schools the students attended. The findings were as follows: “71.7% of student-reported grades agreed exactly with transcript grades, and that 97.4% agreed within one grade. Although 21% overrepresented their grades by one or more grade, seven percent underrepresented them” (Baird, p. 7). Analyzing the discrepancies, Armstrong and Jensen conducted analyses of the choices available to students on the SDQ and came to the following conclusions:

The SDQ needs to take account of multiple grades in the various academic areas assessed; provide better options for non-conventional grades; provide clearer instructions to students who had not taken courses in an area; eliminate the use of the term “semester” because it is not commonly used in high schools; provide examples for students to use as guides; define “social studies: more precisely; encourage students to check their grades with authorities if they are in doubt about them; and use a common time-point for all students, such as end of the junior year (p. 7).

“Students,” Baird (1976) surmised, were confused by the format of the questions, and had responded as well as they were able to do” (p. 7). This finding lead to the aforementioned condition stating question should be clear with no subtlety.

Kuh conducted another study, in 2001, finding similar results regarding the conditions pertaining to validity as had Baird in 1976. They are as follows:

1. The information requested is known by the respondents;
2. The questions are phrased clearly and unambiguously;
3. The questions refer to recent activities;
4. The respondents think the questions merit a serious and thoughtful response; and

5. Answering the questions does not threaten, embarrass, or violate the privacy of the respondent or encourage the respondent to respond in socially desirable ways (p. 4).

All of the studies reviewed in this portion of the literature review asked the students to self-report grades as only one in a survey of many questions requiring a response. We now know that grades are valid and reliable when taken as a self-reported measure. This finding is critical to this study as that is how the grades will be obtained from the respondents, and that grade will be used as a measure of their success in their online course. In order that we may predict that success in this online course will translate into predicting success in another online course, we have to turn to the literature on predictability of self-reported grades.

#### 2.15.4. Self-Reported Grades – Predictive Ability

Hoyt and Munday (1968) revealed that self-reported grades are predictive and sometimes even “better predictors of college grades than tests of academic aptitude....or the ACT” (p. 9). Additional research conducted by Baird (1976), Hoyt (1963), and Richards, Holland and Lutz (1967) reported the same conclusion regarding self-reported grades. Hoyt and Munday’s 1968 summarized data obtained by the “American College Testing Program for 437 colleges between 1965 and 1967” (In Baird, 1976, p. 7) involving 273,000 students. They discovered that the “student-reported high school grades were better predictors of college grades, on the average (the median correlation across colleges was  $r = .54$ ), than were the ACT tests (the median correlations was  $r = .48$ )” (In Baird, 1976, p. 7). In 1973, the American College Testing Program

conducted a similar survey in the years 1968 to 1970, analyzing data from 419 colleges and 298,000 students and the results were very similar. “Student-reported grades were better predictors than the ACT tests, on the average (the median correlations were  $r = .51$  and  $r = .47$ , respectively” (In Baird, 1976, p. 7). In 1969, Cole analyzed “data from 19 subject areas” finding “that self-reported grades predicted grades better in areas representing 304 specific courses, that ACT tests were better predictors in areas representing 69 courses, and that they were equal in areas representing 44 courses” (In Baird, 1976, p. 7). Baird concluded that “there is considerable evidence that self-reported grades can be as useful as school-reported grades as predictors of college grades” (p. 8).

#### 2.15.5. Success and Failure in an Online Academic Setting

Review of the literature has revealed two defined courses of research followed by scientists when studying online learning. Both courses of research had been driven by initially low rates of retention and high rates of failure associated with online learning. These factors have been the catalyst in scientists choosing to study either the characteristic of the learning environment or the characteristics of the learner pertaining to online learning (Roblyer, Davis, Mills, & Pape, 2008). Menchaca and Bekele provided a detailed “summary of success factors in online learning” in their 2008 study reviewing and encompassing a shift in the literature toward identification of *factors of success*, as opposed to reacting to instances of failure, pertaining to online learning (p. 233).

The only literature uncovered utilizing a combined approach of study examining both the characteristics of the learner *and* the characteristics of the environment in terms of success in online learning comes from the research of Roblyer et al. (2008). Roblyer

et al., point out that while common themes can be noted from previous research studying characteristics in either the learner or the learning environment as they pertain to success, there is little generalizability, little follow-up or longitudinal study, and inconsistent findings with varied populations. This particular study focused on participants enrolled in 196 courses from the Virtual High School Global Consortium (VHS). The instrument used was the Educational Success Prediction Instrument (ESPRI), a seventy-item questionnaire with responses based on a Likert Scale from 1 to 7. Items were omitted or added based on their pertinence to the factors studied. For example, those items found in previous uses of the instrument by the same author to “make little contribution to the prediction indexes” (Roblyer et al., p. 95) were omitted, while additional items were needed to assess learner characteristics and, thus, were added. No strategic validation of the additional assessment items was provided, however, the instrument was added to the communication system of all courses in the VHS with the completion incentive of ten extra credit points per student. Fifty-three percent of the total number of students accessed the survey and completed it; an additional 17% completed some portion of the survey, their responses were counted in the findings. Success was defined in this study as completing the course with a grade of A, B, C; failure was defined as receiving a grade of D, F, I or W. Interestingly enough, both self-reported and actual grades were used.

Roblyer et al., (2008) noted that predicting student success based on student characteristics and learning environment was much easier than predicting student failure. Since a student’s “past ability (e.g., as reflected in GPA) is a significant predictor of current success” (p. 150) that specific student characteristic combined with environmental success factors such as having a computer at home or being given school-

day time to work on their online course can be valuable in establishing a predictive model for success in an online VHS course. In other works, learner characteristics as well as the characteristics of the learning environment contribute positively to student success in an online learning environment.

By Roblyer et al.'s (2008) own admission, the findings have to be viewed tentatively given the "nature of the population and the ways in which the data were collected" (p. 105) in this study. Thus, the definition of success continues to be defined as a several pronged term in the literature.

Success can be defined through a variety of terms as associated with the academic classroom. Terms found in the literature defining success include satisfaction, motivation, the assigning of a letter grade of A, B, C, or D viewed as passing, and therefore, achieving success in a class. The definition of success may change substantially in an online environment. In fact, Kanuka and Nocente (2003) suggested that success in an online environment often tips the scale of responsibility for successful learning onto the learner, requiring them "to assume greater responsibility for how best to work through the learning transaction" and, thus, gain success (p. 228). The literature also suggested that in an online environment success can be measured based on student retention (Moore et al., 2002) along with the above mentioned terms. A student completing an online course is considered a success for simply having done so. Perhaps the environment is so new, that completion is a measure of success in and of itself. Kim and Schniederjans (2004) concluded that "achievement reflected in grades is important because the Web-course effectiveness of learning is measured in terms of students' achievement (i.e., grade) and satisfaction" (p. 96).

## 2.16. Summary

This chapter presented an overview of topics related to this study as well as a detailed view of pertinent literature published most recently and providing confirmation or evidence that a study such as is presented will be useful and valuable to the field of academic research relating to online instruction.

Evidence has been provided in this chapter reflecting that many personality assessment tools have some common capabilities with the Myers-Briggs Type Indicator® and are, in fact, based on the works of Jung (1921); it would seem prudent, then, to use the assessment tool most imitated, most replicated, and most referenced in the literature to assess the personalities of the online students in this study. Evidence confirming the choice of this assessment tool was also uncovered and presented during the review of this literature.

The review of this literature did indicate a significant difference between individuals' personality types and in particular as that difference relates to the introvert-extrovert scale. Simultaneously, this review produced evidence of the use of new technologies in the assessment of individual characteristics based on personality type, aptly titled *biological* personality type as they are measured in the brain and through the use of PET scans, MRIs and the like. Laney's (2006) work and identification, for example, of the learning pathways utilized by those identified as introvert or extrovert, along with the self-reported assessment tools, may further the study of learning and cognitive function in individuals far more quickly than self-reported tools alone. As most of the findings regarding *biological* personality types pertain to the introvert-extrovert

scale, it will be interesting to assess more detailed characteristics associated with the other components of the personality as assessed by the MBTI.

Distance education and the creation of the online learning environment were also presented depicting important facts about learners. They will find a way to obtain knowledge and the creation of the internet has not only provided more access, but also created the necessity of the educational community to evaluate the best practices and methods with this type of instruction.

In addition, the case was made in support of the use of self-reported grades as accurate predictors of student performance based on scientific literature. This review also outlines the steps identified in the literature to obtain honest self-reported data. The following chapter will examine the statistical methodology for this study.

## CHAPTER 3. METHODOLOGY

The introduction presented the rationale and purpose of this study. The review of the literature served to point out a gap in the research pertaining to personality type, as indicated by the Myers-Briggs Type Indicator® (MBTI), and success in an online environment. It also revealed the widespread use of the MBTI as a valid and reliable tool for the purposes of indicating preferences and characteristics of students in higher education (Myers et al., 1998) and their subsequent impact on performance. Success in a synchronous or asynchronous environment, however, is not based on performance alone. In the current global educational environment, there may be sense of returning to Dewey's Experiential Educational method (Frase & Streshly, 2000) as educators, while simultaneously seeking to infuse an increase in ethics, morals and values in individuals and communities. As indicated by this method, educating the whole student is the focus. The MBTI plays a part in that redirection through preferences revealed by this typology, which may implicate a link between personality type and success in an online environment. Chapter 2 also provided the explanation for the selection of the MBTI as the primary instrument for this study.

One limitation unveiled in the review of literature was the lack of studies identifying the success of students in an online environment. Given the current use of online degree programs (one Google search indicated 61,600,000 hits) the results of this study may provide pertinent data as the online world of education expands.

The purpose of this chapter is to describe the design of the study, its population, and the statistical treatment to be utilized in analyzing the data.

### 3.1. Design of the Study

This quantitative research attempted to deduce a relationship between the independent (MBTI personality type) and dependent (self-reported grades) variables through the use of statistical hypothesis testing.

#### 3.1.1. Research Questions

The following research questions will be posited for the purpose of this study:

1. Is one personality type as indicated by the Myers-Briggs Type Indicator® more likely to enroll in an online course?
2. Is there a relationship between academic success in an online environment (passing grade) and a specific personality type as indicated by the Myers-Briggs Type Indicator®?
3. Is there a relationship between academic failure in an online environment (failing grade) and a specific personality type as indicated by the Myers-Briggs Type Indicator®?

(H<sub>0</sub>) = No relationship exists between students' personality type and success in an online course.

(H<sub>1</sub>) = A relationship does exist between students' personality type and success in an online course.

### 3.2. Variables

#### 3.2.1. Dependent Variable

The *dependent* variable in this study is the passing/failing grade reported by the student indicating success or failure in this online course. Success will be noted by self-reported grades of A, B, C, or D; whereas, non-success will be determined by the self-reported grade of F.

As uncovered in the review of literature, self-reports appear “to be accurate when they deal with matters that are fairly recent, relevant to the person’s present interest and concerns, verifiable, and, as we shall see in this review, when the questions are phrased in the best way” (Baird, 1976, p. 4). Because of this, the self-report of grades will occur during the semester in which the student is enrolled in the course utilized for the study and the question obtaining this information will be carefully stated.

#### 3.2.2. Independent Variable

The attribute independent variable(s) in this study are the personality type of each student as indicated by the MBTI. Independent variables being defined as present prior to the study. There are, according to the MBTI, 16 types; thus, there are sixteen

categories for this independent variables found in Table 3, which is repeated here from Chapter 2 to assist the reader in recalling the types.

Table 3.1. (Repeated) *The Sixteen Types of Personalities Noted Through the MBTI*

|      |      |      |      |
|------|------|------|------|
| ISTJ | ISFJ | INFJ | INTJ |
| ISTP | ISFP | INFP | INTP |
| ESTP | ESFP | ENFP | ENTP |
| ESTJ | ESFJ | ENFJ | ENTJ |

Note; Adapted from *MBTI Manual: A Guide to the Development and Use of the MBTI Type Indicator* (p. 64) by I.B. Myers, M.H. McCaulley, N.L. Quenk and A.L. Hammer, 2003, Mountain View, CA: CPP, Copyright 2003 by P.B. Myers and K.D Myers. Used with permission for adaption from CPP.

### 3.3. Population and Sample

The population for this study was comprised of degree-seeking traditional and non-traditional, undergraduate and graduate students admitted to a Big 10 land-grant University in the Mid-West. The sample frame consisted of a possible 1201 students from a variety of academic majors seeking to fulfill a degree requirement through the Department of Continuing Education - Distance Learning's online course offerings in the Spring 2011 semester. The sample represented 102 students exhibiting fifteen of the sixteen possible categories of personality type differentiated by the MBTI®, seeking degrees in eleven colleges across campus. Thirty-six online learning environments were also exemplified within this study through the courses these participants chose; some were duplicated in terms of subject matter and instructor. This study was approved by

the Institutional Review Board (IRB), given that human subjects were a necessary component to its completion. A copy of the approval document can be found in Appendix A.

### 3.3.1. Participant Pool

The student profile initially approved by the Institutional Review Board (IRB) comprised of the ENGL 420 and 421 online courses taught during the spring semester 2011. This would have given the researcher a possible participant pool of 200 students. Initial requests for participation, however, yielded such a low response rate (2%) that modification measures had to be employed. Approval for a modification of the study was submitted to and received from the Institution Review Board (IRB) so that the study could proceed (See Appendix A and B). This request included all online learners for the spring semester 2011 (1201 possible) in online courses offered (36) and the addition of an incentive in the form of a chance to receive a \$50 Wal-Mart gift card. The number of participants responding to the invitation to voluntarily assist in this study was 102; for an 8.49 percent response rate.

### 3.3.2. Collection Method

The researcher sought permission for participation from the students currently enrolled in all sections of distance learning courses for the Spring, 2011 semester. Students' response to the invitation email provided the necessary consent to voluntarily participate in this research study. The initial email invitation to participate in the

research study was dated April 12, 2011. The deadline to respond was April 18, 2011. A copy of the letter of introduction and access directions are included in Appendix C.

The researcher provided a URL link whereupon the student accessed an online copy of the MBTI - Form M complete with instructions and answer form for the instrument (Appendix D). The Dean of Students' Testing Center compiled the completed questionnaires, providing a hard copy to the researcher after the close date. The use of the MBTI Form M was funded by the Purdue University Department of Continuing Education; the Office of Distance Learning. The researcher was the only person to have access to the completed MBTI results.

Creating the appropriate environment for the self-reporting MBTI was essential to producing the best-fit type of each respondent (Myers, et al., 1998). Information included in the letter of explanation attempted to create the environment necessary including addressing the following information: 1) taking the MBTI is voluntary, 2) there were no right or wrong answers, 3) the MBTI does not assess mental or emotional health, 4) the respondent is the judge of the accuracy of results and will be provided with their results upon request, and 5) their individual MBTI results will remain confidential.

The MBTI Form M is a 93-item forced choice inventory based on Jung's (1921) theory of personality type. It is designed to identify the respondent's preferences in both cognitive and affective dimensions. Form M, published in 1998 is a re-design of the instrument aimed at improving the precision of reporting within the dichotomies, particularly at the mid-point as well as eliminating separate scoring keys related to gender. The revised Form M was also devised to make clearer the typing of the

individual's preferences by eliminating *all* peripheral questions not pertinent to preference typing (Myers, et al, 1998).

The Form M is designed for completion in as little as 15 to 20 minutes, however, there is no time limit required. It is designed for comprehension at the seventh grade reading level and is meant for use with a normal population (over 14 years of age). The scoring is as follows: each response is assigned one-point, points are summed for each scale, the pole with the most points is assigned as the respondent's preference; this is done on each of the four dimensions producing a four-digit type (Myers, et al, 1998).

As with all instruments, there are limitations. The authors of the MBTI have expressed two. The first is the age appropriate limitation. This instrument has *not* been designed for respondents below the age of 14. According to theory, individuals below the age of 14 are "likely to have less complete and confident knowledge of themselves" and would be less likely to express the attitudes and behaviors underlying their personality preferences (Myers, et al., p. 106). For this study, all participants are expected to be older than 14.

A second limitation of the MBTI as expressed by the authors concerns the T-F (Thinking-Feeling) dichotomy. The authors state that "since the acquisition of good judgment is postulated to be the most difficult to develop, the T-F scale is expected to be particularly vulnerable to deficiencies in type development; therefore, the lowest reliabilities in less effective samples are expected to occur on the T-F scale" (Myers, et al., 1998, p. 160).

As stated in Chapter 2, reliability and validity of the MBTI has been firmly established. Logical and split-half reliability coefficients range from  $r = 0.89$  to  $r = 0.94$

(N=3,036) for Form M. This exhibited an increase from  $r = 0.82$  to  $r = 0.86$  (N=32,671) with the preceding Form G. The MBTI manual (Myers, et al., 2003) report internal consistency with continuous scales based on co-efficient alpha ranging from  $r = 0.88$  to  $r = 0.93$  (N=2,859).

### 3.4. Participant Profiles

Participants in the online courses for the spring semester 2011 are represented in Table 8. These frequencies, presented in Table 8, are based on the dependent and independent variables of MBTI type and grade assessed for success in this study. As can be seen from the table below, the personality types with the highest frequencies in this study are ESTJ (16.67%), ISTJ (14.71%), ENFJ (10.78%), and ISFJ (10.78%). There was one personality type of the possible 16 that was not represented by any responses in this sample – the ENTJ type.

Table 3.2. *Frequency Distribution by Personality Type and Grade*

| MBTI  | A  | B  | C | Total N | Percent of Total |
|-------|----|----|---|---------|------------------|
| ENFJ  | 5  | 6  | 0 | 11      | 10.79            |
| ENFP  | 6  | 2  | 1 | 9       | 8.82             |
| ENTP  | 4  | 0  | 0 | 4       | 3.92             |
| ENTJ  | 0  | 0  | 0 | 0       | 0.00             |
| ESFJ  | 6  | 2  | 0 | 8       | 7.84             |
| ESFP  | 1  | 1  | 0 | 2       | 1.96             |
| ESTJ  | 10 | 7  | 0 | 17      | 16.67            |
| ESTP  | 2  | 1  | 1 | 4       | 3.92             |
| INFJ  | 2  | 0  | 0 | 2       | 1.96             |
| INFP  | 1  | 6  | 1 | 8       | 7.84             |
| INTJ  | 2  | 0  | 0 | 2       | 1.96             |
| INTP  | 0  | 1  | 0 | 1       | 0.98             |
| ISFJ  | 6  | 3  | 2 | 11      | 10.79            |
| ISFP  | 4  | 0  | 0 | 4       | 3.92             |
| ISTJ  | 11 | 4  | 0 | 15      | 14.71            |
| ISTP  | 2  | 1  | 1 | 4       | 3.92             |
| Total | 62 | 34 | 6 | 102     | 100.00           |

Table 8 indicated a range restriction regarding the grades reported by the responding participants. Every student indicated that they expected to be successful in their online course; little useful analysis can be conducted when the full grade scale is not present. This initial finding was pause for thought in terms of what any further analysis might reveal and how to go about defining that within the approved parameters of this research.

The statistical package used to analyze the data was the Statistical Analysis System (SAS). SAS code was employed to run descriptive statistics, Chi-Square, which will be described in detail in statistical treatment section of this chapter. The SAS code used is included in Appendix C. Where Chi-Square statistics was not possible due to sample size in each cell, the Fisher's Exact Test was employed.

Table 9 presents the demographic of gender for the use of further understanding regarding the make-up of the participants.

Table 3.3. *Gender Type of Participants*

| Gender | Frequency | Percent |
|--------|-----------|---------|
| Female | 83        | 81.37   |
| Male   | 19        | 18.63   |
| Total  | 102       | 100.00  |

Table 10 shows the representation of the college of the participants, again, presented to give the reader a better understanding of the students participating in the online learning environment.

Table 3.4. *Colleges Represented by Participating Students*

| College                       | Frequency | Percent |
|-------------------------------|-----------|---------|
| Agriculture                   | 4         | 3.92    |
| Education                     | 6         | 5.88    |
| Engineering                   | 7         | 6.86    |
| Health and Human Sciences     | 28        | 27.45   |
| Liberal Arts                  | 20        | 19.61   |
| Management                    | 9         | 8.82    |
| Pharmacy                      | 2         | 1.96    |
| Science                       | 6         | 5.88    |
| Technology                    | 18        | 17.65   |
| Undergraduate Studies Program | 1         | 0.98    |
| Veterinary Medicine           | 1         | 0.98    |
| Total                         | 102       | 100.00  |

Although course selection was not a measured variable for this study, Table 11 was created providing the reader with the represented online courses and the number of students participating in each in this study.

Table 3.5. *Online Courses and Frequency of Study Participants*

| Class       | Frequency | Percent | Class    | Frequency | Percent |
|-------------|-----------|---------|----------|-----------|---------|
| ANTH 205    | 1         | 0.98    | HORT 403 | 1         | 0.98    |
| COM 212     | 5         | 4.90    | IT 351   | 1         | 0.98    |
| COM 318     | 2         | 1.96    | LIT 100  | 1         | 0.98    |
| CSR 390     | 2         | 1.96    | MGMT 200 | 2         | 1.96    |
| EAS 100/191 | 1         | 0.98    | MUS 250  | 2         | 1.96    |
| ECON 201    | 1         | 0.98    | MUS 375  | 2         | 1.96    |
| ENGL 205    | 1         | 0.98    | NUR 399  | 1         | 0.98    |
| ENGL 227    | 2         | 1.96    | OLS 274  | 1         | 0.98    |
| ENGL 237    | 1         | 0.98    | PHIL 206 | 1         | 0.98    |
| ENGL 238    | 2         | 1.96    | PHIL 212 | 1         | 0.98    |
| ENGL 420    | 5         | 4.90    | POL 130  | 5         | 4.90    |
| ENGL 421    | 8         | 7.84    | PSY 235  | 1         | 0.98    |
| FN 303      | 4         | 3.92    | SOC 100  | 11        | 10.78   |
| HIST 104    | 9         | 8.82    | SOC 220  | 11        | 10.78   |
| HIST 152    | 1         | 0.98    | SOC 310  | 5         | 4.90    |
| HIST 235    | 1         | 0.98    | SOC 382  | 2         | 1.96    |
| HIST 236    | 1         | 0.98    | SOC 391  | 1         | 0.98    |
| HORT 306    | 1         | 0.98    | STAT 301 | 5         | 4.90    |

### 3.5. Statistical Treatment

#### 3.5.1. Chi-Square Statistic

The analysis of the data began by creating a 16 X 4 contingency table based on the number of observed counts where participants indicate a specific personality type (out of sixteen possibilities) and self-report one of four possibilities for grades. The expected counts for each cell were calculated based on the formula below:

$$\text{E.C.} = \frac{\text{Row total} \times \text{Column total}}{\text{Overall total}}$$

Overall total

The expected count was used along with the observed count to calculate the partial Chi-Square ( $\chi^2$ ) with the following formula:

$$(Observed Count - Expected Count)^2$$

The statistical treatment consisted of seven steps providing the answer of a relationship's existence, or lack thereof, between personality type and success in an online course.

**Step 1** was the creation of the 16 X 4 Contingency Table. The numbers exhibited here indicated observed counts for each of the possible sixteen personality types indicated by the Myers-Briggs Type Indicator™ by grade in the online course. Totals were also calculated for rows (MBTI types), columns (online course grade) and an overall summation.

**Step 2** was the calculation of the expected counts for each cell. This was obtained using the following formula:

$$\text{Expected Count} = \frac{\text{Row total} \times \text{Column total}}{\text{Overall total}}$$

**Step 3** was the calculation of the partial Chi-Square ( $\chi^2$ ), which allowed for the creation of another table through the application of the following formula:

$$\text{Partial } (\chi^2) = \frac{(observed - expected)^2}{Expected}$$

A larger Partial ( $\chi^2$ ) value informs us of a “presence of a relationship.” If the Expected Count in any one cell  $< 5$  the Fisher’s Exact Test was applied to reflect the significance of the relationship. If the Expected Counts in all cells are  $> 5$ , the Chi-Squared Test was applied for a similar result. The Expected Count was calculated for each cell in the contingency table; subsequently, we used the Expected Count to calculate the Partial ( $\chi^2$ ) value related to that cell. The end goal was to add Partial ( $\chi^2$ ) values to determine the Chi(2) test statistic, which lead to step four.

**Step 4**  $\chi^2$  - Stat =  $\sum$  all Partial ( $\chi^2$ )

**Step 5** determined the degrees of freedom ( $df$ ). The calculation was made with the following formula:

$$df = (\# \text{ rows} - 1)(\# \text{ columns} - 1)$$

**Step 6** Use  $\alpha$  and  $df$  to obtain  $\chi^2$  cutoff

This information provided a test of significance. The  $\chi^2$  cutoff value depended on  $\alpha$  and degrees of freedom; alpha exhibiting the level of significance.

**Step 7** provided the conclusion for all preceding calculations. It answered the question of the hypothesis in the following manner:

If  $\chi^2$  test statistic  $>$  X<sup>2</sup> cutoff, then Reject H<sub>0</sub> and Assert H<sub>1</sub>

If  $\chi^2$  test statistic  $\leq$  X<sup>2</sup> cutoff, then do not reject H<sub>0</sub>

### 3.6. Summary

This chapter described the research design and methodology pertinent to this study. The mechanics of this study along with a detailed description of the measurement tool have been presented. Dependent and independent variables have been identified and described as has the research design. This provided the groundwork for the proper analysis to be conducted in Chapter 4.

## CHAPTER 4. RESULTS

This study was designed to assess a possible relationship between an individual's personality type and success in an online learning environment. Additional questions that came into play included: is one personality type more likely to enroll in an online course? Is there a positive relationship between academic success (passing grade) and a specific personality type? And is there a positive relationship between academic failure (failing grade) and a specific personality type? These questions are important to study given the popularity of courses and degrees in the online environment as a gauge to match student to environment for the best learning. If data yield information that can direct the field toward better advising to and choices of students regarding the online environment, just imagine the impact on education and learning. This study was not designed nor completed in an attempt to exclude students from this environment, but to provide additional information to participants and assisting them in making the best decision regarding their learning in this environment. Should certain personality types be indicated as being less successful in the online environment, the advising of students choosing this environment may be altered through suggestion of increased study skills or time management habits leading to greater success and learning in an online environment.

#### 4.1. Self-Reported Grade Range

Given that the self-reported grade was a variable in this study, Table 12 indicates the range and distribution of grades in this analysis. Every grade is a passing grade, indicating success in the online course and environment, a full 60.78% were As, followed by one-third (33.33%) Bs, with the scale ending with only 6 reported (5.88%) Cs. This range restriction provides no variation in terms of the measurement of success or failure thereby effectively precluding any viable analysis in terms of research questions pertaining to this study.

Table 4.1. *Indication of Grade Range Restriction*

| Grade | Frequency | Percent |
|-------|-----------|---------|
| A     | 62        | 60.8    |
| B     | 34        | 33.3    |
| C     | 6         | 5.9     |
| Total | 102       | 100     |

#### 4.2. Hypothesis Testing

Three research questions were proposed for testing in this study, none of which could be tested due to the range restriction presented in the self-reported grades. Nevertheless, results are presented along with each hypothesis.

#### 4.2.1. Research Question 1

Is one personality type more likely to enroll in an online course?

Based on frequency data, this study found that the personality type with the highest frequency in this study was ESTJ (16.67%), followed by in order of frequency, ISTJ (14.71%), ENFJ (10.78%), and ISFJ (10.78%). There was one personality type of the possible 16 that was not represented by any responses in this sample – the ENTJ type. Frequency data, however, is of no statistical significance when measured on its own. This frequency measure indicates the most frequent personality type to respond to the survey invitation.

#### 4.2.2. Research Question 2

Is there a positive relationship between academic success (passing grade) and a specific personality type?

H<sub>1o</sub>: There is no significant difference between personality type and success in an online environment.

H<sub>1</sub>: There is a significant difference between personality type and success in an online environment.

A Chi-Square analysis was conducted between personality type and self-reported grade (see Table 13 below or Appendix C for full SAS output) to assess significance between these variables in order to reject or accept the null hypothesis. The Chi-Square analysis revealed a comparison value of 33.2647 and a p-value of 0.2261. This indicated no significant difference, and therefore, H<sub>1o</sub>, the null hypothesis cannot be rejected.

Table 4.2. *Self-Reported Passing Grade and MBTI Type*

| MBTI<br>Type | Grade |         |        | Total  |
|--------------|-------|---------|--------|--------|
|              | A     | B       | C      |        |
| ENFJ         | 5     | 6       | 0      | 11     |
| ENFP         | 6     | 2       | 1      | 9      |
| ENTP         | 4     | 0       | 0      | 4      |
| ENTJ         | 0     | 0       | 0      | 0      |
| ESFJ         | 6     | 2       | 0      | 8      |
| ESFP         | 1     | 1       | 0      | 2      |
| ESTJ         | 10    | 7       | 0      | 17     |
| ESTP         | 2     | 1       | 1      | 4      |
| INFJ         | 2     | 0       | 0      | 2      |
| INFP         | 1     | 6       | 1      | 8      |
| INTJ         | 2     | 0       | 0      | 2      |
| INTP         | 0     | 1       | 0      | 1      |
| ISFJ         | 6     | 3       | 2      | 11     |
| ISFP         | 4     | 0       | 0      | 4      |
| ISTJ         | 11    | 4       | 0      | 15     |
| ISTP         | 2     | 1       | 1      | 4      |
| Total        | 62    | 34      | 6      | 102    |
|              | 60.78 | 33.33   | 5.88   | 100.00 |
|              | DF    | Value   | Prob   |        |
| Chi-Square   | 28    | 33.2647 | 0.2261 |        |

The null hypothesis cannot be rejected, given the range restriction of the self-reported grades. No significant difference can be noted between personality type and success in an online environment due to the fact that all students reported receiving a passing grade. Because the SAS programming produced a warning of validity for the Chi-Square statistic (many cells had less than five counts), the Fisher's Exact Test was performed. This revealed a comparison of 4.486E-14 and a p-value of 0.1070; additional confirmation of no significant difference and an inability to reject the null hypothesis.

#### 4.2.3. Research Question 3

Is there a positive relationship between academic failure (failing grade) and a specific personality type?

H<sub>2o</sub>: There is no significant difference between personality type and failure in an online environment.

H<sub>2i</sub>: There is a significant difference between personality type and failure in an online environment.

No statistical analysis was performed to assess the hypothesis for this research question due to the grade range restriction reported. Because no failing grades were reported by the participants, there is no significance, there is no difference and the null hypothesis cannot be rejected.

Table 4.3. *Self-Reported Failing Grade and MBTI Type*

| MBTI<br>Type | Grade |       |      |      |      | Total  |
|--------------|-------|-------|------|------|------|--------|
|              | A     | B     | C    | D    | F    |        |
| ENFJ         | 5     | 6     | 0    | 0    | 0    | 11     |
| ENFP         | 6     | 2     | 1    | 0    | 0    | 9      |
| ENTP         | 4     | 0     | 0    | 0    | 0    | 4      |
| ENTJ         | 0     | 0     | 0    | 0    | 0    | 0      |
| ESFJ         | 6     | 2     | 0    | 0    | 0    | 8      |
| ESFP         | 1     | 1     | 0    | 0    | 0    | 2      |
| ESTJ         | 10    | 7     | 0    | 0    | 0    | 17     |
| ESTP         | 2     | 1     | 1    | 0    | 0    | 4      |
| INFJ         | 2     | 0     | 0    | 0    | 0    | 2      |
| INFP         | 1     | 6     | 1    | 0    | 0    | 8      |
| INTJ         | 2     | 0     | 0    | 0    | 0    | 2      |
| INTP         | 0     | 1     | 0    | 0    | 0    | 1      |
| ISFJ         | 6     | 3     | 2    | 0    | 0    | 11     |
| ISFP         | 4     | 0     | 0    | 0    | 0    | 4      |
| ISTJ         | 11    | 4     | 0    | 0    | 0    | 15     |
| ISTP         | 2     | 1     | 1    | 0    | 0    | 4      |
| Total        | 62    | 34    | 6    | 0    | 0    | 102    |
|              | 60.78 | 33.33 | 5.88 | 0.00 | 0.00 | 100.00 |

The failure to reject all null hypotheses in this study can perhaps be remedied with a larger sample size, reducing the chances of a type 1 error. As previously mentioned, there were many cases (84% for Appendix E) where the Chi-Square statistic could not be used, resorting to the Fisher's Exact Test due to small sample size and insufficient data to analyze.

#### 4.3. Alternative Searches for Significance

Uncovering no significance led the study on a modified path toward discovery. If none of the research questions posed could be analyzed due to range restriction of grades, then what possible trends could be found providing at the very least thought for future research? The analysis turned to breaking down each pair of the MBTI type and compares that to the self-reported grades, seeking a trend or pattern. Full disclosure of the findings resulting from analysis of the dichotomous pairings and grades can be found in Appendix E. Further grouping and analysis was done regarding specific course, personality and grade, with no significance exhibited. These findings can be shared by contacting the author.

##### 4.3.1. Extrovert or Introvert Pair

Given the description of brain pathways of learning in Chapter 2, there was much hope that some trend may be revealed noting some difference in success as assessed by the grade which could be reported. Referring to Table 15, it is noticed that those typed Introvert are twice as likely (4) to report a grade of C, than those typed Extrovert (2).

Table 4.4. *MBTI Extrovert/Introvert by Grade*

| MBTI                           |        | Grade |        |        | Total  |
|--------------------------------|--------|-------|--------|--------|--------|
| Extrovert/Introvert            |        | A     | B      | C      |        |
| E                              | 34     | 19    | 2      |        | 55     |
| Frequency                      | 33.431 | 18.33 | 3.2353 |        |        |
| Expected                       | 33.33  | 3     | 1.96   |        | 53.92  |
| Percent                        | 61.82  | 18.63 | 3.64   |        |        |
| Row Pct                        | 54.84  | 34.55 | 33.33  |        |        |
| Col Pct                        |        | 55.88 |        |        |        |
| I                              | 28     | 15    | 4      |        | 47     |
| Frequency                      | 28.569 | 15.66 | 2.7647 |        |        |
| Expected                       | 27.45  | 7     | 3.92   |        | 46.08  |
| Percent                        | 59.57  | 14.71 | 8.51   |        |        |
| Row Pct                        | 45.16  | 31.91 | 66.67  |        |        |
| Col Pct                        |        | 44.12 |        |        |        |
| Total                          | 62     | 34    | 6      |        | 102    |
|                                | 60.78  | 33.33 | 5.88   |        | 100.00 |
| Frequency Missing = 1          |        |       |        |        |        |
| Statistic                      |        | DF    |        | Value  |        |
| Chi-Square                     |        | 2     |        | 1.0972 |        |
| Likelihood Ratio Chi-Square    |        | 2     |        | 1.1047 |        |
| Mantel-Haenszel Chi-Square     |        | 1     |        | 0.3481 |        |
| Phi Coefficient                |        |       |        | 0.1037 |        |
| Contingency Coefficient        |        |       |        | 0.1032 |        |
| Cramer's V                     |        |       |        | 0.1037 |        |
| Fisher's Exact                 |        |       |        |        |        |
| Table Probability (P) = 0.0332 |        |       |        |        |        |
| Pr <= P = 0.6770               |        |       |        |        |        |

This is a reported observation or pattern; there is no statistical significance indicated.

However, looking toward the brain pathways and the longer learning pathway of Introverts, the data may confirm something about that lengthier pathway and even a lower grade of C in these courses. It can also be a reflection of the class itself, the course content, design, interaction and other characteristics; however, much more data are needed and more research is required.

#### 4.3.2. Intuitive-Sensing; Feeling-Thinking; Judging-Perceiving Pairs

In these pairings the 2:1 ratio is repeated, with more Sensing types than Intuitive types (Table 16) , more Feeling types than Thinking types (Table 17), and more Perceiving types than Judging types (Table 18) reporting a grade of C.

Table 4.5. *MBTI Intuitive/Sensing by Grade*

| MBTI                           |       | Grade |        |        |        |
|--------------------------------|-------|-------|--------|--------|--------|
| Intuitive/Sensing              |       | A     | B      | C      | Total  |
| N                              | 20    | 15    | 2      |        | 37     |
| Frequency                      | 22.49 | 12.33 | 2.176  |        |        |
| Expected                       | 19.61 | 3     | 5      |        | 36.27  |
| Percent                        | 54.05 | 14.71 | 1.96   |        |        |
| Row Pct                        | 32.26 | 40.54 | 5.41   |        |        |
| Col Pct                        |       | 44.12 | 33.33  |        |        |
| S                              | 42    | 19    | 4      |        | 65     |
| Frequency                      | 39.51 | 21.66 | 3.823  |        |        |
| Expected                       | 41.18 | 7     | 5      |        | 63.73  |
| Percent                        | 64.62 | 18.63 | 3.92   |        |        |
| Row Pct                        | 67.74 | 29.23 | 6.15   |        |        |
| Col Pct                        |       | 55.88 | 66.67  |        |        |
| Total                          | 62    | 34    | 6      |        | 102    |
|                                | 60.78 | 33.33 | 5.88   |        | 100.00 |
| Frequency Missing = 1          |       |       |        |        |        |
| Statistic                      |       | DF    | Value  | Prob   |        |
| Chi-Square                     |       | 2     | 1.3599 | 0.5066 |        |
| Likelihood Ratio Chi-Square    |       | 2     | 1.3446 | 0.5105 |        |
| Mantel-Haenszel Chi-Square     |       | 1     | 0.6155 | 0.4327 |        |
| Phi Coefficient                |       |       | 0.1155 |        |        |
| Contingency Coefficient        |       |       | 0.1147 |        |        |
| Cramer's V                     |       |       | 0.1155 |        |        |
| Fisher's Exact                 |       |       |        |        |        |
| Table Probability (P) = 0.0303 |       |       |        |        |        |
| Pr <=P = 0.5210                |       |       |        |        |        |

Table 4.6. *MBTI Thinking/Feeling by Grade*

| MBTI                           |       |       |        |        |        |
|--------------------------------|-------|-------|--------|--------|--------|
| Feeling/Thinking               | Grade | A     | B      | C      | Total  |
| F                              | 31    | 20    | 4      |        | 55     |
| Frequency                      | 33.43 | 18.33 | 3.235  |        |        |
| Expected                       | 1     | 3     | 3      |        | 53.92  |
| Percent                        | 30.39 | 19.61 | 3.92   |        |        |
| Row Pct                        | 56.36 | 36.36 | 7.27   |        |        |
| Col Pct                        | 50.00 | 58.82 | 66.67  |        |        |
| T                              | 31    | 14    | 2      |        | 47     |
| Frequency                      | 28.56 | 15.66 | 2.764  |        |        |
| Expected                       | 9     | 7     | 7      |        | 46.08  |
| Percent                        | 30.39 | 13.73 | 1.96   |        |        |
| Row Pct                        | 65.96 | 29.79 | 4.26   |        |        |
| Col Pct                        | 50.00 | 41.18 | 33.33  |        |        |
| Total                          | 62    | 34    | 6      |        | 102    |
|                                | 60.78 | 33.33 | 5.88   |        | 100.00 |
| Frequency Missing = 1          |       |       |        |        |        |
| Statistic                      |       | DF    | Value  | Prob   |        |
| Chi-Square                     |       | 2     | 1.1048 | 0.5756 |        |
| Likelihood Ratio Chi-Square    |       | 2     | 1.1159 | 0.5724 |        |
| Mantel-Haenszel Chi-Square     |       | 1     | 1.0927 | 0.2959 |        |
| Phi Coefficient                |       |       | 0.1041 |        |        |
| Contingency Coefficient        |       |       | 0.1035 |        |        |
| Cramer's V                     |       |       | 0.1041 |        |        |
| Fisher's Exact                 |       |       |        |        |        |
| Table Probability (P) = 0.0332 |       |       |        |        |        |
| Pr <=P = 0.6438                |       |       |        |        |        |

Table 4.7. *MBTI Judging/Perceiving by Grade*

| MBTI4              |       | Grade |       |   |        |
|--------------------|-------|-------|-------|---|--------|
| Judging/Perceiving |       | A     | B     | C | Total  |
| J                  | 42    | 22    | 2     |   | 66     |
| Frequency          | 40.11 | 22    | 3.882 |   |        |
| Expected           | 8     | 21.57 | 4     |   | 64.71  |
| Percent            | 41.18 | 33.33 | 1.96  |   |        |
| Row Pct            | 63.64 | 64.71 | 3.03  |   |        |
| Col Pct            | 67.74 |       | 33.33 |   |        |
| P                  | 20    | 12    | 4     |   | 36     |
| Frequency          | 21.88 | 12    | 2.117 |   |        |
| Expected           | 2     | 11.76 | 6     |   | 35.29  |
| Percent            | 19.61 | 33.33 | 3.92  |   |        |
| Row Pct            | 55.56 | 35.29 | 11.11 |   |        |
| Col Pct            | 32.26 |       | 66.67 |   |        |
| Total              | 62    | 34    | 6     |   | 102    |
|                    | 60.78 | 33.33 | 5.88  |   | 100.00 |

Frequency Missing = 1

| Statistic                   | DF | Value  | Prob   |
|-----------------------------|----|--------|--------|
| Chi-Square                  | 2  | 2.8361 | 0.2422 |
| Likelihood Ratio Chi-Square | 2  | 2.6885 | 0.2607 |
| Mantel-Haenszel Chi-Square  | 1  | 1.6495 | 0.1990 |
| Phi Coefficient             |    | 0.1667 |        |
| Contingency Coefficient     |    | 0.1645 |        |
| Cramer's V                  |    | 0.1667 |        |

Fisher's Exact

Table Probability (P) = 0.0159

Pr &lt;= P = 0.2914

Of the reported C grades seen in Table 19, the types self-reporting that grade are in order of frequency: ISFJ (2), INFP (1), ISTP (1), ESTP (1), ENFP (1) all of whom are female.

Table 4.8. *Self-Reported Grades of C*

| MBTI Type | Grade | Total |
|-----------|-------|-------|
| ISFJ      | C     | 2     |
| INFP      | C     | 1     |
| ISTP      | C     | 1     |
| ESTP      | C     | 1     |
| ENFP      | C     | 1     |
|           |       | 6     |

Again, no statistical significance is expressed by this finding; it more a point of interest that only female students would claim the lowest of the grades reported.

#### 4.4. Summary

The focus of this study was to assess a possible relationship between a students' personality type as evidenced by the MBTI and their self-reported grade in an online learning environment. The 16 possible personality types, participating in 36 different online courses, with the possibility of a full grade range were explored. The lack of variation or range restriction of grade reported by the student participants did alter the analysis of the study. The fact is that with no variation encompassing the entire spectrum of grades (i.e., no failing grades), only success could be noted and that provides no level of comparison.

### Research Question 1

Is one personality type more likely to enroll in an online course?

Based on frequency, the most noted personality type assessed by the MBTI for the purposes of this study was that of ESTJ – Extrovert, Sensing, Thinking, Judging with a reporting of 16.67%. The second most frequent personality type assessed by the MBTI was that of ISTJ – Introvert, Sensing, Thinking, Judging with a reported 14.71%. While not found to be significant statistically, it is interesting to note that the only difference between the top two most frequent types reported is the Extrovert – Introvert Component. This may be worth looking into in the future.

### Research Question 2

Is there a positive relationship between academic success (passing grade) and a specific personality type?

No significant relationship exists between success as evidenced by a passing grade and a specific personality type in this study. A restricted grade range was analyzed, in that only passing, and therefore successful grades, were reported by all participants. In order to assess any significance a full grade range would be necessary and therefore the null hypothesis cannot be rejected.

### Research Question 3

Is there a positive relationship between academic failure (failing grade) and a specific personality type?

No significant relationship exists between failure as evidenced by a self-reported grade and a specific personality type in this study. Since no failing grades were reported by any participant, this question cannot be analyzed and the null hypothesis cannot be rejected. In order to assess any significance a full grade range would be necessary along with an increased number of participants.

#### 4.5. Post-Hoc Data Analysis

Given that all students reported a passing grade in their online course during the Spring semester, 2011, the researcher endeavored to utilize a data mining procedure called Recursive Partitioning in an attempt to further split the data revealing descriptive information which may lead to further analysis (Zhang and Singer, 2010).

Recursive Partitioning creates a decision tree with categorical data. It is a system of classification and differentiation, seeking the largest break in the data. The software program used for this partitioning was JMP, developed by SAS. This program allows for a simple drag and drop of each of the datasets pertaining to the dependent variables and compares them to the independent variables. The break in the dataset was very interesting and could have important ramifications in the field of online learning and success. Table 20 shows the first break between MBTI component Thinking and Feeling

and Gender and Grade. Interestingly enough students seeking degrees in the Colleges of Veterinary Medicine, Technology, Pharmacy and Science exhibit the largest break at the behavioral level. While further research is necessary, this suggests that behavior is more important in terms of making an A or a B in the course. In fact, those students exhibiting a Feeling preference in their personality type received an A at a much lower level than those with the Thinking preference in these colleges. The difference is startling at almost three times lower the rate.

Table 4.9. *Recursive Partitioning of Data Feeling and Thinking Dimensions Colleges of Veterinary Medicine, Technology, Pharmacy and Science*

| Count | G <sup>2</sup> | LogWorth       |       |          |                |
|-------|----------------|----------------|-------|----------|----------------|
| 96    | 124.79         | 0.7396         |       |          |                |
| Level | Rate           | Prob           |       |          |                |
| A     | 0.6458         | 0.6458         |       |          |                |
| B     | 0.3542         | 0.3542         |       |          |                |
| <hr/> |                |                |       |          |                |
| Count | G <sup>2</sup> | LogWorth       |       |          |                |
| 26    | 34.64          | 1.2088         |       |          |                |
| Level | Rate           | Prob           |       |          |                |
| A     | 0.3846         | 0.3943         |       |          |                |
| B     | 0.6154         | 0.6057         |       |          |                |
| <hr/> |                |                |       |          |                |
| Count | Feeling        | G <sup>2</sup> | Count | Thinking | G <sup>2</sup> |
| 11    | Rate           | Prob           | 15    | Rate     | Prob           |
| Level | Prob           |                | Level | Prob     |                |
| A     | 0.1818         | 0.2184         | A     | 0.5333   | 0.5388         |
| B     | 0.8182         | 0.7816         | B     | 0.4667   | 0.4612         |

For the colleges of Health and Human Services, Engineering, Agriculture, Management, Liberal Arts, Education and Undergraduate Studies, the largest break in the data was on the demographic data of gender. This suggests that gender may be more important in the processing of information and learning for students in these colleges than is personality type.

*Table 4.10. Recursive Partitioning of Data Female and Male Colleges of Health and Human Services, Engineering, Agriculture, Management, Liberal Arts, Education and Undergraduate Studies*

| Count | G <sup>2</sup> | LogWorth |
|-------|----------------|----------|
| 96    | 124.79         | 0.7396   |
| Level | Rate           | Prob     |
| A     | 0.6458         | 0.6458   |
| B     | 0.3542         | 0.3542   |

| Count | G <sup>2</sup> | LogWorth |
|-------|----------------|----------|
| 70    | 79.80          | 0.6069   |
| Level | Rate           | Prob     |
| A     | 0.7429         | 0.7415   |
| B     | 0.2571         | 0.2585   |

| Count | Female | G <sup>2</sup> | Count | Male   | G <sup>2</sup> |
|-------|--------|----------------|-------|--------|----------------|
| 61    |        | 72.18          | 9     |        | 6.27           |
| Level | Rate   | Prob           | Level | Rate   | Prob           |
| A     | 0.7213 | 0.7202         | A     | 0.8889 | 0.8655         |
| B     | 0.2787 | 0.2798         | B     | 0.1111 | 0.1345         |

## CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

### 5.1. Introduction

This chapter contains conclusions gained from findings in the previous chapter. Any implications from the drawn conclusions are presented along with recommendations for future research.

### 5.2. Conclusions

Research question one asked if any one personality was more likely to enroll in an online course. It can be concluded that there is one personality type with higher enrollment in terms of this sample of the population of online learners at Mid-West Land Grant University in the spring semester of 2011 than any other. The most frequently recorded personality type is ESTJ with 17 out of 102 (16%) online students typed with this personality. The second most recorded personality type ISTJ with 15 out of 102 (14%) typed with this personality. Note the only variation, albeit a potentially an important one, is between the E and I (Extrovert and Introvert). Given that the frequencies were close in number and that all students reported a passing grade (i.e., A, B, or C) for their course, this extrovert-introvert variation in type may be a cause for additional study; this analysis, however, did not yield any significant findings in terms of success in an online learning environment and personality type.

Research question 2 asked if there was a positive relationship between academic success as indicated by a passing grade and a specific personality type. Although there were a few seemingly interesting patterns established in the data, there were no unexpected relationships noted. This was due because all students reported their expectation of receiving a passing grade for their class. With no variance in the data, one cannot draw a conclusion of any positive or negative relationships that may exist between the variables.

Finally, research question 3 asked if a positive relationship may exist between academic failure and a specific personality type. For reasons stated above, no relationship was discovered; positive or negative as no student reported their expectation of receiving a failing grade in their online class.

### 5.3. Overall Study Conclusions

The fact that all students participating in the study expressed an expectation to receive a passing grade in their online course, given the number of students (102) participating, the variation in the personality types represented (15 of the possible 16), and the variety of courses (36 courses represented) in which the students were participating – indicating a variety of teaching, learning, and assessment techniques gives this author pause regarding the potential impact of personality type at all with regard to success. Future research will include a comparison of the same courses taught face-to-face and online along with personality type to distinguish possible differences in grading and assessment in both learning environments.

A larger participant pool would also have been necessary to produce any findings in this study. Analyzing data for 102 participants fell short of the required number of participants needed to exhibit any unexpected relationships using the Chi-square statistic. It is necessary to have at least five data points in each cell in order for SAS to attempt to calculate any relationship and the sample was not large enough to do so. Accounting for that possibility, the Fisher's Exact statistical test was also run; however, the data here also proved expected.

One pattern emerging from the data was that of the six grades of C reported, those with the types including I indicating introvert (ISFJ, ISTP and INFP) accounted for four of the six; the additional two types reporting a grade of C were ENFP and ESTP. While, not significant, perhaps a larger sample would exhibit some useful data indicating some viable pattern. This might also be tied to the brain pathways explained in Chapter 2 and allow for further understanding between at least the introverted and extroverted students utilizing this learning environment.

#### 5.4. Future Recommendations and Summary

Even with the lack of significant relationships exhibited in the data, personality type, given its specific and individual nature may be found to be related to academic success or failure in an online learning environment. Further studies consisting of many more participants and perhaps the stacking of longitudinal basis are suggested. By studying a particular course and its patterns over time, improvements may be made in the field of online learning impacting course design and assessment practices leading to an impact on student success or failure when engaged in an online learning environment.

Given that the distribution of grades was on the upper end of the scale, future research may also be warranted in terms of the grading and assessment practices regarding the online environment. Faculty need to continue to ensure continuous improvement in their teaching techniques and learning practices; the investment in establishing proper assessment practices are necessary at any time, but particularly in this age of technology.

As technological advances uncover images of the learning pathways of individual brains, advances in learning and teaching techniques may also be uncovered. The magnificence of the brain is a territory not fully discovered; the processing of knowledge and method of learning for individual students continue to be areas demanding more research.

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## REFERENCES

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## APPENDICES

## Appendix A Initial Document of Approval for study from Institutional Review Board

HUMAN RESEARCH PROTECTION PROGRAM  
INSTITUTIONAL REVIEW BOARDS

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**To:** GEORGE ROGERS  
KNOY 367

**From:** RICHARD MATTES, Chair  
Social Science IRB

**Date:** 03/14/2011

**Committee Action:** Exemption Granted

**IRB Action Date:** 03/11/2011

**IRB Protocol #:** 1102010471

**Study Title:** Personality Type and Success in an Online Learning Environment

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2).

If you wish to revise or amend the protocol, please submit a revision request to the IRB for consideration. Please contact our office if you have any questions.

We wish you good luck with your work. Please retain copy of this letter for your records.

Below is a list of best practices that you should be aware of and keep in mind when conducting your research.

**Category 1**

- Written permission from preschools, primary and/or secondary schools should be obtained prior to the investigator engaging in research, such as recruitment and conducting research procedures. If the written permission was not submitted with the protocol at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval), the investigator must submit the written permission to the IRB office immediately upon receipt from the school. This is a Human Research Protection Program requirement.

**Categories 2 and 3**

- Surveys and data collection instruments should note that only participants 18 years of age and over are eligible to participate in the research, state that participation is voluntary and that any questions may be skipped, and include the investigator's name and contact information.
- Investigators should explain to participants the amount of time required to participate. Additionally, they should explain to participants how confidentiality will be maintained or if it will not be maintained.
- When conducting focus group research, investigators cannot guarantee that all participants in the focus group will maintain the confidentiality of other group participants. The investigator should make participants aware of this potential for breach of confidentiality.
- Written permission from businesses, preschools, primary and/or secondary schools should be obtained prior to the investigator engaging in research, such as recruitment and conducting research procedures. If the written

permission was not submitted with the protocol at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval), the investigator must submit the written permission to the IRB office immediately upon receipt from the school. This is a Human Research Protection Program requirement.

Category 6

- Surveys and data collection instruments should note that participation is voluntary.
- Surveys and data collection instruments should note that participants may skip any questions.
- When taste testing foods which are highly allergenic (e.g., peanuts, milk, etc.) investigators should disclose the possibility of a reaction to potential subjects.

General

- To recruit from Purdue University classrooms, the instructor and all others associated with conduct of the course (e.g., teaching assistants) must not be present during announcement of the research opportunity or any recruitment activity. This may be accomplished by announcing, in advance, that class will either start later than usual or end earlier than usual so this activity may occur. It should be emphasized that attendance at the announcement and recruitment are voluntary and the students attendance and enrollment decision will not be known by those administering the course.
- When conducting human subjects research at non-Purdue colleges and universities, investigators are urged to contact that institution's IRB to determine requirements for conducting research at that institution.
- When conducting human subjects research in places of business, investigators must obtain written permission from an appropriate authority from the business prior to engaging in research activities such as recruitment or conducting study procedures.

Appendix B Document of Approval for Modification of study from Institutional Review Board



UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM  
INSTITUTIONAL REVIEW BOARDS

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**To:** GEORGE ROGERS  
KNOY 367

**From:** RICHARD MATTES, Chair  
Social Science IRB

**Date:** 04/11/2011

**Committee Action:** Exemption Granted *FYI /A001 EB*

**IRB Action Date:** 04/08/2011

**IRB Protocol #:** 1102010471

**Study Title:** Personality Type and Success in an Online Learning Environment

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2).

If you wish to revise or amend the protocol, please submit a revision request to the IRB for consideration. Please contact our office if you have any questions.

We wish you good luck with your work. Please retain copy of this letter for your records.

Below is a list of best practices that you should be aware of and keep in mind when conducting your research.

**Category 1**

- Written permission from preschools, primary and/or secondary schools should be obtained prior to the investigator engaging in research, such as recruitment and conducting research procedures. If the written permission was not submitted with the protocol at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval), the investigator must submit the written permission to the IRB office immediately upon receipt from the school. This is a Human Research Protection Program requirement.

**Categories 2 and 3**

- Surveys and data collection instruments should note that only participants 18 years of age and over are eligible to participate in the research, state that participation is voluntary and that any questions may be skipped, and include the investigator's name and contact information.
- Investigators should explain to participants the amount of time required to participate. Additionally, they should explain to participants how confidentiality will be maintained or if it will not be maintained.
- When conducting focus group research, investigators cannot guarantee that all participants in the focus group will maintain the confidentiality of other group participants. The investigator should make participants aware of this potential for breach of confidentiality.
- Written permission from businesses, preschools, primary and/or secondary schools should be obtained prior to the investigator engaging in research, such as recruitment and conducting research procedures. If the written

permission was not submitted with the protocol at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval), the investigator must submit the written permission to the IRB office immediately upon receipt from the school. This is a Human Research Protection Program requirement.

Category 6

- Surveys and data collection instruments should note that participation is voluntary.
- Surveys and data collection instruments should note that participants may skip any questions.
- When taste testing foods which are highly allergenic (e.g., peanuts, milk, etc.) investigators should disclose the possibility of a reaction to potential subjects.

General

- To recruit from Purdue University classrooms, the instructor and all others associated with conduct of the course (e.g., teaching assistants) must not be present during announcement of the research opportunity or any recruitment activity. This may be accomplished by announcing, in advance, that class will either start later than usual or end earlier than usual so this activity may occur. It should be emphasized that attendance at the announcement and recruitment are voluntary and the students attendance and enrollment decision will not be known by those administering the course.
- When conducting human subjects research at non-Purdue colleges and universities, investigators are urged to contact that institution's IRB to determine requirements for conducting research at that institution.
- When conducting human subjects research in places of business, investigators must obtain written permission from an appropriate authority from the business prior to engaging in research activities such as recruitment or conducting study procedures.

## Appendix C Letter of Introduction/Access Directions

Dear Online Learner at Purdue University:

I am a candidate for a PhD in the College of Technology at Purdue. I am inviting you to participate in a research study, which will capture your personality type along with your projected grade in your current online course. I am collecting this information to assess a potential relationship between success in an online environment and personality type. An assessed relationship may be useful to professors, advisors and other students' faced with the choice of taking or suggesting a class in an online environment.

You must be at least 18 years old. Your participation is voluntary. Your participation or your selection NOT to participate will not under any circumstances affect your final grade. Your instructors will not know if you participate. Information you provide will remain confidential.

**This study consists of two parts. BOTH surveys must be completed to be eligible for the gift card drawing:**

1. Read and follow the instructions for accessing the personality survey below (completion time: about 15 minutes<sup>⌚</sup>). When you log in – the company does have a short demographic survey pertaining to work *before* you actually come to the MBTI™ -- please answers those questions to the best of your ability until you come to the personality survey.
2. Access and complete the demographic survey through the link provided below, you may have to cut and paste it in the browser.

[https://purdue.qualtrics.com/SE/?SID=SV\\_6r0XVNLCehywz3e](https://purdue.qualtrics.com/SE/?SID=SV_6r0XVNLCehywz3e)

Following the submission of both surveys, you will have the opportunity to participate in a random drawing for a chance to win a \$50 gift card from Wal-Mart. This will be rewarded at the end of the study. You will have a 1/200 chance to win and I will contact the winner via email!

Your key contact, should you have any questions about this research project, is Linda Mellish – please feel free to email me at [lmellish@purdue.edu](mailto:lmellish@purdue.edu). You may also contact Dr. George Rogers at (765) 494-1092 or [rogersg@purdue.edu](mailto:rogersg@purdue.edu).

Linda L. Mellish  
DTE  
Graduate Student  
Investigator  
[lmellish@purdue.edu](mailto:lmellish@purdue.edu)

George E. Rogers, Ed.D.,  
Professor/Primary

## Instructions for Taking the Myers Briggs Type Indicator (MBTI)

*Please read through all directions first – then follow them completely – feel free to ask if you have any questions. Contact Linda Mellish:  
[lmellish@purdue.edu](mailto:lmellish@purdue.edu)*

1. Log on to the SkillsOne web administration site:

|  |
|--|
| <b><a href="http://online.cpp.com/">http://online.cpp.com/</a></b>       |
| *Note – <u>Do not</u> type in “www” – that is <b>not</b> part of the URL |

2. **Login and Password Required:** The login and password are for this assessment only.

|                  |   |
|------------------|---|
| <b>Login</b>     |   |
| <b>Login:</b>    | <input type="text" value="boilers"/> ← <b>Type this</b>   |
| <b>Password:</b> | <input type="text" value="tcschl"/> ← <b>Type this</b>  |
| <b>User ID:</b>  | <input type="text"/> ← <b>Leave BLANK!</b><br>Nothing is entered here unless you are returning to |

3. Select (**MBTI**): Click the begin button to the right of “**MBTI®Step I (Form M)**”

**BEGIN**

4. Click on the down arrow after Webbatch and choose the “**Success Online**” Option in the drop down menu

5. There are an initial few questions - answer those and proceed to the Instructions and complete the inventory by answering each question seriously and honestly. Take your time. When you have answered all 93 questions, select DONE

Reminder:

Here's the URL to access the demographic survey, which also needs completing:

[https://purdue.qualtrics.com/SE/?SID=SV\\_6r0XVNLCehywz3e](https://purdue.qualtrics.com/SE/?SID=SV_6r0XVNLCehywz3e)

Thank you for your participation!

## Appendix D SAS Code Used in Analysis

```
proc print data=linda;
run;

/* variable names: Subject_ID Name Gender College_of Class MBTI Grade */

proc freq data=linda;
run;

data linda2;
set linda;
drop Name;
run;

proc freq data=linda2;
run;

proc freq data=linda2;
tables MBTI1*Grade /chisq expected fisher; run;

proc freq data=linda2;
tables MBTI2*Grade /chisq expected fisher; run;

proc freq data=linda2;
tables MBTI3*Grade /chisq expected fisher; run;

proc freq data=linda2;
tables MBTI4*Grade /chisq expected fisher; run;
```

## Appendix E SAS Output for Variables

| MBTI Type | Grade |      |       | Total |
|-----------|-------|------|-------|-------|
|           | A     | B    | C     |       |
| ENFJ      | 5     | 6    | 0     | 11    |
|           | 6.686 | 3.66 | 0.647 |       |
|           | 3     | 67   | 1     | 10.78 |
|           | 4.90  | 5.88 | 0.00  |       |
|           | 45.45 | 54.5 | 0.00  |       |
|           | 8.06  | 5    | 0.00  |       |
| ENFP      |       | 17.6 |       |       |
|           |       | 5    |       |       |
|           | 6     | 2    | 1     | 9     |
|           | 5.470 | 3    | 0.529 |       |
|           | 6     | 1.96 | 4     | 8.82  |
|           | 5.88  | 22.2 | 0.98  |       |
| ENTP      | 66.67 | 2    | 11.11 |       |
|           | 9.68  | 5.88 | 16.67 |       |
|           | 4     | 0    | 0     | 4     |
|           | 2.431 | 1.33 | 0.235 |       |
|           | 4     | 33   | 3     | 3.92  |
|           | 3.92  | 0.00 | 0.00  |       |
| ESFJ      | 100.0 | 0.00 | 0.00  |       |
|           | 0     | 0.00 | 0.00  |       |
|           | 6.45  |      |       |       |
|           | 6     | 2    | 0     | 8     |
|           | 4.862 | 2.66 | 0.470 |       |
|           | 7     | 67   | 6     | 7.84  |
|           | 5.88  | 1.96 | 0.00  |       |
|           | 75.00 | 25.0 | 0.00  |       |
|           | 9.68  | 0    | 0.00  |       |
|           |       | 5.88 |       |       |
|           |       |      |       |       |
|           |       |      |       |       |

| MBTI<br>Type | Grade |      |       |  | Total |
|--------------|-------|------|-------|--|-------|
|              | A     | B    | C     |  |       |
| ESFP         | 1     | 1    | 0     |  | 2     |
| Frequency    | 1.215 | 0.66 | 0.117 |  |       |
| Expected     | 7     | 67   | 6     |  | 1.96  |
| Percent      | 0.98  | 0.98 | 0.00  |  |       |
| Row Pct      | 50.00 | 50.0 | 0.00  |  |       |
| Col Pct      | 1.61  | 0    | 0.00  |  |       |
|              |       | 2.94 |       |  |       |
| ESTJ         | 10    | 7    | 0     |  | 17    |
| Frequency    | 10.33 | 5.66 | 1     |  |       |
| Expected     | 3     | 67   | 0.00  |  | 16.67 |
| Percent      | 9.80  | 6.86 | 0.00  |  |       |
| Row Pct      | 58.82 | 41.1 | 0.00  |  |       |
| Col Pct      | 16.13 | 8    |       |  |       |
|              |       | 20.5 |       |  |       |
|              |       | 9    |       |  |       |
| ESTP         | 2     | 1    | 1     |  | 4     |
| Frequency    | 2.431 | 1.33 | 0.235 |  |       |
| Expected     | 4     | 33   | 3     |  | 3.92  |
| Percent      | 1.96  | 0.98 | 0.98  |  |       |
| Row Pct      | 50.00 | 25.0 | 25.00 |  |       |
| Col Pct      | 3.23  | 0    | 16.67 |  |       |
|              |       | 2.94 |       |  |       |
| INFJ         | 2     | 0    | 0     |  | 2     |
| Frequency    | 1.215 | 0.66 | 0.117 |  |       |
| Expected     | 7     | 67   | 6     |  | 1.96  |
| Percent      | 1.96  | 0.00 | 0.00  |  |       |
| Row Pct      | 100.0 | 0.00 | 0.00  |  |       |
| Col Pct      | 0     | 0.00 | 0.00  |  |       |
|              |       | 3.23 |       |  |       |

| MBTI<br>Type | Grade     |       |       |       | Total |
|--------------|-----------|-------|-------|-------|-------|
|              | A         | B     | C     |       |       |
| INFP         | 1         | 6     | 1     |       | 8     |
|              | Frequency | 4.862 | 2.66  | 0.470 |       |
|              | Expected  | 7     | 67    | 6     | 7.84  |
|              | Percent   | 0.98  | 5.88  | 0.98  |       |
|              | Row Pct   | 12.50 | 75.0  | 12.50 |       |
|              | Col Pct   | 1.61  | 0     | 16.67 |       |
| INTJ         |           |       |       |       |       |
|              | 2         | 0     | 0     |       | 2     |
|              | Frequency | 1.215 | 0.66  | 0.117 |       |
|              | Expected  | 7     | 67    | 6     | 1.96  |
|              | Percent   | 1.96  | 0.00  | 0.00  |       |
|              | Row Pct   | 100.0 | 0.00  | 0.00  |       |
| INTP         | 0         | 0     | 0     |       | 1     |
|              | Frequency | 0.607 | 0.33  | 0.058 |       |
|              | Expected  | 8     | 33    | 8     | 0.98  |
|              | Percent   | 0.00  | 0.98  | 0.00  |       |
|              | Row Pct   | 0.00  | 100.  | 0.00  |       |
|              | Col Pct   | 0.00  | 00    | 0.00  |       |
| ISFJ         |           |       |       |       |       |
|              | 6         | 3     | 2     |       | 11    |
|              | Frequency | 6.686 | 3.66  | 0.647 |       |
|              | Expected  | 3     | 67    | 1     | 10.78 |
|              | Percent   | 5.88  | 2.94  | 1.96  |       |
|              | Row Pct   | 54.55 | 27.2  | 18.18 |       |
| Col Pct      | 9.68      | 7     | 33.33 |       |       |
|              |           | 8.82  |       |       |       |

| MBTI Type                   | Grade                 |       |      |         | Total  |
|-----------------------------|-----------------------|-------|------|---------|--------|
|                             | A                     | B     | C    |         |        |
| ISFP                        | 4                     | 0     | 0    |         | 4      |
|                             | Frequency             | 2.431 | 1.33 | 0.235   |        |
|                             | Expected              | 4     | 33   | 3       | 3.92   |
|                             | Percent               | 3.92  | 0.00 | 0.00    |        |
|                             | Row Pct               | 100.0 | 0.00 | 0.00    |        |
|                             | Col Pct               | 0     | 0.00 | 0.00    |        |
|                             |                       | 6.45  |      |         |        |
| ISTJ                        | 11                    | 4     | 0    |         | 15     |
|                             | Frequency             | 9.117 | 5    | 0.882   |        |
|                             | Expected              | 6     | 3.92 | 4       | 14.71  |
|                             | Percent               | 10.78 | 26.6 | 0.00    |        |
|                             | Row Pct               | 73.33 | 7    | 0.00    |        |
|                             | Col Pct               | 17.74 | 11.7 | 0.00    |        |
|                             |                       | 6     |      |         |        |
| ISTP                        | 2                     | 1     | 1    |         | 4      |
|                             | Frequency             | 2.431 | 1.33 | 0.235   |        |
|                             | Expected              | 4     | 33   | 3       | 3.92   |
|                             | Percent               | 1.96  | 0.98 | 0.98    |        |
|                             | Row Pct               | 50.00 | 25.0 | 25.00   |        |
|                             | Col Pct               | 3.23  | 0    | 16.67   |        |
|                             |                       | 2.94  |      |         |        |
| Total                       | 62                    | 34    | 6    |         | 102    |
|                             | 60.78                 | 33.3  | 5.88 |         | 100.00 |
|                             |                       | 3     |      |         |        |
|                             | Frequency Missing = 1 |       |      |         |        |
| Statistic                   |                       |       | DF   | Value   | Prob   |
| Chi-Square                  |                       |       | 28   | 33.2647 | 0.2261 |
| Likelihood Ratio Chi-Square |                       |       | 28   | 37.5056 | 0.1081 |
| Mantel-Haenszel Chi-Square  |                       |       | 1    | 0.0153  | 0.9016 |
| Phi Coefficient             |                       |       |      | 0.5711  |        |
| Contingency Coefficient     |                       |       |      | 0.4959  |        |

| MBTI<br>Type  | Grade     |   |   |        | Total |
|---|-----------|---|---|--------|-------|
|   | A         | B | C |        |       |
| Cramer's V  |           |   |   | 0.4038 |       |
| WARNING: 84% of the cells have expected counts less than 5. Chi-Square may not be a valid test. |           |   |   |        |       |
| Fisher's Exact Test   |           |   |   |        |       |
| Table Probability (P)   | 4.486E-14 |   |   |        |       |
| Pr <= P   | 0.1070    |   |   |        |       |

## Appendix F SAS Output for Dichotomous Pairings Extrovert – Introvert

| MBTI<br>Extrovert/Introvert    | Grade |       |       |        | Total  |
|--------------------------------|-------|-------|-------|--------|--------|
|                                | A     | B     | C     |        |        |
| E                              | 34    | 19    | 2     |        | 55     |
| Frequency                      | 33.43 | 18.33 | 3.235 |        |        |
| Expected                       | 1     | 3     | 3     |        | 53.92  |
| Percent                        | 33.33 | 18.63 | 1.96  |        |        |
| Row Pct                        | 61.82 | 34.55 | 3.64  |        |        |
| Col Pct                        | 54.84 | 55.88 | 33.33 |        |        |
| I                              | 28    | 15    | 4     |        | 47     |
| Frequency                      | 28.56 | 15.66 | 2.764 |        |        |
| Expected                       | 9     | 7     | 7     |        | 46.08  |
| Percent                        | 27.45 | 14.71 | 3.92  |        |        |
| Row Pct                        | 59.57 | 31.91 | 8.51  |        |        |
| Col Pct                        | 45.16 | 44.12 | 66.67 |        |        |
| Total                          | 62    | 34    | 6     |        | 102    |
|                                | 60.78 | 33.33 | 5.88  |        | 100.00 |
| Frequency Missing = 1          |       |       |       |        |        |
| Statistic                      |       | DF    |       | Value  |        |
| Chi-Square                     |       | 2     |       | 1.0972 |        |
| Likelihood Ratio Chi-Square    |       | 2     |       | 1.1047 |        |
| Mantel-Haenszel Chi-Square     |       | 1     |       | 0.3481 |        |
| Phi Coefficient                |       |       |       | 0.1037 |        |
| Contingency Coefficient        |       |       |       | 0.1032 |        |
| Cramer's V                     |       |       |       | 0.1037 |        |
| Fisher's Exact                 |       |       |       |        |        |
| Table Probability (P) = 0.0332 |       |       |       |        |        |
| Pr <= P = 0.6770               |       |       |       |        |        |

| Statistic   | DF | Value  | Prob   |
|---|----|--------|--------|
| Chi-Square  | 2  | 1.0972 | 0.5778 |
| Likelihood Ratio Chi-Square   | 2  | 1.1047 | 0.5756 |
| Mantel-Haenszel Chi-Square  | 1  | 0.3481 | 0.5552 |
| Phi Coefficient   |    | 0.1037 |        |
| Contingency Coefficient   |    | 0.1032 |        |
| Cramer's V  |    | 0.1037 |        |
| WARNING: 33% of the cells have expected counts less than 5. Chi-Square may not be a valid test. |    |        |        |

| Fisher's Exact Test   |        |
|-----------------------|--------|
| Table Probability (P) | 0.0332 |
| Pr <= P               | 0.6770 |

## Appendix G SAS Output for Dichotomous Pairings Intuitive – Sensing

| MBTI<br>Intuitive/Sensin<br>g  | Grade |       |        | Total  |
|--------------------------------|-------|-------|--------|--------|
|                                | A     | B     | C      |        |
| N                              | 20    | 15    | 2      | 37     |
|                                | 22.49 | 12.33 | 2.176  |        |
|                                | 19.61 | 3     | 5      | 36.27  |
|                                | 54.05 | 14.71 | 1.96   |        |
|                                | 32.26 | 40.54 | 5.41   |        |
|                                |       | 44.12 | 33.33  |        |
| S                              | 42    | 19    | 4      | 65     |
|                                | 39.51 | 21.66 | 3.823  |        |
|                                | 41.18 | 7     | 5      | 63.73  |
|                                | 64.62 | 18.63 | 3.92   |        |
|                                | 67.74 | 29.23 | 6.15   |        |
|                                |       | 55.88 | 66.67  |        |
| Total                          | 62    | 34    | 6      | 102    |
|                                | 60.78 | 33.33 | 5.88   | 100.00 |
| Frequency Missing = 1          |       |       |        |        |
| Statistic                      |       | DF    | Value  | Prob   |
| Chi-Square                     |       | 2     | 1.3599 | 0.5066 |
| Likelihood Ratio Chi-Square    |       | 2     | 1.3446 | 0.5105 |
| Mantel-Haenszel Chi-Square     |       | 1     | 0.6155 | 0.4327 |
| Phi Coefficient                |       |       | 0.1155 |        |
| Contingency Coefficient        |       |       | 0.1147 |        |
| Cramer's V                     |       |       | 0.1155 |        |
| Fisher's Exact                 |       |       |        |        |
| Table Probability (P) = 0.0303 |       |       |        |        |
| Pr <=P = 0.5210                |       |       |        |        |

| Statistic   | DF | Value  | Prob   |
|---|----|--------|--------|
| Chi-Square  | 2  | 1.3599 | 0.5066 |
| Likelihood Ratio Chi-Square   | 2  | 1.3446 | 0.5105 |
| Mantel-Haenszel Chi-Square  | 1  | 0.6155 | 0.4327 |
| Phi Coefficient   |    | 0.1155 |        |
| Contingency Coefficient   |    | 0.1147 |        |
| Cramer's V  |    | 0.1155 |        |
| WARNING: 33% of the cells have expected counts less than 5. Chi-Square may not be a valid test. |    |        |        |

| Fisher's Exact Test   |        |
|-----------------------|--------|
| Table Probability (P) | 0.0303 |
| Pr <= P               | 0.5210 |

## Appendix H SAS Output for Dichotomous Pairings Feeling – Thinking

| MBTI<br>Feeling/Thinking    | Grade |       |        |        | Total  |
|-----------------------------|-------|-------|--------|--------|--------|
|                             | A     | B     | C      |        |        |
| Frequency                   |       |       |        |        |        |
| Expected                    |       |       |        |        |        |
| Percent                     |       |       |        |        |        |
| Row Pct                     |       |       |        |        |        |
| Col Pct                     |       |       |        |        |        |
| F                           | 31    | 20    | 4      |        | 55     |
| Frequency                   | 33.43 | 18.33 | 3.235  |        |        |
| Expected                    | 1     | 3     | 3      |        | 53.92  |
| Percent                     | 30.39 | 19.61 | 3.92   |        |        |
| Row Pct                     | 56.36 | 36.36 | 7.27   |        |        |
| Col Pct                     | 50.00 | 58.82 | 66.67  |        |        |
| T                           | 31    | 14    | 2      |        | 47     |
| Frequency                   | 28.56 | 15.66 | 2.764  |        |        |
| Expected                    | 9     | 7     | 7      |        | 46.08  |
| Percent                     | 30.39 | 13.73 | 1.96   |        |        |
| Row Pct                     | 65.96 | 29.79 | 4.26   |        |        |
| Col Pct                     | 50.00 | 41.18 | 33.33  |        |        |
| Total                       | 62    | 34    | 6      |        | 102    |
|                             | 60.78 | 33.33 | 5.88   |        | 100.00 |
| Frequency Missing = 1       |       |       |        |        |        |
| Statistic                   |       | DF    | Value  | Prob   |        |
| Chi-Square                  |       | 2     | 1.1048 | 0.5756 |        |
| Likelihood Ratio Chi-Square |       | 2     | 1.1159 | 0.5724 |        |
| Mantel-Haenszel Chi-Square  |       | 1     | 1.0927 | 0.2959 |        |
| Phi Coefficient             |       |       | 0.1041 |        |        |
| Contingency Coefficient     |       |       | 0.1035 |        |        |

| MBTI<br>Feeling/Thinking<br>g  | Grade |   |   | Total  |
|--------------------------------|-------|---|---|--------|
|                                | A     | B | C |        |
| Frequency                      |       |   |   |        |
| Expected                       |       |   |   |        |
| Percent                        |       |   |   |        |
| Row Pct                        |       |   |   |        |
| Col Pct                        |       |   |   |        |
| Cramer's V                     |       |   |   | 0.1041 |
| Fisher's Exact                 |       |   |   |        |
| Table Probability (P) = 0.0332 |       |   |   |        |
| Pr <= P = 0.6438               |       |   |   |        |

| Fisher's Exact Test   |        |
|-----------------------|--------|
| Table Probability (P) | 0.0332 |
| Pr <= P               | 0.6438 |

## Appendix I SAS Output for Dichotomous Pairings Judging – Perceiving

| MBTI4<br>Judging/Perceiving    |           | Grade |       |        |        |
|--------------------------------|-----------|-------|-------|--------|--------|
|                                |           | A     | B     | C      | Total  |
| J                              | Frequency | 42    | 22    | 2      | 66     |
|                                | Expected  | 40.11 | 22    | 3.882  |        |
|                                | Percent   | 8     | 21.57 | 4      | 64.71  |
|                                | Row Pct   | 41.18 | 33.33 | 1.96   |        |
|                                | Col Pct   | 63.64 | 64.71 | 3.03   |        |
|                                |           | 67.74 |       | 33.33  |        |
| P                              | Frequency | 20    | 12    | 4      | 36     |
|                                | Expected  | 21.88 | 12    | 2.117  |        |
|                                | Percent   | 2     | 11.76 | 6      | 35.29  |
|                                | Row Pct   | 19.61 | 33.33 | 3.92   |        |
|                                | Col Pct   | 55.56 | 35.29 | 11.11  |        |
|                                |           | 32.26 |       | 66.67  |        |
| Total                          |           | 62    | 34    | 6      | 102    |
|                                |           | 60.78 | 33.33 | 5.88   | 100.00 |
| Frequency Missing = 1          |           |       |       |        |        |
| Statistic                      |           |       | DF    | Value  | Prob   |
| Chi-Square                     |           |       | 2     | 2.8361 | 0.2422 |
| Likelihood Ratio Chi-Square    |           |       | 2     | 2.6885 | 0.2607 |
| Mantel-Haenszel Chi-Square     |           |       | 1     | 1.6495 | 0.1990 |
| Phi Coefficient                |           |       |       | 0.1667 |        |
| Contingency Coefficient        |           |       |       | 0.1645 |        |
| Cramer's V                     |           |       |       | 0.1667 |        |
| Fisher's Exact                 |           |       |       |        |        |
| Table Probability (P) = 0.0159 |           |       |       |        |        |
| Pr <= P = 0.2914               |           |       |       |        |        |

| Statistic   | DF | Value  | Prob   |
|---|----|--------|--------|
| Chi-Square  | 2  | 2.8361 | 0.2422 |
| Likelihood Ratio Chi-Square   | 2  | 2.6885 | 0.2607 |
| Mantel-Haenszel Chi-Square  | 1  | 1.6495 | 0.1990 |
| Phi Coefficient   |    | 0.1667 |        |
| Contingency Coefficient   |    | 0.1645 |        |
| Cramer's V  |    | 0.1667 |        |
| WARNING: 33% of the cells have expected counts less than 5. Chi-Square may not be a valid test. |    |        |        |

| Fisher's Exact Test   |        |
|-----------------------|--------|
| Table Probability (P) | 0.0159 |
| Pr <= P               | 0.2914 |

VITA

## VITA

**Linda L. Mellish****EDUCATION****Doctorate of Philosophy, Technology, May, 2012**

The College of Technology, Purdue University, West Lafayette, IN

**Dissertation:** Personality Type and Success in an Online Learning Environment

Advisor: George E. Rogers

**Master of Science in Human Resource Management, May, 1996**

The Krannert Graduate School of Management, Purdue University, West Lafayette, IN

\* **Assistant to the Director of the Professional Masters Programs,**  
1995 - 1996

\* **Marketing Coordinator,** August 1994 to May 1995

**Bachelors of Science, Music Therapy and Music Education, December, 1981**

East Carolina University, Greenville, NC

**CURRENT POSITION**

Interim Director, Academic Success Center, College of Education, East Carolina University, Greenville, NC

July 2011 to present

Manage operation of Academic Success Center including

- Participate in the Developmental Advising Model of students in the College of Education
- Develop new programs leading to more efficient and effective advising practices and more success in the progression of students
- Recruit, train and supervise all advisors and support staff in the Center: Currently, two professional advisors, two part-time advisors and one administrative assistant
- Collect and analyze data pertaining to student retention, change of major and attrition

- Assess unit effectiveness, develop recommendation and initiate appropriate action plans
- Teach one section of COAD 1000 an incoming freshman seminar
- Maintain budget and all budgetary decisions for the Academic Success Center
- Develop and co-ordinate an internship program for Graduate practicum student seeking Master's degree in Department of Counselor and Adult Education
- Administer Starfish Retention Program for the College of Education
- Administer PLATO training system for PRAXIS I preparation for the College of Education
- Audit and approve senior summaries for matriculation
- Collaborate with other departments, colleges and central university administrators to ensure a coordinated approach to student recruitment, retention and attrition
- Attend and participate in campus-wide Director's meetings
- Conduct performance reviews of all personnel in the Center
- Serve on committees as assigned by the Dean of the College of Education
- Perform other duties as assigned by the Dean of the College of Education

Part-Time Instructor, EDTC 4001 Technology in Education  
 Department of Mathematics, Science and Instructional Technology, East Carolina University, Greenville, NC

January to present

- Instruct pre-service teaching students on the use of technology in the classroom
- Instructional design, video applications, basic and expanded educational uses are covered
- Students create a portfolio of work as evidence of instruction

## **CERTIFICATIONS**

Certified Lead Auditor, ISO 9000 Standard

## **RESEARCH INTERESTS**

- Student behavior particular to Online Learning (success, choice, motivation)
- Brain pathways particular to Learning
- Chronotype and Online Learning Environment
- Cultivation of a *living* Online Community

## TEACHING INTERESTS

- Graduate and Undergraduate elements of Educational Technology including, but not limited to, basics of design, applicable technology selection and Web applications, communities of practice and inquiry, online course design, development and delivery
- Graduate and Undergraduate business courses in Human Resources including, but not limited to change management and organizational behavior, effective team work and leadership

## RESEARCH EXPERIENCE

Graduate Research Assistant, Institute for P-12 Engineering Research and Learning (INSPIRE), Purdue University, West Lafayette, IN  
June 2010 – June 2011

- Conduct research on Chronotypes and Online Learning
- Conduct research on Cultivating an Online Community with P-12 teachers
- Responsible for design, development and implementation of Online Community for P-12 Teachers in Engineering Education
- Responsible for design and development of INSPIRE website
- Manage and maintain the teaching engineering video case library

Graduate Assistant, Department of Distance Education-Continuing Education and Conferences, Purdue University, West Lafayette, IN  
August 2008 to June 2011

- Research Assistant to the Associate Dean of Distance Learning – conducting research on students choice to pursue online learning (2010 - present)
- Assistant to the Manager of the Distance Education Learning Center
- Liaison between instructors and Distance Education Department
- Responsible for coordination of online course offerings
- Responsible for compensation system for instructors

## TEACHING EXPERIENCE

Instructor, Department of Counselor and Adult Education, East Carolina University, Greenville, NC  
August 2011 to present

- Prepared and delivered lectures for COAD 1000 – Student Development and Learning in Higher Education
- Utilized goal-setting theory, personality and learning assessments to assist students in understanding their skills and developing adaptive characteristics to assist in successful education and adaptation
- Coordinated Subject Matter Experts to present and discuss University policies and procedures with freshman class
- Designed rubrics for assessing assignments

Teaching Assistant, Department of Curriculum & Instruction, Purdue University, West Lafayette, IN

January 2009 to May, 2010

- Prepared and delivered lectures for 2 laboratory sections per semester of the undergraduate introductory Educational Technology Course
- Contributed to course improvements – both curriculum and project based
- Designed rubrics for assessing assignments
- Graded quizzes and assignments
- Advised undergraduate students during office hours (face to face and virtual)
- Mentored future teaching assistants and undergraduate teaching assistants
  - Observed and assessed teaching skills
  - Held weekly meetings pertaining to instruction methods

Adjunct Professor, Department of Organizational Leadership &

Supervision, Purdue University, West Lafayette, IN

January 1999 to 2001

Taught two sections of OLS 376, Human Resource Issues

- Prepared and delivered lectures on human resource topics
- Advised students about OLS curriculum
- Advised and counseled students regarding career options
- Advised and counseled students seeking graduate school application upon graduation
- Counseled students on progress and goal setting/achievement

Taught one section of OLS 274, Leadership Applications

- Prepared and delivered lectures on topics of leadership, including participatory projects defining and interviewing leaders in community

Taught one section of OLS 474, Conference Leadership

- Prepared and delivered lectures on topics pertaining to conference leadership, learning practices of effective meeting making

## **OTHER GRADUATE EXPERIENCE**

Graduate Assistant, Department of Curriculum & Instruction, Purdue University, West Lafayette, IN  
August 2007 to 2008

- Transcribed interviews for research teaching English language to Russian teachers

Graduate Assistant, Department of Industrial Technology, Purdue University, West Lafayette, IN  
January 2008 to May 2008

## **OTHER RELEVANT EXPERIENCE**

Head Academic Advisor, Department of Computer & Information Technology, West Lafayette, IN  
January 2001 to 2007

Served as academic counselor to all 517 CPT students

- Advised and counseled students regarding course selection methods
- Advised and counseled students regarding career options
- Developed and implemented programs designed to increase student development and responsibility
- Designed and implemented a Mentor/Mentee program for incoming freshman
- Designed and implemented a more efficient registration process including on-line sign up for sessions
- Teamed with software professor to modify and implement on-line registration program for CODO meetings and registration sessions sign-up - prior to self-registration system now in place at University
- Served as liaison between students and faculty

## **PUBLICATIONS**

Luo, Y., Pan, R., Choi, J.H., Mellish, L. & Strobel, J. (2011) Why Choose Online Learning: Relationship of Existing Factors and Chronobiology. *Journal of Educational Computing Research* 45(4) pp. 379-397.

## **CONFERENCE PROCEEDINGS**

Luo, Y., Pan, R., Mellish, L., Choi, J. & Strobel, J. (2010). Chronobiology and Online Learning: Biologically-Based Preferences. In J. Sanchez & K. Zhang (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2010* (pp. 2000-2007). Chesapeake, VA: AACE.

## **PEER REVIEWED CONFERENCE PRESENTATIONS**

Luo, Y., Pan, R., Mellish, L., Choi, J. & Strobel, J. (2011). Chronobiology and Online Learning: Biologically-Based Preferences. American Educational Research Association Annual Meeting, New Orleans, LA.

Liu, W. and Mellish, L. (2011). Cultivating Engineering Education Community of Practice for K-12 Teachers. Association for Educational Communications and Technology (AECT).

## **JUDGED POSTER SESSION**

Liu, W. and Mellish, L. *Cultivating engineering education community of practice for K-12 Teachers*. Poster session presented at the 5th Annual Graduate Student Educational Research Symposium, Purdue University, West Lafayette, IN.

## **INVITED POSTER SESSION**

Liu, W. and Mellish, L. (2011, March). *Cultivating engineering education community of practice for K-12 Teachers*. Poster session presented at the Spring 2011 Purdue P-12 Engagement Symposium, Purdue University, West Lafayette, IN.

## **INVITED SPEAKER AT PURDUE**

- Guest Speaker for PESC (Purdue Engineering Student Council) preparation for Industrial Roundtable on “Impression Management” 1997-1999
- Conducted Mock Interview sessions students including feedback 1999-2000
- Guest Speaker for colleagues’ classes on several occasions 1997-2000

## **INDUSTRIAL EXPERIENCE**

Corporate Quality Manager, Houghton International Inc., Valley Forge, PA

February 2000 to November 2000

Quality Manager, BENCYN, Inc., Lafayette, IN (purchased by Houghton above)

May 1997 to 2000

- Team Leader for ISO 9001 Certification Process for 3 manufacturing facilities
- Team Leader for ongoing re-certification process of 4 manufacturing facilities
- Design, Organize and Lead ISO Education Training
- Facilitator for Policy and Procedure Meetings pertaining to ISO Certification/Needs
- Responsible for the continuing adherence to the current quality systems, while seeking opportunities for continuous improvement at all manufacturing sites
- Conducted Cost Analysis and Selection of multi-site ISO certification body
- Selected site-specific ISO Teams for Implementation of System
- Team Leader for ISO 14000 Certification Process

VP, Human Resources, BENCYN, Inc., Lafayette, IN

June 1996 to August 1998

- Strategic Planning and Development
- Design/utilize structured interviewing process
- Develop policies and procedures
- Implement tools for job evaluation, job descriptions and performance appraisals
- Training
- Oversee the administration of benefits
- Employee relations
- Administration of Health & Safety Standards
- Advise employees on career development, education, or additional training

Consultant, Tooling Technology & Supply Co., Inc., Indianapolis, IN

November 1998 to 2000

- Team Leader for ISO 9002 Certification Process
- Design and Conduct ISO Training

Strategic Planner/Human Resources, Fairview Midwest, Inc.,

Remington, IN

November 1996 to February 1997

- Advise President of selection methods/training/performance appraisal systems
- Analyze and suggest improvements manufacturing process
- Devise, implement, and monitor the above mentioned systems

- Designing/utilizing structured interviewing process
- Employee relations

Human Resource Specialist, Ingersoll-Rand Company, Indianapolis, Crawfordsville, IN and Cincinnati, OH

July 1995 to December 1996

- Recruiting for senior level positions for the Architectural Hardware Group
- Designing/utilizing structured interviews
- Conducted benchmarking effort regarding the use of outside agencies for recruiting assistance

## HONORS AND ACTIVITIES

- Association for Educational Communications and Technology (AECT), 2009 to present
  - Board Member of the Division of Distance Learning
  - Member of the Division of Design & Development
- Member, PACADA (Purdue's Academic Advising Association, 2001 to 2008)
  - Served as Chair of the Professional Development Committee
- Member, Marketing Task Force for Department of Computer Technology, 2003-2007
- Academic Affair Board Member 2005
- Member, QN 9000 Network, Lafayette, IN, 1996-2000
  - Steering Committee Member
- President, Society for Human Resource Management (Student Chapter, 1994-1995)